

WELL-MANAGED HIGHWAY INFRASTRUCTURE: A CODE OF PRACTICE



OCTOBER 2016

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Department for Transport
Great Minster House
33 Horseferry Road
London SW1P 4DR
Telephone 0300 330 3000
Website www.dft.gov.uk

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COMMENTS & FEEDBACK

The UK Roads Liaison Group would welcome any comments and feedback on this Code of Practice, so that it may be reviewed, improved and refined to give the sector the best support possible.

If you wish to make a comment, or report any broken weblinks, please send an email to ukrlg@ciht.org.uk with the header, 'Feedback on Well-managed Highway Infrastructure: A Code of Practice'.

WELL-MANAGED HIGHWAY INFRASTRUCTURE: A CODE OF PRACTICE

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LOG OF UPDATES

Reference	Action	Date	Topic
Summary of recommendations Recommendation 15 – Competencies and Training	Amended: to match with existing Recommendation 15 within main text	15 March 2017	Competencies and Training
A.4.2.6	Paragraph amended: website removed	15 March 2017	Public Rights of Way

SUMMARY OF RECOMMENDATIONS

RECOMMENDATION 1 – USE OF THE CODE

This Code, in conjunction with the UKRLG Highway Infrastructure Asset Management Guidance, should be used as the starting point against which to develop, review and formally approve highway infrastructure maintenance policy and to identify and formally approve the nature and extent of any variations.

RECOMMENDATION 2 – ASSET MANAGEMENT FRAMEWORK

An Asset Management Framework should be developed and endorsed by senior decision makers. All activities outlined in the Framework should be documented.
(HIAMG Recommendation 1)

RECOMMENDATION 3 – ASSET MANAGEMENT POLICY AND STRATEGY

An asset management policy and a strategy should be developed and published. These should align with the corporate vision and demonstrate the contribution asset management makes towards achieving this vision. (HIAMG Recommendation 3)

RECOMMENDATION 4 – ENGAGING AND COMMUNICATING WITH STAKEHOLDERS

Relevant information should be actively communicated through engagement with relevant stakeholders in setting requirements, making decisions and reporting performance.
(Taken from HIAMG Recommendation 2)

RECOMMENDATION 5 – CONSISTENCY WITH OTHER AUTHORITIES

To ensure that users' reasonable expectations for consistency are taken into account, the approach of other local and strategic highway and transport authorities, especially those with integrated or adjoining networks, should be considered when developing highway infrastructure maintenance policies.

RECOMMENDATION 6 – AN INTEGRATED NETWORK

The highway network should be considered as an integrated set of assets when developing highway infrastructure maintenance policies

RECOMMENDATION 7 – RISK BASED APPROACH

A risk based approach should be adopted for all aspects of highway infrastructure maintenance, including setting levels of service, inspections, responses, resilience, priorities and programmes.

RECOMMENDATION 8 – INFORMATION MANAGEMENT

Information to support a risk based approach to highway maintenance should be collected, managed and made available in ways that are sustainable, secure, meet any statutory obligations, and, where appropriate, facilitate transparency for network users.

RECOMMENDATION 9 – NETWORK INVENTORY

A detailed inventory or register of highway assets, together with information on their scale, nature and use, should be maintained. The nature and extent of inventory collected should be fit for purpose and meet business needs. Where data or information held is considered sensitive, this should be managed in a security-minded way.

RECOMMENDATION 10 – ASSET DATA MANAGEMENT

The quality, currency, appropriateness and completeness of all data supporting asset management should be regularly reviewed. An asset register should be maintained that stores, manages and reports all relevant asset data.

(HIAMG Recommendation 5)

RECOMMENDATION 11 – ASSET MANAGEMENT SYSTEMS

Asset management systems should be sustainable and able to support the information required to enable asset management. Systems should be accessible to relevant staff and, where appropriate, support the provision of information for stakeholders.

(HIAMG Recommendation 12)

RECOMMENDATION 12 – NETWORK HIERARCHY

A network hierarchy, or a series of related hierarchies, should be defined which include all elements of the highway network, including carriageways, footways, cycle routes, structures, lighting and rights of way. The hierarchy should take into account current and expected use, resilience, and local economic and social factors such as industry, schools, hospitals and similar, as well as the desirability of continuity and of a consistent approach for walking and cycling.

RECOMMENDATION 13 – WHOLE LIFE / DESIGNING FOR MAINTENANCE

Authorities should take whole life costs into consideration when assessing options for maintenance, new and improved highway schemes. The future maintenance costs of such new infrastructure are therefore a prime consideration.

RECOMMENDATION 14 – RISK MANAGEMENT

The management of current and future risks associated with assets should be embedded within the approach to asset management. Strategic, tactical and operational risks should be included as should appropriate mitigation measures.

(HIAMG Recommendation 11)

Amended 15 March 2017:

RECOMMENDATION 15 – COMPETENCIES AND TRAINING

The appropriate competencies for all staff should be identified. Training should be provided where necessary for directly employed staff, and contractors should be required to provide evidence of the appropriate competencies of their staff.

RECOMMENDATION 16 – INSPECTIONS

A risk-based inspection regime, including regular safety inspections, should be developed and implemented for all highway assets.

RECOMMENDATION 17 – CONDITION SURVEYS

An asset condition survey regime, based on asset management needs and any statutory reporting requirements, should be developed and implemented.

RECOMMENDATION 18 – MANAGEMENT SYSTEMS AND CLAIMS

Records should be kept of all activities, particularly safety and other inspections, including the time and nature of any response, and procedures established to ensure efficient management of claims whilst protecting the authority from unjustified or fraudulent claims.

RECOMMENDATION 19 – DEFECT REPAIR

A risk-based defect repair regime should be developed and implemented for all highway assets.

RECOMMENDATION 20 – RESILIENT NETWORK

Within the highway network hierarchy a 'Resilient Network' should be identified to which priority is given through maintenance and other measures to maintain economic activity and access to key services during extreme weather.

RECOMMENDATION 21 – CLIMATE CHANGE ADAPTATION

The effects of extreme weather events on highway infrastructure assets should be risk assessed and ways to mitigate the impacts of the highest risks identified.

RECOMMENDATION 22 – DRAINAGE MAINTENANCE

Drainage assets should be maintained in good working order to reduce the threat and scale of flooding. Particular attention should be paid to locations known to be prone to problems, so that drainage systems operate close to their designed efficiency.

RECOMMENDATION 23 – CIVIL EMERGENCIES AND SEVERE WEATHER EMERGENCIES PLANS

The role and responsibilities of the Highway Authority in responding to civil emergencies should be defined in the authority's Civil Emergency Plan. A Severe Weather Emergencies Plan should also be established in consultation with others, including emergency services, relevant authorities and agencies. It should include operational, resource and contingency plans and procedures to enable timely and effective action by the Highway Authority to mitigate the effects of severe weather on the network and provide the best practicable service in the circumstances.

RECOMMENDATION 24 – COMMUNICATIONS

Severe Weather and Civil Emergencies Plans should incorporate a communications plan to ensure that information including weather and flood forecasts are received through agreed channels and that information is disseminated to highway users through a range of media.

RECOMMENDATION 25 – LEARNING FROM EVENTS

Severe Weather and Civil Emergencies Plans should be regularly rehearsed and refined as necessary. The effectiveness of the Plans should be reviewed after actual events and the learning used to develop them as necessary.

RECOMMENDATION 26 – PERFORMANCE MANAGEMENT FRAMEWORK

A performance management framework should be developed that is clear and accessible to stakeholders as appropriate and supports the asset management strategy. (HIAMG Recommendation 4)

RECOMMENDATION 27 – PERFORMANCE MONITORING

The performance of the Asset Management Framework should be monitored and reported. It should be reviewed regularly by senior decision makers and when appropriate, improvement actions should be taken. (HIAMG Recommendation 13)

RECOMMENDATION 28 – FINANCIAL PLANS

Financial plans should be prepared for all highway maintenance activities covering short, medium and long term time horizons.

RECOMMENDATION 29 – LIFECYCLE PLANS

Lifecycle planning principles should be used to review the level of funding, support investment decisions and substantiate the need for appropriate and sustainable long term investment. (HIAMG Recommendation 6)

RECOMMENDATION 30 – CROSS ASSET PRIORITIES

In developing priorities and programmes, consideration should be given to prioritising across asset groups as well as within them.

RECOMMENDATION 31 – WORKS PROGRAMMING

A prioritised forward works programme for a rolling period of three to five years should be developed and updated regularly. (HIAMG Recommendation 7)

RECOMMENDATION 32 – CARBON

The impact of highway infrastructure maintenance activities in terms of whole life carbon costs should be taken into account when determining appropriate interventions, materials and treatments.

RECOMMENDATION 33 – CONSISTENCY WITH CHARACTER

Determination of materials, products and treatments for the highway network should take into account the character of the area as well as factoring in whole life costing and sustainability. The materials, products and treatments used for highway maintenance should meet requirements for effectiveness and durability.

RECOMMENDATION 34 – HERITAGE ASSETS

Authorities should identify a schedule of listed structures, ancient monuments and other relevant assets and work with relevant organisations to ensure that maintenance reflects planning requirements.

RECOMMENDATION 35 – ENVIRONMENTAL IMPACT, NATURE CONSERVATION AND BIODIVERSITY

Materials, products and treatments for highway infrastructure maintenance should be appraised for environmental impact and for wider issues of sustainability. Highway verges, trees and landscaped areas should be managed with regard to their nature conservation value and biodiversity principles as well as whole-life costing, highway safety and serviceability.

RECOMMENDATION 36 – MINIMISING CLUTTER

Opportunities to simplify signs and other street furniture and to remove redundant items should be taken into account when planning highway infrastructure maintenance activities.

WELL-MANAGED HIGHWAY INFRASTRUCTURE

PART A. OVERARCHING PRINCIPLES

SECTION A.1.

INTRODUCTION

A.1.1. PRINCIPLES AND CONTEXT OF THIS CODE

- A.1.1.1. This document is the first edition of 'Well-managed Highway Infrastructure'. It replaces Well-maintained Highways, Management of Highway Structures and Well-lit Highways.
- A.1.1.2. The Code is intended to apply throughout the United Kingdom. Production has been overseen by the UK Roads Liaison Group (UKRLG) and its Roads, Bridges and Lighting Boards. It is recognised that there are differences in approach to some matters in England, Scotland, Wales and Northern Ireland, which are not always detailed in the Code, but general principles are set out.
- A.1.1.3. The Code is designed to promote the adoption of an integrated asset management approach to highway infrastructure based on the establishment of local levels of service through risk-based assessment. It also includes guidance on some additional topics.
- A.1.1.4. The Code is produced as a single document to emphasise the integrated approach to highway network infrastructure assets. Overarching matters are dealt with in Part A and additional asset specific matters in Parts B, C and D.
- A.1.1.5. Delivery of a safe and well maintained highway network relies on good evidence and sound engineering judgement. The intention of this Code is that Authorities will develop their own levels of service and the Code therefore provides guidance for authorities to consider when developing their approach in accordance with local needs, priorities and affordability.
- A.1.1.6. Changing from reliance on specific guidance and recommendations in the previous Codes to a risk-based approach determined by each Highway Authority will involve appropriate analysis, development and gaining of approval through authorities' executive processes. Some authorities may be able to implement a full risk-based approach immediately. Others may require more time and may choose to continue with existing practices for an interim period, in which case the previous Codes will remain valid for them until the earlier of when they have implemented their approach or a period of two years from the date of publication of this Code.
- A.1.1.7. In the interest of route consistency for highway users, all authorities, including strategic, local, combined and those in alliances, are encouraged to collaborate in determining levels of service, especially across boundaries with neighbours responsible for strategic and local highway networks. Boundaries are not usually apparent to users and authorities should be aware of the possibility of distinct changes to levels of service through a risk-based local approach, both across authority boundaries and between roads with different character within an authority.
- A.1.1.8. All Highway Authorities should consider adoption of new and emerging technologies as part of their highway service. This should include consideration of new ideas, methods of working and innovation in order to drive greater efficiency.

A.1.1.9. References to third party documents and web sites are included throughout to provide further information and support on various topics, but are not to be seen as part of the Code of Practice. References are to the version current at the time of this Code's publication, unless otherwise indicated.

A.1.2. STATUS OF THE CODE

A.1.2.1. This Code of Practice is not statutory but provides Highway Authorities with guidance on highways management. Adoption of the recommendations within this document is a matter for each Highway Authority, based on their own legal interpretation, risks, needs and priorities.

A.1.3. GUIDANCE HIERARCHY

A.1.3.1. The UKRLG guidance hierarchy is shown in Figure 1. This diagram is updated from the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\)](#) to reflect this single Code replacing Well-maintained Highways, Well-lit Highways and Management of Highway Structures. It is intended that Part A of this Code should also apply to [Management of Electronic Traffic Equipment](#).

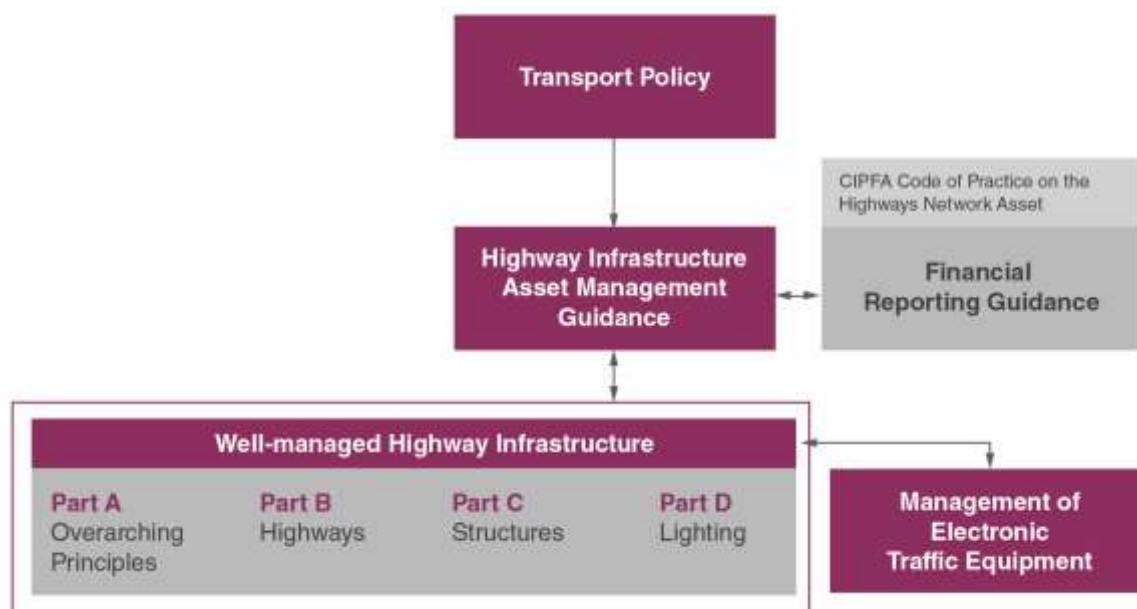


Figure 1 – Hierarchy of Guidance

A.1.3.2. The HIAMG sets out the approach to asset management. This Code refers extensively to the [HIAMG](#) and is intended to be useful additional guidance. Topics covered in the HIAMG are referred to, but not repeated in this Code. Nothing in this Code supersedes the HIAMG, unless specifically stated.

A.1.3.3. The HIAMG sets out the activities that support asset management:

- the context of asset management;
- the asset management planning process; and
- enablers to support implementation of asset management.

A.1.3.4. In Scotland and Wales, the principles and recommendations of the HIAMG are accepted, however, CSS Wales and the Society of Chief Officers of Transportation in Scotland (CSSW/SCOTS) have jointly developed practical Asset Management Guidance for use in Scotland and Wales. Topics covered in the CSSW/SCOTS Asset Management Guidance are referred to, but not repeated in this Code. This Code is not intended to supersede the CSSW/SCOTS Highway Asset Management Guidance, unless specifically stated.

A.1.4. TERMINOLOGY

A.1.4.1. For the purposes of this Code publicly understood definitions are used for the major parts of the highway. There are also differences in definitions across the various legal systems in the UK that would be inappropriate to repeat at length. In such cases the English term is used. The main relevant definitions are:

- The term ‘highway’ is used to include ‘road’ and ‘street’.
- The term ‘authority’ is used to include all forms of national and local authorities having responsibility for highway infrastructure management.
- The term ‘carriageway’ is used for facilities used by motor vehicles.
- The term ‘footway’ is used for that part of a highway over which the public have a right of way on foot only, e.g. segregated surfaced paths used by pedestrians. ‘Footway’ includes the commonly understood use of the term ‘pavement’. The term ‘remote footway’ is used where a footway is not immediately adjoining a carriageway. The term ‘housing footway’ is used for those footways serving predominantly housing areas which may be unadopted as public highways but have established public rights of access and may be maintained separately by the housing authority. Users will make no distinction and will consider the footway network as a whole.
- The term ‘footpath’ is used for the majority of Public Rights of Way (PROW).
- The term ‘cycle route’ is used as the collective term for facilities used by cyclists. These include cycle lanes on carriageways, cycle tracks adjacent to or away from carriageways, on carriageway provision with cycle symbols and shared use facilities.

A.1.4.2. Some supporting documents use industry terms. These are not used in the Code, but are referenced for completeness. The main items are:

- The industry term ‘running surface’ is used as the collective term for all hardened surfaces within the highway, including carriageways, footways and cycle routes.
- The industry term ‘pavement’ is used for the construction of running surfaces, particularly carriageways.

A.1.5. RELATED ACTIVITIES

A.1.5.1. There are a number of related functions that are not dealt with in detail by this Code, but which could affect and be affected by highway infrastructure maintenance activity. They have the potential for value to be added through co-operation and co-ordination. Such functions include:

- network management, including implementation of the traffic management duty, or equivalent;
- highway development control, including securing funds associated with developer obligations;
- integrated street management, including cleansing; and
- town centre management, including use of public space.

A.1.6. MAINTENANCE PRACTICE

A.1.6.1. Maintenance types contribute in varying degrees to the core objectives of safety, customer service, serviceability and sustainability. Levels of service and delivery arrangements should be established having regard to these objectives and be focussed on outcomes, rather than on inputs mainly related to maintenance type.

A.1.6.2. The main types of maintenance are as follows:

- reactive – responding to inspections, complaints or emergencies;
- routine – regular schedule, generally for lamp replacement, patching, cleaning, grass cutting and landscape maintenance, cleaning bridge drainage;
- programmed – flexibly planned schemes primarily of reconditioning or structural renewal;
- regulatory – inspecting and regulating the activities of others;
- Winter Service; and
- resilience and emergencies.

A.1.7. LIMITATIONS TO THE CODE OF PRACTICE

A.1.7.1. The Code is not intended as a detailed technical reference for all aspects of highway infrastructure maintenance or to repeat technical guidance available elsewhere. Areas referred to but not dealt with in detail include:

- highway improvement and new construction;
- network management, including management of utilities;
- management and maintenance of Public Rights of Way; and
- management of street cleansing.

A.1.8. FURTHER ADVICE AND GUIDANCE

A.1.8.1. The Highways Maintenance Efficiency Programme (HMEP) has developed a wide range of guidance on topics from asset management to procurement. This is available from the [HMEP homepage](#) or via the weblinks below.

Asset Management

- [Highway Infrastructure Asset Management Guidance](#)
- [Asset Management E-learning Toolkit](#)
- [Guidance on the Management of Highways Drainage Assets](#)
- [Lifecycle Planning Toolkit, incorporating default carriageway deterioration models](#)
- [The Potholes Review](#)

Collaboration & Change

- [Maximising Client and Provider Collaboration in Highways Maintenance Services](#)
- [Local Highway Authorities Collaborative Alliance Toolkit](#)
- [Creating the Culture to Deliver Toolkit](#)
- [A LEAN Toolkit for Highway Services](#)
- [Shared Services Toolkit](#)

Procurement, Contracting and Standardisation

- [The Standard Form of Contract for Highways Maintenance Services](#)
- [Guidance on a Standard Specification and Standard Details for Local Highway Maintenance](#)
- [Procurement Route Choices Toolkit for Highways Maintenance Services](#)
- [Supply Chain Collaboration Toolkit](#)
- [Collaborative Contracting Strategy](#)

A.1.8.2. Transport Scotland and SCOTS have developed a range of guidance on collaboration and service improvement:

- www.improvementservice.org.uk/roads-collaboration-programme.html
- <https://khub.net/web/roads-collaboration-programme>
- www.transportscotland.gov.uk
- <http://www.improvementservice.org.uk/benchmarking/>

- <https://khub.net/web/scots-society-of-chief-officers-of-transportation-in-scotland->
- A.1.8.3. The UKRLG carried out a study into the provision of design and maintenance guidance for Local Highway Authorities. Through consultation with local authority practitioners, the study identified examples of relevant good practice documents that have been produced around the UK. 48 examples of good practice documents collated from local authorities from across the UK can be found at the [CIHT's Transport Advice Portal](#).
- A.1.8.4. The same study identified gaps in guidance and produced new guidance documents to address these gaps:
- [Whole Life Costing for Option Appraisal of Maintenance Schemes for Local Authorities](#)
 - [Provision of Road Restraint Systems on Local Highway Authority Roads](#)
 - [Departures from Standards: Procedures for Local Highway Authorities](#)
- A.1.8.5. The [Potholes Review, Prevention and a Better Cure](#) makes 17 recommendations that will, if implemented, provide an improvement in highway maintenance and reduce the number of potholes occurring. There are three key messages: prevention is better than cure; right first time for better repairs; clarity for the public.
- A.1.8.6. [Guidance on implementing disabled persons parking places in Scotland](#) has been produced by SCOTS.
- A.1.8.7. [Planning for Walking](#) has been published by the Chartered Institution of Highways and Transportation.
- A.1.8.8. [Street Design for All](#), 2014, provides an update to advice and good practice.
- A.1.8.9. Guidance on design for cycling may be found in the Department for Transport [LTN2/08 Cycle infrastructure design](#) (2008), the Welsh Government's [Active Travel Design Guidance](#) (2014), and Transport for London's "[London Cycling Design Standards](#)" (2014) which includes specific advice on designing for cyclists at roadworks.
- A.1.8.10. In 2016, Sustrans published their [Greenway management handbook](#), which provides guidance on how to manage traffic free cycle and walking routes or 'greenways' for the benefit of both people and wildlife.
- A.1.8.11. [Guidelines for Motorcycling](#) has been published by the Institute of Highway Engineers.
- A.1.8.12. SCOTS has published guidance on the [management of tributes placed at the scene of road deaths](#).

SECTION A.2. POLICY FRAMEWORK

A.2.1. USING THE CODE IN THE DEVELOPMENT OF ASSET MANAGEMENT POLICY

- A.2.1.1. Asset management policy is dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance Document, Part B](#). This document should be referred to and the advice below considered supplementary.
- A.2.1.2. Asset management is widely accepted as a means to deliver a more efficient and effective approach to management of highway infrastructure assets through longer term planning and ensuring that levels of service are defined and achievable for available budgets. It supports making the case for funding, for better communication with stakeholders, and facilitates a greater understanding of the contribution highway infrastructure assets make to economic growth and social well-being of local communities.
- A.2.1.3. Authorities have certain legal obligations with which they need to comply, and which may be the subject of claims for loss or personal injury or of legal action by those seeking to establish non-compliance by authorities. It is recognised that in such cases, the Code may be considered to be a relevant consideration. Where authorities elect in the light of local circumstances to adopt policies or approaches different from those suggested by the Code, it is essential that they are identified, together with the reasoning for such differences, be approved by the authority's Executive and published.

RECOMMENDATION 1 – USE OF THE CODE

This Code, in conjunction with the UKRLG Highway Infrastructure Asset Management Guidance, should be used as the starting point against which to develop, review and formally approve highway infrastructure maintenance policy and to identify and formally approve the nature and extent of any variations.

RECOMMENDATION 2 – ASSET MANAGEMENT FRAMEWORK

An Asset Management Framework should be developed and endorsed by senior decision makers. All activities outlined in the Framework should be documented. (HIAMG Recommendation 1)

RECOMMENDATION 3 – ASSET MANAGEMENT POLICY AND STRATEGY

An asset management policy and a strategy should be developed and published. These should align with the corporate vision and demonstrate the contribution asset management makes towards achieving this vision. (HIAMG Recommendation 3)

- A.2.1.4. Authorities should also be conscious of HIAMG Recommendations 8, 9 and 14 (Leadership and Commitment, Making the Case for Asset Management and Benchmarking) in respect to asset management.

A.2.2. STAKEHOLDERS AND COMMUNICATION

- A.2.2.1. Stakeholder expectations and the importance of good communications and liaison are dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance Document, Part A](#). This document should be referred to and the advice below considered supplementary.
- A.2.2.2. Arrangements should be established to facilitate the involvement of all authority elected members, employees, contractors and agents in building commitment and pride in the highway maintenance service and maximising individual contributions to the process of continuous improvement.
- A.2.2.3. Many aspects of the maintenance process are highly technical and may be difficult to explain, but it is important that legal duties and obligations are understood. Users' concerns may tend to focus on the short term, more visible deficiencies in the network rather than the underlying less apparent problems. CIHT has published a document [Involving the Public and Other Stakeholders](#) which provides guidance on this topic.

RECOMMENDATION 4 – ENGAGING AND COMMUNICATING WITH STAKEHOLDERS

Relevant information should be actively communicated through engagement with relevant stakeholders in setting requirements, making decisions and reporting performance.

(Taken from HIAMG Recommendation 2)

A.2.3. OTHER AUTHORITIES

- A.2.3.1. Consultation will be necessary with other local, combined and strategic Highway Authorities, especially adjoining authorities, as part of the duty to manage the network and to ensure that users' reasonable requirements for consistency of service and integrated programming of works are considered and taken into account.
- A.2.3.2. Responsibility for assets on authority boundaries, e.g. river bridges, should be agreed with adjoining authorities.
- A.2.3.3. It may be appropriate for authorities to enter into agreements with adjacent or other authorities for certain aspects of service to be carried out by one authority on behalf of the other. [Guidance on provision of shared services](#) is provided by HMEP.
- A.2.3.4. Consultation and coordination will also be required with utilities, public transport operators and other key stakeholders.
- A.2.3.5. Consultation and agreements should be recorded.

RECOMMENDATION 5 – CONSISTENCY WITH OTHER AUTHORITIES

To ensure that users' reasonable expectations for consistency are taken into account, the approach of other local and strategic highway and transport authorities, especially those with integrated or adjoining networks, should be considered when developing highway infrastructure maintenance policies.

A.2.4. INTEGRATED NETWORK MANAGEMENT

- A.2.4.1. Highway infrastructure management policy needs to be developed integrally with the overall management of the network. Transport users, whatever their mode, do not distinguish between many categories of road, or types of work, whether maintenance or improvement. It is irrelevant to them who is undertaking the work, whether local authority, contractor or utility. They expect the network to be managed and maintained holistically to provide consistent and appropriate levels of service and the ability to change modes as easily as possible.
- A.2.4.2. Planning for highway maintenance should take into account and add value to other elements of local transport policy and strategy wherever possible, including supporting economic growth, regeneration, public health, resilience, emergency services, walking and cycling, bus and freight partnerships, casualty reduction and prevention, travel planning, safer routes to school, and routes to stations and other interchange facilities.
- A.2.4.3. Authorities should have regard to the totality of highway network management functions, including asset management, traffic management, parking and other regulatory functions.
- A.2.4.4. Authorities should consider the needs of all road users, particularly vulnerable users, in planning and managing the network. This has special implications for maintenance, as when schemes are planned and programmed there may be an opportunity to incorporate added value to the safety, priority, integrity or quality of:
- footways and crossing facilities (particularly for vulnerable users);
 - cycle routes and crossing facilities;
 - riders of motorcycles;
 - equestrians and crossing facilities;
 - facilities for public transport and users (and also to influence reliability); and
 - facilities for freight movement.
- A.2.4.5. Planning and budgeting for highway maintenance should also recognise that integrated transport, especially in urban areas, is likely to result in a more complex and diverse streetscene. Good design may limit the scale of more complex signage, but a wider range of more expensive signs, road markings, coloured surfacing and other materials may be necessary for management. When considering these features, authorities should take into account the potential cost of keeping this more complex arrangement in good order.
- A.2.4.6. Policies, priorities and programmes for highway maintenance should have particular regard to the principles of sustainability.
- A.2.4.7. When determining the balance between structural, preventative and reactive maintenance, the principle that “prevention is better than cure” should be adopted.

- A.2.4.8. In areas where public transport is not regulated, routes of services may be less predictable and vary more frequently. Close liaison with operators will be necessary if works are to be co-ordinated so as to minimise disruption to public transport users. Other forms of public transport, including light rail and guided bus schemes, bring their own challenges for maintenance, especially Winter Service.
- A.2.4.9. [Manual for Streets](#), 2007, provides guidance on effective street design where appropriate, for a range of practitioners involved in the planning, design, provision and approval of new residential streets and modifications to existing ones. [Manual for Streets 2](#), 2010 explains how the principles can be applied more widely. In Scotland, the relevant document is [Designing Streets](#).
- A.2.4.10. It may be appropriate for authorities to develop a series of related policies for specific assets or for specific activities, e.g.:
- highways;
 - footways;
 - cycle routes;
 - structures;
 - lighting;
 - trees;
 - designing for maintenance;
 - skidding resistance; and
 - sustainability.

RECOMMENDATION 6 – AN INTEGRATED NETWORK

The highway network should be considered as an integrated set of assets when developing highway infrastructure maintenance policies.

A.2.5. RISK BASED APPROACH

- A.2.5.1. Authorities should adopt a risk-based approach and a risk management regime for all aspects of highway maintenance policy. This will include investment, setting levels of service, operations, including safety and condition inspections, and determining repair priorities and replacement programmes. It should be undertaken against a clear and comprehensive understanding and assessment of the likelihood of asset failure and the consequences involved.
- A.2.5.2. There are no prescriptive or minimum standards in this Code. Adoption of a risk based approach, taking account of the advice in the Code, will enable authorities to establish and implement levels of service appropriate to their circumstances.

RECOMMENDATION 7 – RISK BASED APPROACH

A risk based approach should be adopted for all aspects of highway infrastructure maintenance, including setting levels of service, inspections, responses, resilience, priorities and programmes.

A.2.6. SECURITY MINDED APPROACH

- A.2.6.1. Authorities should adopt a security-minded approach to their assets, information and people through understanding and routine application of appropriate and proportionate security measures to deter and/or disrupt hostile, malicious, fraudulent and criminal behaviours or activities. To support such an approach, the Centre for the Protection of National Infrastructure has published [Passport to Good Security](#).

A.2.7. INFORMATION MANAGEMENT

- A.2.7.1. Information is fundamental to the development of infrastructure maintenance policy and to the ability to communicate effectively with stakeholders. Effective and sustainable management of that information, which is likely to arise from many sources, and the distribution of that information to stakeholders and network users is crucial.
- A.2.7.2. A risk-based approach to highway maintenance needs to be founded on information that is sufficiently robust to enable decisions on levels of service to be taken and reviewed over time.
- A.2.7.3. Records of construction and maintenance treatments should be kept to inform lifecycle plans. Information on mobile electronic devices used by maintenance practitioners in the field can support their decision making and reporting of asset condition and defects in real time.
- A.2.7.4. Authorities should be aware of the need to identify and protect information which could impact on the safety and security of individuals, sensitive assets and systems and the benefits which the sensitive asset or system exist to deliver, through the adoption of a security-minded approach to the handling and management of data and information.
- A.2.7.5. From time to time, governments may require specific information to be reported, either to themselves or publicly, e.g. on authorities' websites, and authorities' information systems should facilitate this.
- A.2.7.6. The Building Information Modelling (BIM) approach, sometimes known as Better Information Management, is being introduced into the construction industry. It involves supply chain collaboration in the creation and use of intelligent three-dimensional models and accompanying data and information to drive efficiency, aid communication and facilitate better management of assets over their lifecycle. The Department for Transport and UKRLG have produced [BIM Guidance for Infrastructure Bodies](#).
- A.2.7.7. The British Standards Institution has published a series of Standards: [BS 1192:2007](#), [PAS 1192-2:2013](#), [PAS 1192-3:2014](#), [BS 1192-4:2014](#), [PAS 1192-5:2015](#) and [BS 8536-1:2015](#).

RECOMMENDATION 8 – INFORMATION MANAGEMENT

Information to support a risk-based approach to highway maintenance should be collected, managed and made available in ways that are sustainable, secure, meet any statutory obligations, and, where appropriate, facilitate transparency for network users.

SECTION A.3. LEGAL FRAMEWORK

A.3.1. GENERAL AND SPECIFIC REQUIREMENTS

- A.3.1.1. General duties and powers are dealt with in this Part of the Code. Duties and powers related to specific assets, e.g. highways, structures and lighting, are dealt with in the relevant parts of the Code.
- A.3.1.2. Much of highway infrastructure maintenance activity is based upon statutory powers and duties contained in legislation and precedents developed over time as a result of claims and legal proceedings. Some important aspects of these statutory powers and duties are noted in this section. The UK Highway Liability Joint Task Group has developed [guidance on Highway Risk and Liability Claims](#).
- A.3.1.3. All those involved in highway maintenance, including members of authorities, should have a clear understanding of their duties and powers, their implications, and the procedures used to manage and mitigate risk.
- A.3.1.4. Specific legislation mentioned is generally that for England. Scotland, Wales and Northern Ireland often have equivalent or similar legislation and the phrase 'or equivalent' following mention of an Act of Parliament is intended to refer to these. Nothing in or omitted from this Code can, of course, supersede the law.

A.3.2. GENERAL REQUIREMENTS

Duty of Care

- A.3.2.1. There are many specific duties and powers, but even in the absence of specific duties and powers, authorities have a general duty of care to users and the community to maintain the highway in a condition fit for its purpose. This principle should be applied to all decisions affecting policy, priority, programming and implementation of highway maintenance works.

Health and Safety

- A.3.2.2. [The Health and Safety at Work Act 1974](#), or equivalent, together with the [Construction \(Design and Management\) Regulations 2015](#), or equivalent, provide for a requirement for highway, traffic and street authorities to carry out work in a safe manner and establish arrangements for the management of construction works.
- A.3.2.3. All those involved in the planning, management and delivery of highway infrastructure maintenance services should receive training and regular updating, as necessary, in health and safety requirements of the service.

Localism

- A.3.2.4. [The Localism Act 2011](#) predominantly applies to England and confers on local authorities the power, with certain limitations, to do anything that individuals generally may do for the benefit of the authority, its area, or persons resident or present in its area. It also introduced measures such as the community right to challenge.

Best Value

- A.3.2.5. [The Local Government Act 2000](#), or equivalent, provides for the general duty of best value and aims to improve local services in terms of both cost and quality.

Duties and Powers for Highway Maintenance

- A.3.2.6. There are a number of specific pieces of legislation that provide the basis for duties and powers relating to highway maintenance.

Main Highways Provisions

- A.3.2.7. [The Highways Act 1980](#), or equivalent, sets out the main duties and powers of Highway Authorities. In particular it imposes a duty to maintain highways maintainable at public expense. Almost all claims against authorities relating to highway functions arise from alleged breach of this section.
- A.3.2.8. The Act provides a defence against action relating to alleged failure to maintain on grounds that the authority has taken such care as in all the circumstances was reasonably required to secure that the part of the highway in question was not dangerous for traffic. A key difference in Scotland is that there is no equivalent defence against alleged failure to maintain, although case law will have established some basis for this.
- A.3.2.9. Where an authority exercises a power to install new infrastructure, e.g. lighting, safety barriers, etc, it will become responsible for its maintenance.

Winter Service

- A.3.2.10. [The Highways Act 1980](#), or equivalent, and the [Railways and Transport Safety Act 2003](#) in England set out duties for Winter Service.

Traffic Management

- A.3.2.11. [The Traffic Management Act 2004](#), or equivalent, sets out a number of provisions including Highways England Traffic Officers, local authority duty for network management, permits for work on the highway, increased control of utility works, and increased civil enforcement of traffic offences.
- A.3.2.12. The Act establishes a duty for local traffic authorities 'to manage their road network with a view to achieving, so far as may be reasonably practicable having regard to their other obligations and policies, to secure the expeditious movement of traffic on the authority's road network, and to facilitate the expeditious movement of traffic on road networks for which another authority is the traffic authority'. The term 'traffic' specifically includes pedestrians, so the duty requires the authority to consider all road users.
- A.3.2.13. The duty is not limited to the actions of the department responsible for traffic within an authority, so authorities will need to consider the duty when exercising their powers under any legislation where this impacts on the operation of the road network. Authorities are required to appoint a Traffic Manager to administer the network management duty. Authorities are expected to operate the Act even-handedly, applying conditions and enforcement activity equally to their own and utilities works.

Utility Companies

- A.3.2.14. Various companies and agencies have statutory powers and obligations to work in the highway. Their activity in the highway is regulated by the [New Roads and Streetworks Act 1991](#), or equivalent, and by the [Traffic Management Act 2004](#), or equivalent.

Public Rights Of Way

- A.3.2.15. Responsibilities for Public Rights of Way (PROW) ([Countryside and Rights of Way Act 2000](#) in England) vary considerably throughout the UK, but in general authorities are required to maintain records and ensure that ways are adequately signposted, maintained and free from obstruction. In urban areas PROW can present wider problems relating to issues such as crime. Certain legislation can facilitate closure of rights of way where deemed appropriate.

Related Powers and Duties

- A.3.2.16. Duties and powers contained in the Highways Act, or equivalent, sit within a much broader legislative framework specifying a wider range of duties and powers. These include, or equivalents:
- [New Roads and Street Works Act 1991](#);
 - [Road Traffic Regulation Act 1984](#);
 - [Traffic Signs Regulations and General Directions 2016](#);
 - [Road Traffic Act 1988](#) – provides a duty for Highway Authorities to promote road safety, including a requirement to undertake accident studies and take such measures as appear appropriate to prevent such accidents occurring;
 - [Road Traffic Reduction Act 1997](#);
 - [Flood and Water Management Act 2012](#) or equivalent [Flood Risk Management \(Scotland\) Act 2009](#) – aims to reduce the flood risk associated with extreme weather. Provides for better, more comprehensive management of flood risk for people, homes and businesses;
 - [Transport Act 2000](#) – designation of quiet lanes or a home zones;
 - [Active Travel Act \(Wales\) 2013](#) – legislates for the provision of routes designed for cycling and walking;
 - [Wildlife and Countryside Act 1981](#) – environmental and countryside issues with which highways operations must comply;
 - [Environmental Protection Act 1990](#) – provides the statutory basis for other environmental issues, in particular waste management, with which highway maintenance operations must comply; and
 - [Clean Neighbourhoods and Environment Act 2005](#).

A.3.2.17. There is also a framework of legislation not specifically related to highways functions, but dealing with wider community issues with which the services are involved. These include, or equivalents:

- [Equality Act 2010](#);
- [Criminal Justice and Public Order Act 1994](#);
- [Human Rights Act 1998](#);
- [Freedom of Information Act 2000](#);
- Local Government Acts; and
- [Civil Contingencies Act 2004](#).

SECTION A.4. STRATEGY AND HIERARCHY

A.4.1. HIGHWAY INFRASTRUCTURE ASSET MANAGEMENT STRATEGY

A.4.1.1. Development of a highway infrastructure asset management strategy is dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Part B](#). This document should be referred to and the advice below considered supplementary.

A.4.1.2. The asset management strategy sets out how the asset management policy is to be achieved, how long term objectives for managing the highway are to be met and how the strategy is to be implemented, including setting targets and measuring performance. It sets clear direction, provides links with other relevant documents, such as corporate plans, and sets out the benefits of investing in the highway infrastructure. It should be a clear, public-facing message.

A.4.1.3. The core objectives for maintenance could be considered to be:

Network Safety complying with statutory obligations; and

meeting users' needs for safety.

Customer Service user experience/satisfaction;

communication;

information; and

levels of service.

Network Serviceability ensuring availability;

achieving integrity;

maintaining reliability;

resilience; and

managing condition.

- A.4.1.7. Particular aspects of highway maintenance may have wider impacts than the immediate local implementation issues. For example, the need to address carriageway defects could compromise, at least temporarily, public transport convenience and reliability. Work at night to minimise disruption may have noise and cost implications, and bridge works may require lengthy diversions. Arrangements should be put in place to identify the potential for such conflicts at an early stage, to resolve them, and to mitigate the effects as effectively as possible.
- A.4.1.8. Users will expect reasonable continuity of safety and serviceability with neighbouring Highway Authorities, particularly at the higher end of the network hierarchy and with services such as Winter Service, but also at the lower levels of hierarchy where safety is a prime consideration. In such cases, serious discontinuities in levels of service should be avoided through consultation and agreement. [The Code of Practice for the Co-ordination of Street Works and Works for Road Purposes and Related Matters](#) published to support the Traffic Management Act provides specific advice on this.
- A.4.1.9. Inter-authority co-ordination, at both the strategic and operational level, can bring other benefits in terms of cost and resource management, levels of service and user perception. Opportunities for such co-operation include:
- integrated route management;
 - optimisation of cross boundary service provision;
 - optimised programming and procurement;
 - shared traffic management and publicity;
 - avoidance of multiple user delays; and
 - research, development and innovation.
- A.4.1.10. The Department for Transport commissioned a research project on [highway service levels](#), focusing on getting an improved understanding, in qualitative terms, of the levels of service the public expects for the surface of carriageways, cycle routes and footways.

A.4.2. NETWORK INVENTORY

Asset Data

- A.4.2.1. Asset data is dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance, Part B](#). This document should be referred to and the advice below considered supplementary.
- A.4.2.2. Highway Authorities have a legal duty to keep a register containing such information as may be prescribed with respect to maps and statements of roads that are maintainable at public expense, which is primarily used for Land Charge Searches.
- A.4.2.3. There is also a requirement to maintain information for the purpose of:

- identifying streets described as traffic sensitive, where work should be avoided at certain times of the day;
- identifying structures and other features described as special engineering difficulty, which need special consideration when work is planned; and
- identifying reinstatement categories used by statutory undertakers in the reinstatement of their street works.

A.4.2.4. Accurate inventory information is required to submit updated information to Government each year on road lengths maintained and is also used for national valuation purposes. In some countries this information is used for the calculation of local authority spending allocations.

A.4.2.5. The above requirements can be satisfied with fairly basic information, much less detailed than that required for maintenance management purposes. An appropriately detailed highway inventory or asset register or database is however an essential prerequisite of establishing a cost effective and adequate maintenance regime.

Paragraph amended 15 March 2017:

A.4.2.6. Some Highway Authorities are required to keep the definitive map and statement, or equivalent, for Public Rights of Way (PROW) that forms the legal record of the position and status of PROW. Certain parts of the network could be recorded both on the register of roads and the definitive map. Authorities in Scotland are required to keep records of 'Core Paths'.

RECOMMENDATION 9 – NETWORK INVENTORY

A detailed inventory or register of highway assets, together with information on their scale, nature and use, should be maintained. The nature and extent of inventory collected should be fit for purpose and meet business needs. Where data or information held is considered sensitive, this should be managed in a security-minded way.

RECOMMENDATION 10 – ASSET DATA MANAGEMENT

The quality, currency, appropriateness and completeness of all data supporting asset management should be regularly reviewed. An asset register should be maintained that stores, manages and reports all relevant asset data. (HIAMG Recommendation 5)

Asset Management Systems

A.4.2.7. Asset management systems are dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance, Part C](#).

RECOMMENDATION 11 – ASSET MANAGEMENT SYSTEMS

Asset management systems should be sustainable and able to support the information required to enable asset management. Systems should be accessible to relevant staff and, where appropriate, support the provision of information for stakeholders. (HIAMG Recommendation 12)

A.4.3. FUNCTIONAL HIERARCHY

- A.4.3.1. A network hierarchy based on asset function is the foundation of a risk-based maintenance strategy. It is crucial in establishing levels of service and to the statutory network management role for developing co-ordination and regulating occupation.
- A.4.3.2. It is important that the hierarchy adopted reflects the whole highway network and the needs, priorities and actual use of each infrastructure asset. The carriageway hierarchy, for example, may be determined by traffic volume or by local social and economic importance – perhaps a route leading to a major hospital or industrial area, or urban, rural or busy shopping street, residential street, etc. Hierarchy may also be influenced by factors such as pedestrian or cyclist usage. Collectively, these issues may be referred to as the ‘functionality’ of the section of highway in question.
- A.4.3.3. Whilst different asset types may have their own hierarchies, all should be related such that each asset type can be considered in relation to others and to the whole highway network. Network hierarchy should take into account the desirability of continuity and of a consistent approach for walking and cycling.
- A.4.3.4. The adoption of a common hierarchy to reflect the network management duty, or equivalent, and the requirements for maintenance management based on highway functionality is desirable. This may be difficult to achieve completely, bearing in mind the differing definitions of protected streets, traffic sensitive streets, and streets with special engineering difficulties, associated with the Traffic Management duty, or equivalent. However, a high degree of compatibility between networks is desirable.
- A.4.3.5. There will also be a need to define hierarchies for Resilience and for Winter Service. These should take as a starting point the hierarchy developed for general maintenance purposes but are likely to require extensive modification to accommodate local operational factors.
- A.4.3.6. It is important to consider the hierarchy of neighbouring authorities for both locally and nationally maintained networks. Users will expect reasonable continuity of levels of service and collaboration in developing the network hierarchy can contribute to achieving this.
- A.4.3.7. Hierarchies are a useful basis on which to consult users and the community. They are strategic but relatively easy to present and understand and not so detailed as to cause difficulties in interpreting the results. They can also address directly some of the wider policy issues, including special needs of certain groups of people.
- A.4.3.8. Hierarchies should be dynamic and regularly reviewed to reflect changes in network characteristics and functionality so that maintenance strategy reflects the current situation, rather than the use expected when the hierarchy was originally defined.
- A.4.3.9. Where major maintenance, construction or other development involves significant traffic diversion, or when congestion in one part of the network results in traffic shift to another part of the network, these changes should be reflected in the hierarchy and subsequently in the maintenance and network management regimes. There may also be seasonal influences on hierarchy.

- A.4.3.10. The Rees Jeffreys Road Fund study [A Major Road Network for England](#) has developed proposals and recommendations for a more logical, integrated network of major roads across England.

RECOMMENDATION 12 – NETWORK HIERARCHY

A network hierarchy, or a series of related hierarchies, should be defined which include all elements of the highway network, including carriageways, footways, cycle routes, structures, lighting and rights of way. The hierarchy should take into account current and expected use, resilience, and local economic and social factors such as industry, schools, hospitals and similar, as well as the desirability of continuity and of a consistent approach for walking and cycling.

Carriageways

- A.4.3.11. Carriageway hierarchy will not necessarily be determined by the road classification, but by functionality and scale of use. Table 1 is intended to be used as a reference point from which to develop local hierarchies. The descriptions relate to the most usual circumstances encountered in the UK. There are likely to be, some very significant variations and authorities should take their own circumstances into account.

Table 1 – Factors to Consider – Carriageways

Category	Type of Road General Description	Description
Motorway	Limited access - motorway regulations apply	Routes for fast moving long distance traffic. Fully grade separated and restrictions on use.
Strategic Route	Trunk and some Principal 'A' class roads between Primary Destinations	Routes for fast moving long distance traffic with little frontage access or pedestrian traffic. Speed limits are usually in excess of 40 mph and there are few junctions. Pedestrian crossings are either segregated or controlled and parked vehicles are generally prohibited.
Main Distributor	Major Urban Network and Inter-Primary Links. Short - medium distance traffic	Routes between Strategic Routes and linking urban centres to the strategic network with limited frontage access. In urban areas speed limits are usually 40 mph or less, parking is restricted at peak times and there are positive measures for pedestrian safety.
Secondary Distributor	B and C class roads and some unclassified urban routes carrying bus, HGV and local traffic with frontage access and frequent junctions	In residential and other built up areas these roads have 20 or 30 mph speed limits and very high levels of pedestrian activity with some crossing facilities including zebra crossings. On-street parking is generally unrestricted except for safety reasons. In rural areas these roads link the larger villages, bus routes and HGV generators to the Strategic and Main Distributor Network.
Link Road	Roads linking between the Main and Secondary Distributor Network with frontage access and frequent junctions	In urban areas these are residential or industrial interconnecting roads with 20 or 30 mph speed limits, random pedestrian movements and uncontrolled parking. In rural areas these roads link the smaller villages to the distributor roads. They are of varying width and not always capable of carrying two-way traffic.
Local Access Road	Roads serving limited numbers of properties carrying only access traffic	In rural areas these roads serve small settlements and provide access to individual properties and land. They are often only single lane width and unsuitable for HGVs. In urban areas they are often residential loop roads or cul-de-sacs.
Minor road	Little used roads serving very limited numbers of properties.	Locally defined roads.

A.4.3.12. Assignment of a carriageway to a particular category is a matter for local discretion. However, the following issues should be taken into consideration:

- character and volume of traffic;
- current usage and proposed usage;
- routes to important local facilities and to the strategic network;
- designation as a traffic sensitive route;
- accident and other risk assessment;
- potential for use as a diversion route;
- special characteristic of certain assets, e.g. historic structures;
- access to schools, hospitals and medical centres;
- vulnerable users or people with special needs, elderly people's homes etc; and
- ceremonial routes and special events.

A.4.3.13. Other factors should be taken into account and an on-site 'reality check' undertaken where there is any uncertainty about position in the hierarchy, for example:

- road use might be at the margin of the category but have higher than normal levels of growth. Extensive development may be taking place or planned;
- there might have been a higher than normal level of accidents or related incidents which would suggest unusually high levels of risk;
- although traffic flows on the carriageway might be low, there might be high levels of pedestrians or cyclists;
- the route might be the subject of promotion by the authority, for example as a 'Safer Route to School' or access to a railway station. A cycling route may be part of the [National Cycle Route Network](#);
- the route may be temporarily being used as a diversion route around a road closure on a route at a higher level within the hierarchy; and
- traffic composition might indicate unusually high proportions of particular users, for example motorcyclists or cyclists for whom surface condition is of particular importance.

Footways

- A.4.3.14. Footway hierarchy should be determined by functionality and scale of use. Table 2 is intended to be used as a reference point from which to develop local hierarchies. The detailed descriptions relate to the most usual circumstances encountered in the UK. There are, however, some very significant variations from the norm and authorities should take their own circumstances into account.

Table 2 – Factors to Consider – Footways

Category	Description
Prestige Walking Zones	Very busy areas of towns and cities with high public space and streetscene contribution.
Primary Walking Routes	Busy urban shopping and business areas and main pedestrian routes.
Secondary Walking Routes	Medium usage routes through local areas feeding into primary routes, local shopping centres etc.
Link Footways	Linking local access footways through urban areas and busy rural footways.
Local Access Footways	Footways associated with low usage, short estate roads to the main routes and cul-de-sacs.
Minor Footways	Little used rural footways serving very limited numbers of properties

- A.4.3.15. Assignment of a footway to a particular category is a matter for local discretion. However, the following issues should be taken into consideration:
- pedestrian volume;
 - designation as a traffic sensitive pedestrian route;
 - current usage and proposed usage;
 - contribution to the quality of public space and streetscene;
 - age and distribution of the population, proximity of schools or other establishments attracting higher than normal numbers of pedestrians;
 - accident and other risk assessment; and
 - character and traffic use of adjoining carriageway.
- A.4.3.16. The footway hierarchy should have regard to any network of ‘housing footways’, serving housing estates or related development, which may be unadopted as public highways but have established public rights of access and may be maintained separately by the housing authority. Users will make no distinction and will consider the footway network as a whole.

Cycle Routes

- A.4.3.17. The categories suggested for cycle routes are shown in Table 3. They are categorised not by use or functionality but by location, which reflects the differing risks associated with shared, partially segregated and fully segregated cycle routes.
- A.4.3.18. Where the level of use on particular cycle routes is significant and relevant to maintenance need, for example on commuter cycle routes, authorities may choose to establish categories based on use.

Table 3 – Factors to Consider – Cycle Routes

Description
Cycle lane forming part of the carriageway, commonly a strip adjacent to the nearside kerb. Cycle gaps at road closure point (no entry to traffic, but allowing cycle access).
Cycle track - a highway route for cyclists not contiguous with the public footway or carriageway. Shared cycle/pedestrian paths, either segregated by a white line or other physical segregation, or un-segregated.
Cycle provision on carriageway, other than a marked cycle lane or marked cycle provision, where cycle flows are significant.
Cycle trails, leisure routes through open spaces. These are not necessarily the responsibility of the Highway Authority, but may be maintained by an authority under other powers or duties.

Bridges and Structures

- A.4.3.19. Factors to consider include:
- position on the carriageway, footway, cycle route or PROW hierarchy;
 - type of asset, e.g. bridge, tunnel, retaining wall, earth structure, etc;
 - obstacle crossed, bridge span, retained earth height;
 - critical asset, historic structure, permanent weight, height, width or swept path restriction;
 - construction material, e.g. concrete or steel bridge, arch, slab or beam/girder bridge, concrete or stone walls, etc; and
 - local factors.

Street Lighting

- A.4.3.20. Factors to consider include:
- position on the carriageway, footway, cycle route or PROW hierarchy;
 - type of asset, e.g. street light, subway light, illuminated traffic sign or bollard, cable system, etc;
 - construction material, e.g. aluminum, concrete or steel lamp columns;
 - lamp and control type;

- highway use, casualty and crime statistics during hours of darkness; and
- local factors.

Public Rights Of Way

A.4.3.21. Factors to consider include:

- byways open to all traffic (BOAT);
- long distance trails and designated recreational routes;
- Core Paths (Scotland);
- rights of way;
- strategic link path;
- recreational path;
- surface type; and
- other access rights.

A.4.3.22. Some PROW may be metalled and within or on the fringe of urban areas. To recognise users' requirements for consistency, these should be considered for maintenance consistent with a similar footway and be incorporated in the footway hierarchy, irrespective of their designation.

A.4.4. RESILIENT NETWORK AND MINIMUM WINTER NETWORK

A.4.4.1. A 'Resilient Network' should be identified which will receive priority through maintenance and other measures in order to maintain economic activity and access to key services during disruptive events. The process for identifying the Resilient Network will consider which routes are absolutely essential and which can be done without for a time. It is implicit that these decisions will not simply follow road classification or categorisation. The process should engage key business and interest groups and involve the community. See also Section A.6 of this Code.

A.4.4.2. The Resilient Network is likely to include:

- those routes crucial to the economic and social life of the local or wider area;
- take account of repeat events, e.g. flooding; and
- local factors.

- A.4.4.3. A minimum Winter Service network should also be defined. This network may relate to the Resilient Network and may be a subset of the normal winter treatment network. It should provide a minimum essential service to the public, including links to the strategic network, access to key facilities and local communities, and other transport needs. It is important that there is continuity across boundaries. It is recognised that authorities may have difficulty in treating all public and school bus routes, however, where practicable, arrangements should be made to enable bus operators to run minimum services.
- A.4.4.4. Issues to consider when defining resilient and minimum Winter Service networks are:
- What is the key infrastructure access to be maintained? To this end, the authority's emergency planning department should be consulted. Consideration should be given to a wide range of services, including consideration for private asset infrastructure. For example, water treatment works may require chemical deliveries to ensure continuity of water supply but may not be on the primary treated road network.
 - How will carriageways, cycle routes and footways be prioritised across the authority's network?
 - How will the networks interface with other authorities? There is little point expending effort to keep a route open if it may be unusable in a neighbouring authority.

A.4.5. CRITICAL INFRASTRUCTURE

- A.4.5.1. Critical infrastructure is dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance, Part A](#).
- A.4.5.2. Having identified critical infrastructure assets it may be appropriate to consider their position in their asset hierarchy in a different way to similar, non-critical, assets. For example, a critical asset may be elevated to a higher category, or dealt with in isolation. It is also likely that a security minded approach may need to be adopted in relation to them.

A.4.6. LIFECYCLE / DESIGNING FOR MAINTENANCE

- A.4.6.1. Although much maintenance activity is undertaken on highway construction of long standing, new and improved highway schemes and facilities form an increasing proportion of the network over time. The future maintenance costs of such new infrastructure are therefore a prime consideration.
- A.4.6.2. Scheme development should focus on delivering the objectives whilst minimising network disruption and lifecycle costs and without compromising other important aspects such as access arrangements, environmental and sustainability issues, etc. Where it is not possible to minimise both disruption and lifecycle costs, compromise may need to be sought.
- A.4.6.3. There are many cases where careful consideration of maintenance implications at the design stage would have provided an equally effective outcome, but without maintenance complications either increasing costs or introducing practical difficulties which may compromise the effectiveness of the feature. Examples include:

- materials requiring a disproportionately high frequency of maintenance;
 - access difficulties for routine maintenance such as drain clearance and cleansing;
 - inappropriate use of bridge expansion joints rather than integral bridges;
 - inappropriate treatments and planting on central reservations or narrow verges;
 - maintenance requiring disproportionate traffic management and associated user disruption costs;
 - traffic calming and safety features with high rates of deterioration; and
 - operatives exposed to working close to live carriageways or at height.
- A.4.6.4. Disproportionately costly or inconvenient maintenance requirements may inhibit or prevent programmed maintenance taking place. Failure to provide the specified maintenance regime could have serious consequences for the potential liability of the authority and its employees.
- A.4.6.5. Given that works of highway improvement and significant maintenance will usually be funded from capital and that subsequent maintenance works will often be funded from revenue, the potential financial impact is greater than might be first perceived. The benefits of whole life designs and treatments should always be considered. The balance between capital and revenue expenditure could be different in certain forms of public private partnership.
- A.4.6.6. This is not to say that creativity should be inhibited. High quality or relatively expensive materials may provide appropriate, low maintenance and cost effective treatments in terms of their contribution to wider regeneration objectives, for example in improving the quality of public space and streetscape. It may also be appropriate to use environmentally sensitive materials in certain locations, despite the possibility of higher future maintenance costs. A series of regional guides published by [English Heritage](#) in collaboration with Department for Transport provide useful advice.
- A.4.6.7. Co-ordination of design and specifications between highway maintenance and highway improvement schemes can be improved through formal and informal liaison and co-operation between those involved to ensure that the whole life costs of schemes are optimised. These could involve formal consultation, value management and/or engineering, or a system of maintainability audits for a sample of schemes to establish local good practice. [Guidance on standard specification and standard details for Local Highway Authorities](#) has been produced by HMEP.
- A.4.6.8. Section A.4.9 of this Code outlines a number of factors that may be considered when designing for maintenance.

- A.4.6.9. Unusual maintenance requirements and costs associated with schemes or materials brought forward for approval should be identified so that they can be taken into account at the time. This is particularly important where new highways are being assessed for adoption and may be reflected in commuted sums for any higher than usual future maintenance costs sought from developers. The Association of Directors of Environment, Economy, Planning and Transport (ADEPT) has published guidance that aims to provide [advice on the commuted sums mechanism](#) through which developers are required to contribute to future maintenance of areas adopted by local authorities.

RECOMMENDATION 13 – WHOLE LIFE / DESIGNING FOR MAINTENANCE
Authorities should take lifecycle costs into consideration when assessing options for maintenance, new and improved highway schemes. The future maintenance costs of such new infrastructure are therefore a prime consideration.

A.4.7. ROAD/RAIL INCURSION

- A.4.7.1. Highway Authorities should work with relevant organisations to identify road/rail interfaces where a risk of incursion of road traffic onto a railway is present. The Department for Transport publication [Managing the accidental obstruction of the railway by road vehicles](#) details a risk ranking process to be followed at each road over rail and road/rail site. Higher ranked locations should be subject to a secondary assessment which will determine any necessary improvements or other mitigation measures. It also sets out what Highway Authorities, rail infrastructure authorities and other organisations need to do to identify how the risk of road vehicle incursion to the railway can be jointly managed and a protocol for apportioning responsibility and costs of improvement and mitigation measures.
- A.4.7.2. Highway Authorities should ensure that appropriate warning signs on the approaches to road/rail interfaces are placed and maintained such that they are clearly visible to road users.
- A.4.7.3. The following are recent links to RAIB reports which authorities will wish to note the recommendations and to ensure that action is taken where applicable:
- [Oxshott, August 2011](#);
 - [Stowmarket, November 2012](#);
 - [Aspatria, June 2014](#); and
 - [Froxfield, January 2016](#).

A.4.8. ABNORMAL LOADS

- A.4.8.1. The movement of abnormal loads on highways needs to be carefully managed so that large and/or heavy vehicles only use those parts of the network that can safely accommodate them. An abnormal load is considered to be a vehicle that is outside the classification of normal permitted traffic by virtue of its gross weight, length, width or axle configuration according to current road vehicle regulations. Authorities have powers to direct movement of abnormal loads and submission of a notification by the haulier enables the movement to take place legally.

- A.4.8.2. The movement of abnormal loads should be managed in such a way as to ensure that the load effects induced by the abnormal loads do not exceed the load bearing capacity of structures on the route. The suitability of a specific abnormal load to cross a particular structure should be checked broadly in accordance with the procedures recommended in [BD 21 or BD 86](#), or equivalent. Where an initial assessment shows that the load effects induced by an abnormal load marginally exceed the capacity of a bridge on the route, it may be possible for the abnormal load to safely cross the bridge provided other normal traffic is kept clear of the bridge when the abnormal load crosses it.
- A.4.8.3. The suitability of an abnormal load to travel along the proposed route should be checked by the haulier in relation to any height restrictions from overbridges and restrictions on manoeuvrability along narrow roads and sharp bends etc. Consideration should be given to the placing and specification of street furniture on regularly used/defined abnormal load routes, e.g. bollards and pedestrian guard rails which may need to be removed to allow passage of abnormal vehicles.
- A.4.8.4. In certain cases, e.g. vehicles wider than the traffic lane, abnormal loads should be escorted to provide appropriate warning to other traffic. Escorting may be undertaken by the police or by the haulier concerned as allowed for in the [Code of Practice – Self Escorting of Abnormal Loads and Abnormal Vehicles](#), or equivalent.
- A.4.8.5. Where road works are restricting the availability of regularly used abnormal load routes, consideration should be given as to how hauliers can be made aware of this.
- A.4.8.6. The management of abnormal loads requires coordination between:
- Abnormal Loads Officer – person responsible for receiving notifications of movements from hauliers, ensuring that such notifications are assessed and that the haulier is advised if there is any reason why a proposed movement should not take place.
 - Structures Advisor – a civil or structural engineer with good experience of Highway Structure Assessments to whom the Abnormal Loads Officer should refer decisions relating to vehicle movements which fall outside the agreed guidelines which otherwise determine whether or not particular vehicle movements should be accepted.
 - Traffic Manager – the person responsible for the coordination of all traffic management on the highway network. All owners or managers of highway structures should establish and maintain a system to receive notifications from hauliers in respect of abnormal load movements. The system should enable hauliers to be advised within the statutory time limits if there is any reason why the movement should not proceed.
- A.4.8.7. [The Electronic Service Delivery for Abnormal Loads \(ESDAL\) system](#), or equivalent, provides a process for managing abnormal load movements.

A.4.9. FACTORS TO CONSIDER FOR FUTURE MAINTENANCE

A.4.9.1. Tables 4 and 5 provide factors to consider by designers during the design process, to ensure that adequate consideration is given to future maintenance requirements of schemes. The list is not exhaustive but includes a number of key issues that may need to be addressed.

Table 4 – Factors to Consider for Future Maintenance (i)

Issue	Check	Action
Scope and Scale		
Intended life of scheme	Is the scheme long life or 'temporary' and likely to be affected by future redevelopment?	Choose materials and products relevant to the life of scheme.
Nature of scheme	Is the scheme a 'unique' prestige project or a 'routine' standard one?	Choose materials and products relevant to the type of scheme.
Scope of scheme	Has the scheme been 'value-managed' to consider all possible marginal benefits?	All 'significant' schemes should be value managed.
Use of scheme	Is the scheme likely to be subjected to particularly 'heavy duty' traffic use with high rates of wear?	Select design and materials to mitigate these affects so far as possible.
Cost of scheme	Have the costs of future maintenance been calculated and included in future budgets?	Identify any extraordinary maintenance costs and report these alongside construction costs.
Design Aspects		
Pedestrians and cyclists	Do footways and cycle routes fit the actual paths used?	Redesign to reflect actual paths to avoid erosion and later replacement.
Heavy goods vehicles	Is footway paving likely to be over-ridden by HGV or other parked vehicles?	Where necessary use heavy duty paving or prevent over-riding to avoid frequent costly replacement.
Grassed and planted areas	Are grassed and planted areas of a size and position to be effectively maintained?	Redesign or remove where necessary to avoid future poor appearance and later resign.
Trees	Have trees been selected and positioned to avoid future problems with roots, obstruction or leaf fall?	Reselect or reposition where necessary to avoid potentially expensive future problems.
Traffic signs	Are traffic signs required to be illuminated or can they be reflectorised?	Maximise use of reflective signs to reduce energy costs.

Table 5 – Factors to Consider for Future Maintenance (i)

Maintenance Operations		
Maintenance regime	Does the scheme require specialist maintenance regime?	Identify cost of specialist regime and, where appropriate, consider cheaper alternatives.
Cleansing	Does the scheme require specialist cleansing regime?	Identify cost of specialist regime and, where appropriate, consider cheaper alternatives.
Traffic management	Will maintenance require special traffic management?	Identify traffic management costs and minimise wherever possible, possible through co-ordination with other works.
Maintenance access	Is there safe and convenient access for plant and personnel?	Redesign scheme to provide safe and convenient access.
Materials and products		
Specialist materials	Are the materials used for the scheme of standard or specialist nature?	If specialist materials used ensure availability of future replacements.
Durability of materials	Does the durability of the materials provide substandard, oblique, sufficient or excessive life?	Select materials relevant to the intended life and nature of the scheme.
Failure mechanism	How will material/product approach the failure condition – slowly/quickly?	Programme safety and service inspections on basis of risk assessment.
Life extension	Are there any processes which could be used to extend useful service life at economic cost?	Investigate cost benefit of using life extension products.
Replacement practicability	Are there likely to be any difficulties in replacing failed sections?	Undertake risk assessment and plan for the likely difficulties.
Replacement cost	Is the cost of replacement likely to be disproportionately high?	Consider alternative materials or products.
Reuse and Recycling		
Practicability of reuse	If the scheme is a short life scheme what is the scope reusing materials and products?	Choose re-useable materials and products wherever possible.
Practicability of recycling	What is the scope for recycling materials and products?	Where re-useable materials and products are not appropriate, use recyclable wherever possible.

SECTION A.5.

RISK-BASED APPROACH

A.5.1. PRINCIPLES AND CONSIDERATIONS

- A.5.1.1. Risk management is dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Part C](#). This document should be referred to and the advice below considered supplementary.
- A.5.1.2. Management of highway infrastructure maintenance, including setting policy, strategy and levels of service, establishment of inspection and condition assessment regimes, determining priorities and programmes, procuring the service and the management of all associated data and information should all be undertaken against a clear and comprehensive understanding and assessment of the risks and consequences involved.
- A.5.1.3. The principle of this Code is that Highway Authorities will adopt a risk-based approach in accordance with local needs (including safety), priorities and affordability. This is consistent with [ISO 55000](#), which states that “asset management translates the organisation’s objectives into asset-related decisions, plans and activities, using a risk based approach.” The Code will not therefore outline any minimum or default standards, but includes guidance and advice to support development of local levels of service.
- A.5.1.4. Further guidance on general risk management can be found within the following publications:
- [ISO 31000:2009 – Risk management – Principles and guidelines](#)
 - [BS 31100:2011 – Risk management – Code of practice and guidance for the implementation of BS ISO 31000](#)
 - [The Institute of Risk Management – Risk Appetite and Tolerance](#)
- A.5.1.5. Specific examples of managing risk in a highways claims and liability context can be found below:
- [The UK Highway Liability Joint Task Group – Highway Risk and Liability Claims](#)
 - [Alarm, the public risk management association – Managing the risk of highway claims – best practice guidelines for highway asset managers](#)

RECOMMENDATION 14 – RISK MANAGEMENT

The management of current and future risks associated with assets should be embedded within the approach to asset management. Strategic, tactical and operational risks should be included as should appropriate mitigation measures. (HIAMG Recommendation 11)

A.5.2. DEVELOPING THE RISK BASED APPROACH

A.5.2.1. The risk-based approach to highway infrastructure maintenance should be documented, and essentially be based on:

- an understanding of and alignment with the authority's corporate objectives, legislative requirements, and corporate approach to risk and management of risk;
- an understanding of risk in a highways service and its application to all areas of operations, including people, infrastructure, data, finance and suppliers;
- an understanding of the potential risks and their likely significance to users, stakeholders, the authority and to the data and information held;
- an understanding of the inventory, function, criticality, sensitivity, characteristics and use of the various assets comprising the highway network;
- the establishment of hierarchies and levels of service with appropriate funding;
- the implementation of the agreed levels of service;
- the competency required in development and implementation of the risk-based approach; and
- regular evidence-based reviews.

A.5.2.2. Establishment of a risk register is important. Where partnerships are involved, this will need to identify the assignment of risks between the respective parties.

A.5.3. COMPETENCIES AND TRAINING

A.5.3.1. Competencies and training are covered in the [UKRLG Highway Infrastructure Asset Management Guidance, Part C](#). This document should be referred to and the advice below considered supplementary.

A.5.3.2. Those involved in managing, developing and implementing the risk-based approach must be competent to the satisfaction of the Highway Authority. Authorities should provide clear guidance and training to employees and establish requirements for others managing or carrying out activities. The guidance and training should include establishment of the risk-based approach itself and practical implementation. Activities included are likely to cover management, developing the local approach to risk, risk assessment and analysis, maintenance planning, making the right choices when designing and specifying techniques and materials, and work on site such as safety and other inspections, testing and maintenance works. Where appropriate, it should also include security awareness and relevant information on the security-minded approach adopted. Training should recognise the possibility of legal challenge to decisions.

- A.5.3.3. The Engineering Council, as the UK regulatory body for the engineering profession, sets and maintains standards of professional competence and ethics that govern the award and retention of the titles Chartered Engineers (CEng), Incorporated Engineers (IEng) and Engineering Technicians (EngTech). The Engineering Council holds details of degree programmes that partially or fully satisfy the education requirement for CEng and IEng registration and of programmes that professional engineering institutions have approved as contributing towards EngTech registration.
- A.5.3.4. A programme of Continuing Professional Development and training for all staff and others involved in developing and implementing the risk based approach should be provided to enable them to maintain up to date knowledge and skills and specifically to understand and implement the processes described in this Code. It is recommended that agents and contractors are required to demonstrate that their personnel are adequately trained and competent for the work they undertake.

RECOMMENDATION 15 – COMPETENCIES AND TRAINING

The appropriate competencies for all staff should be identified. Training should be provided where necessary for directly employed staff, and contractors should be required to provide evidence of the appropriate competencies of their staff.

A.5.4. INSPECTIONS AND SURVEYS

- A.5.4.1. Establishment of an effective regime of inspection, survey and recording is the most crucial component of highway infrastructure maintenance. The characteristics of the regime, including types and frequency of inspection, items to be recorded and nature of response, should be defined following an assessment of the relative risks associated with potential circumstances of location, agreed level of service and condition. These should be set in the context of the authorities' overall asset management strategy.
- A.5.4.2. The inspection, survey and recording regime should provide the basic information for addressing the core objectives of highway maintenance namely:
- network safety;
 - network serviceability; and
 - network sustainability.
- A.5.4.3. It will also provide the basic condition data for the development of maintenance programmes.
- A.5.4.4. All elements of the inspection and survey regime should be applied systematically and consistently. This is particularly important in the case of network safety, where information may be crucial in respect of legal proceedings. It is important to recognise that all information recorded, even if not primarily intended for network safety purposes, may have consequential implications for safety and may therefore be relevant to legal proceedings. It is also important to recognise that records may have to be made available for public inspection and reference.

A.5.5. CATEGORIES OF INSPECTION AND SURVEYS

- A.5.5.1. Inspections and surveys can be considered in the categories below, approximately corresponding to the core objectives of highway maintenance. Authorities are not statutorily obliged to undertake inspections of all highway elements under all of these categories, but are strongly advised to undertake at least safety inspections in accordance with the principles of this Code. Further guidance on risk-based inspection and surveys for specific assets is provided in Parts B, C and D of this Code.
- A.5.5.2. Safety inspections are designed to identify all defects likely to create danger or serious inconvenience to users of the network or the wider community. The risk of danger is assessed on site and the defect identified with an appropriate priority response. These inspections may include systematic testing of some facilities.
- A.5.5.3. Service inspections mainly comprise detailed inspections tailored to the requirements of particular highway assets and elements to ensure that they meet requirements for serviceability. The scale and scope of these inspections will be determined by the authority's approach to asset management. These inspections also include inspections for network integrity and for regulatory purposes, including NRSWA, intended to maintain network availability and reliability.
- A.5.5.4. Condition surveys are primarily intended to identify deficiencies which, if untreated, are likely to adversely affect long term performance, serviceability and safety. Processing survey data through a decision support system can provide evidence of future life expectancy and for when intervention may be appropriate. Authorities may be required to undertake certain condition surveys to enable reporting to national governments and to satisfy the requirements of valuation regimes.
- A.5.5.5. Assessment of structures is to determine the ability or capacity of the structure to carry the loads which are imposed upon it, and those which may reasonably be expected to be imposed upon it in the foreseeable future.
- A.5.5.6. Reports from members of the public provide a further source of information on the condition of all aspects of the highway network. If this source is to be used to complement formal inspections and surveys, a policy should be made public with processes and systems in place to ensure that suitable communication is provided to contributors to acknowledge receipt of information and provide feedback on how it has been used (for example, any resulting maintenance activity). Appropriate quality assurance measures may be needed to check reports as appropriate, ensure duplicate reports are identified and combined, and to maintain auditability of information.

- A.5.5.7. There are a wide range of inspections which need to be considered by authorities and it may be possible to co-ordinate these to make the best use of resources. It may also be possible to integrate inspections with other activities. For example, where integrated street management arrangements are in place in town centres for cleansing and repair it may be possible to combine safety inspections with cleansing and other inspections undertaken by Street or Community Wardens. Authorities may choose to combine safety and service inspections. Where combined inspections are adopted, particular care should be taken to ensure that consistent levels of quality are maintained when recording results. Highway Authorities should ensure that those carrying out inspections are trained, qualified and competent.
- A.5.5.8. Inspection and survey regimes should be planned using a risk based approach to provide increased levels of scrutiny to areas or assets deemed to be of higher risk. For example, where flooding has been identified as a risk in a specific area, then an authority may wish to supplement its existing inspection arrangements of drainage assets with a visual survey.

RECOMMENDATION 16 – INSPECTIONS

A risk-based inspection regime, including regular safety inspections, should be developed and implemented for all highway assets.

RECOMMENDATION 17 – CONDITION SURVEYS

An asset condition survey regime based on asset management needs and any statutory reporting requirements should be developed and implemented.

A.5.6. MANAGEMENT SYSTEMS, RECORDING AND MONITORING OF INFORMATION

- A.5.6.1. An asset register may be used by authorities to record inventories of asset types for which they have liability. This register may in practice be a combination of several asset specific systems and will form the basis of identifying which asset items safety and serviceability inspections should cover.
- A.5.6.2. The asset register should also provide for recording service requests, complaints, reports or information from users and other third parties. These may require immediate action, special inspection, or influence future inspection or monitoring arrangements. The nature of response, including nil returns, should also be recorded. All inspections should record as a matter of course: time, weather conditions, any unusual circumstances of the inspection and the person conducting the inspection.
- A.5.6.3. Arrangements should be made to review the inspection, assessment and recording regime at intervals to consider:
- changes in network characteristics and use;
 - completeness and effectiveness of data collected;
 - effectiveness of data analysis; and
 - the need for changes to the inspection regime derived from risk assessment.

- A.5.6.4. The frequency of such reviews should have regard to the extent and nature of changing circumstances. The analysis will also be helpful for other purposes, however, and these might also influence the frequency of review, which could include the following:
- ensuring compliance with legal obligations;
 - measuring network serviceability and condition performance;
 - establishing extent of outstanding work;
 - seeking continuous improvement; and
 - monitoring service delivery arrangements.
- A.5.6.5. Managing the safety and wide range of other risks associated with the delivery of highway infrastructure maintenance will require effective and co-ordinated information systems. Record systems should include all user contact information, records of inspection and condition and records of all maintenance activity. They should also be co-ordinated with other relevant record systems, for example road accidents database.
- A.5.6.6. The efficiency, accuracy and quality of information and records maintained by authorities will be crucial both to the effective management of the service and to the defence of claims against the authority for alleged failure to maintain. The management system will need to support compliance with standards of evidence provision.
- A.5.6.7. Where information systems hold sensitive and/or personally identifiable information, a security minded approach, appropriate to the level of risk, should be adopted in relation to the capture, creation, processing, storage, distribution and use of relevant data and information in accordance with the Data Protection Act.
- A.5.6.8. All information obtained from inspections and surveys, together with the nature of response, including nil returns, should be recorded consistently to facilitate analysis. Such analysis should enable the data from inspections and surveys to be reviewed independently, but also in conjunction with other information to enable a holistic view to be taken of likely future maintenance need, asset condition and trends related to network characteristics and use.

RECOMMENDATION 18 – MANAGEMENT SYSTEMS AND CLAIMS

Records should be kept of all activities, particularly safety and other inspections, including the time and nature of any response, and procedures established to ensure efficient management of claims whilst protecting the authority from unjustified or fraudulent claims.

A.5.7. SAFETY INSPECTIONS

- A.5.7.1. Safety inspections are designed to identify all defects likely to create danger or serious inconvenience to users of the network or the wider community. Such defects should include those that are considered to require urgent attention as well as those where the locations and sizes are such that longer periods of response would be acceptable.

- A.5.7.2. Authorities should determine frequencies of inspection through a risk-based approach that reflects the characteristics of the particular asset or asset group, e.g. carriageway, footway, structures, lighting, etc, and their position in the hierarchy. Authorities should also determine the most appropriate way to undertake surveys for each of the different assets or asset groups, and keep abreast of new technologies which may improve safety and quality.
- A.5.7.3. Additional inspections may be necessary in response to user or community concern, as a result of incidents or extreme weather conditions, or in the light of monitoring information. These may be identified through the risk-based approach.
- A.5.7.4. The safety inspection regime forms a key aspect of an authority's approach to managing liabilities and risks. The parameters which need to be considered for a safety inspection regime are:
- frequency of inspection;
 - items for inspection;
 - type of traffic and intensity;
 - method of inspection; and
 - nature of response.
- A.5.7.5. The regime should be developed based on a risk assessment and provide a practical and reasonable approach to the risks and potential consequences identified. It should take account of potential risks to all users, and in particular those most vulnerable.
- A.5.7.6. Frequencies for safety inspections of individual network sections or individual assets should be based upon consideration of:
- category within the network hierarchy;
 - type of asset, e.g. carriageway, footway, embankment, cutting, structure, electrical apparatus, etc;
 - critical assets;
 - consequence of failure,
 - network resilience;
 - use, characteristics and trends;
 - incident and inspection history;
 - characteristics of adjoining networks elements;
 - the approach of adjoining Highway Authorities; and
 - wider policy or operational considerations.

- A.5.7.7. Where asset condition has deteriorated significantly, it may be appropriate to inspect particular assets more frequently than would otherwise be the case.

A.5.8. DEFECT RECORDING AND REPAIR

- A.5.8.1. All defects observed during safety inspections that provide a risk to users should be recorded and the level of response determined on the basis of risk assessment. The degree of deficiency in highway elements will be crucial in determining the nature and speed of response. Although some general guidance can be given by authorities on the likely risk associated with particular defects, on-site judgement will always need to take account of particular circumstances. For example, the degree of risk from a pothole depends upon not merely its depth but also its surface area and location.
- A.5.8.2. A procedure for risk assessment is described in the [UKRLG Highway Infrastructure Asset Management Guidance, Part C](#). Any item with a defect level which corresponds to, or is in excess of, the defect investigatory level adopted by the authority is to be assessed for likely risk.
- A.5.8.3. Defects which are considered to require urgent attention should be corrected or made safe at the time of the inspection, if reasonably practicable. In this context, making safe may constitute displaying warning notices, coning off or fencing off to protect the public from the defect. If it is not possible to correct or make safe the defect at the time of inspection, repairs of a permanent or temporary nature should be carried out as soon as possible. If temporary repairs have been used, permanent repair should be carried out within a reasonable period.
- A.5.8.4. Defects that do not represent an immediate or imminent hazard or risk of short term structural deterioration may have safety implications, although of far less significance than those which are considered to require urgent attention. They are more likely to have serviceability or sustainability implications. If repairs are to be undertaken these are likely to be within a planned programme of works with their priority determined by risk assessment. Access requirements, other works on the network, traffic levels, and the desirability of minimising traffic management, should also be considered as part of the response.

RECOMMENDATION 19 – DEFECT REPAIR

A risk-based defect repair regime should be developed and implemented for all highway assets.

A.5.9. REPORTING BY THE PUBLIC

- A.5.9.1. Feedback from members of the public is an increasing source of data on the condition of all aspects of the highway network, with the use of smartphones and other personal mobile technology providing details such as location, time and imagery.
- A.5.9.2. If this source of data is to be used to complement dedicated inspection and survey techniques outlined above, then a policy should be approved and made public, with processes and systems put in place to ensure:
- an efficient system for logging and managing such reports should be used;
 - appropriate quality assurance measures are in place to check reports by the public and maintain auditability of data; and

- suitable communication is provided to contributors to both acknowledge receipt of any submitted information, and also feedback on how it has been used (for example, any resulting maintenance activity).

A.5.10. WORKS PROGRAMMES

- A.5.10.1. Works programming is dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance, Part B](#).

A.5.11. FURTHER GUIDANCE ON DEVELOPING AND IMPLEMENTING THE RISK BASED APPROACH

Introduction

The following is an example risk management process suitable for use to implement the risk-based approach within a Highway Authority. In order for risk management to be successful it must be appropriate and adapted to each organisation.

Figure 2 below shows an example of a risk management process, based on [ISO 31000](#) and the [UKRLG HIAMG Part C](#).

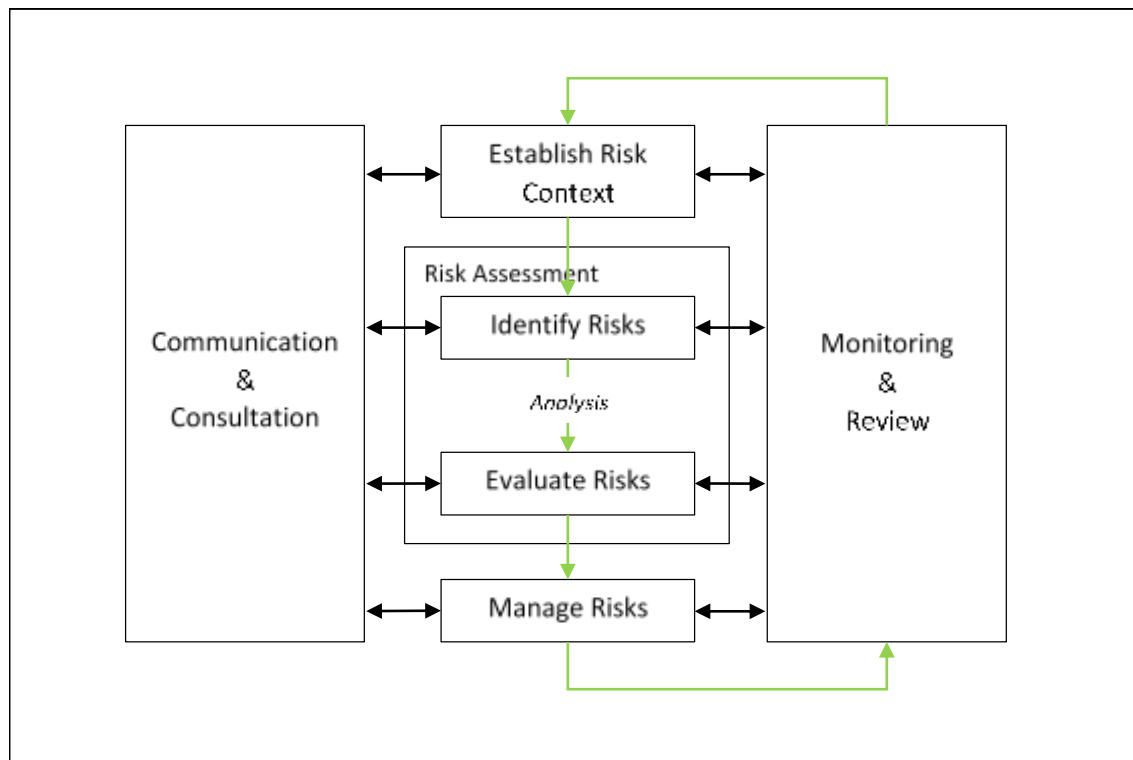


Figure 2 – An Example of a Risk Management Process

The figure shows that two parts of the process, Communications & Consultation and Monitoring & Review, persist throughout the risk management process and can impact on all stages.

These could be internal discussions that lead to a new risk being identified, or customer engagement reporting issues on the network which may require a review of inspection frequency.

The risk management process will have regular reviews but should also be agile enough to respond as a part of day-to-day management, embedding the risk-based approach in an authority's operations.

The explanations below of the various elements of the process give generic examples of actors, actions, activities and roles which could be involved at each part of the process.

At each stage in the process actions may be required to ensure that risks remain at tolerable levels, or are exploited to an organisation's advantage.

This will only occur where clear responsibility and accountability is defined and understood, and acted upon for each and every individual risk.

Establish Risk Context
<ul style="list-style-type: none"> The authority's corporate risk management approach, appetite and framework/process will all need to be clearly understood.
<ul style="list-style-type: none"> Risk will be managed at many different levels within each Highway Authority, but when implementing a truly risk-based approach the wider risk context must form the start of the process.
<ul style="list-style-type: none"> Risk management should support the delivery of organisational objectives and as a result, the risk management approach and risk appetite will be owned by the executive and senior management – this will set the context within which risk-based highway management can be developed.
<ul style="list-style-type: none"> The wider context may include the influence of partners, suppliers, customer groups, Local Enterprise Partnerships, Local Resilience Forums, Government Departments and other issues such as economic circumstances, climate change or political aspirations.
<ul style="list-style-type: none"> Whilst part of the context, these issues should always be viewed through the filter of the organisation's risk management approach.
<ul style="list-style-type: none"> The authority's designated corporate risk manager will be a key point of contact, as will departmental and team risk management leads.
<ul style="list-style-type: none"> Government departments, stakeholders, partners and customers may all form part of the groups relevant to the risk context, whilst not setting it directly.
<ul style="list-style-type: none"> The monitoring and review; and communication and consultation aspects of the process can be used to manage these interactions.

Risk Assessment
Risk assessment comprises three stages, these may be recorded on a risk register as a tool to provide a statement of risk management at any particular time, but each aspect is a separate consideration.
Identify Risks
<ul style="list-style-type: none"> Once the context and approach to risk management has been defined, risks should be identified across the Highway Authority's operations. These will cover a diverse range of subjects as detailed in section 13.3 of the UKRLG HIAMG.
<ul style="list-style-type: none"> The risk identification stage is a crucial opportunity to ensure risks are visible throughout the organisation.
<ul style="list-style-type: none"> Risks should be unmitigated at this stage to allow for later prioritisation.
<ul style="list-style-type: none"> To fully understand all risks and compare risks across risk groupings will require a collaborative process across the authority with subject matter experts, managers and corporate functions all likely to contribute specific knowledge relevant to differing risk types.
<ul style="list-style-type: none"> Risk management groups and teams may be useful in facilitating this flow of information and integrating the highways risk process into the corporate risk management framework.
<ul style="list-style-type: none"> The frequency and format of risk identification will need to be based on the organisation's risk management guidance and the risk context.
<ul style="list-style-type: none"> It will be important to establish and regularly review the risk management basis of both the hierarchy and inspection frequency, including the impact of the defined Resilient Network.
<ul style="list-style-type: none"> It will also be an opportunity for a Highway Authority to consider the sustainability and agility of its arrangements and develop its risk based approach appropriate to local circumstances.
Evaluate Risks
<ul style="list-style-type: none"> Risk evaluation is a product of understanding the likelihood and consequence of a particular event. It is important to note that whilst this is often viewed as a negative 'impact' risks can also present opportunities.
<ul style="list-style-type: none"> Authorities will already have an established corporate risk management approach and this will need to be extended and adapted to be appropriate to the highway risk-based approach.
<ul style="list-style-type: none"> Consequence descriptions in the evaluation process may need to be developed in the highways context, and the corporate risk manager should be consulted as part of this process.
<ul style="list-style-type: none"> Section 13.5 of the UKRLG HIAMG provides more detail on risk evaluation and should help authorities gain a clear understanding of the risks they face, such that they can be compared and risk management decisions made.

Manage Risks
<ul style="list-style-type: none"> • Treatment of risk ensures that an organisation is conscious of the risks it faces and has a coordinated approach to the management and mitigation of risks, where possible, and is aware of the remaining risk levels where mitigation is not possible or desirable.
<ul style="list-style-type: none"> • The risk appetite of the Highway Authority will shape the management of each risk and will need to be clearly understood and communicated to all those involved in risk management decisions.
<ul style="list-style-type: none"> • It is important to note that financial, resourcing, political, environmental and other circumstances will all impact risk appetite and decisions made, but clear decisions and residual risk levels should be recorded and shared within the authority.
<ul style="list-style-type: none"> • In the example of highway inspection and associated defect repairs it will be equally important for Highway Authorities to deliver efficiencies through accurately identifying risks that can be managed and resolved through planned programmes of work as it will be to make provision for the appropriate prompt response to high risks.
<ul style="list-style-type: none"> • This will rely on good risk management process and competencies.

Communication & Consultation
<ul style="list-style-type: none"> • Communications and consultation is a constant part of the risk management process and impacts at each and every stage, since for risk management to be fully embedded in an organisation the risk management process should be part of normal operations management.
<ul style="list-style-type: none"> • It is likely that there will be regular cycles of review, but for an organisation to have fully adopted a risk-based approach, all routine management decisions should also be cognisant of the impact, positive or negative, that they will have on remaining risk levels.
<ul style="list-style-type: none"> • This safeguards the organisation's strategic objectives and focusses delivery but, most importantly, recognises that risk management decisions are routinely made every day, keeping an authority's risk-based approach agile and relevant to their operations.
<ul style="list-style-type: none"> • Formal consultation, communication and governance will likely be in place for risk management within an authority and wherever possible, this should be adopted and extended to include the highways risk-based approach.
<ul style="list-style-type: none"> • External communications will be essential in seeking to align customer expectations, political aspirations, and a deliverable and sustainable risk management approach.
<ul style="list-style-type: none"> • The preparation and approval governance of such external communications may lead to internal challenge and review of the arrangements and re-affirmation of the message before the communication.

Monitoring & Review
<ul style="list-style-type: none"> At all stages of the risk process different people will identify, evaluate, communicate and manage a risk.
<ul style="list-style-type: none"> The risk-based approach adopted by an authority should clearly identify roles and responsibilities of those involved in the process so that ownership and monitoring of each stage of the process is clearly understood and managed appropriately.
<ul style="list-style-type: none"> Highway Authorities should be mindful of the agility of their risk based approach to support adequate management of locations of increased risk, including when they are located within parts of their network generally exhibiting lower risk characteristics.
<ul style="list-style-type: none"> Monitoring and review should be dynamic so that as risk levels change, an organisation's approach to managing the risk can too.
<ul style="list-style-type: none"> Timely review and appropriate information sharing will be key to an agile and responsive risk management process.
<ul style="list-style-type: none"> Finally the risk management process itself must be subject to regular review and monitoring to ensure it is fit for purpose and suitably managing risks.
<ul style="list-style-type: none"> Authorities are often undergoing significant corporate or departmental change which may result in a requirement to amend the process, change management arrangements or reallocate roles and responsibilities to ensure the risk-based approach is continuing to add value and deliver corporate objectives.

SECTION A.6.

NETWORK RESILIENCE

A.6.1. OVERVIEW

A.6.1.1. The UK's road network is an important part of our national infrastructure, enabling the successful operation of many social and economic activities and the continued availability and operation of these routes is a vital part of keeping our towns, cities and regions running.

A.6.1.2. Resilience is defined by the Cabinet Office as the 'ability of the community, services, area or infrastructure to detect, prevent, and, if necessary to withstand, handle and recover from disruptive challenges.' There are four components to resilience and Highway Authorities are likely to draw on a combination of these in reducing risk of failure, especially on their Resilient Networks:

- resistance – preventing damage (e.g. a flood wall);
- reliability – operation under a range of conditions (e.g. earthworks stabilisation);
- redundancy – availability of backups or spare capacity (e.g. a suitable diversion route); and
- recovery – enabling a fast response and recovery (e.g. temporary bridges).

A.6.1.3. This approach fits well with the guidance given in this Code and provides an overview of what network resilience should aim to deliver.

A.6.1.4. The [National Risk Register of Civil Emergencies](#) is the source document for risk assessment in the UK and is supported by specific guidance and Local Risk Registers within all Local Resilience Forums. These documents will help frame the risks faced and the threat they present. Interaction with emergency planning teams within all organisations and partners will be key to understanding and aligning response to the risks.

A.6.1.5. Current risks especially pertinent to this document are:

- **human diseases** – especially with regard to their impact on business continuity;
- **flooding** – including pluvial, fluvial, groundwater and coastal, as experienced in many locations within the last few years;
- **severe space weather** – such as solar flares, relevant as technology increases in operation, maintenance and within user's vehicles;
- **severe weather** – both in the context of seasonal norms and sudden impact events;
- **major industrial accidents** – especially where they touch the road network;

- **widespread electricity failure** – impacting on technology resilience;
- **major transport accidents** – the ability to mitigate, respond and recover;
- **disruptive industrial action** – often with an impact on network operation and usage;
- **terrorist, malicious or criminal attacks or civil protest** – in a variety of forms, linked to operations and security;
- **cyber security** (encompassing computer and computer network security) – a burgeoning risk with a specific impact on intelligent systems, automated systems and systems comprising a computational aspect and physical aspect working together to accomplish a task or function; and
- **severe wildfires.**

A.6.1.6. The resilience measures implemented to manage these and other local risks are likely to include physical works, staff training, customer information, management plans and procedures and adoption of an appropriate and proportionate security minded approach.

A.6.1.7. If failure of an asset could lead to major consequences, it should be identified as a critical asset and assessed in greater detail, as defined in [HIAMG](#) Section 13.4.

A.6.1.8. Tools that are developed to assess, improve and manage network resilience will reveal information about parts of the highway infrastructure, or other related assets such as utilities, which are critical from a security perspective. Where this is the case, the adoption of a security minded approach in relation to use of the tool and the information it generates will be essential.

A.6.2. TRANSPORT RESILIENCE REVIEW

A.6.2.1. The extreme weather in some parts of the UK over the winter of 2013/14 led to considerable disruption to transport networks. A succession of storms brought the highest winter rainfall across southern England since records began in 1766, resulting in widespread flooding and extensive wind and coastal damage. The events raised the question of how transport systems could be made more resilient so as to reduce the disruption from extreme weather in the future. The [Transport Resilience Review](#) was published in 2014 and the [Government Response](#) to the Review was published in the following November.

A.6.2.2. The Transport Resilience Review made 63 recommendations, a number of which relate to the management of the highway network. Some of these recommendations have been incorporated into the guidance in this Code.

A.6.3. RESILIENT NETWORK

A.6.3.1. The Transport Resilience Review recognises that an economically rational approach should be taken to spending on resilience, “ensuring that enough is invested, with the right prioritisation, and avoiding wasteful and economically unjustified expenditure”.

A.6.3.2. There are a wide variety of highway types, functions and uses across the UK and it is not practicable to either assess or build resilience across all of the Highway Authority networks. There is a need to focus resilience risk assessments and plans on a subset of each network - defined as the “Resilient Network” and outlined in Section A.4 of this Code. It should be developed and reviewed as necessary to ensure that it provides:

- connectivity between major communities;
- links to the strategic highway network;
- connectivity across authority boundaries where appropriate;
- links to transport interchanges;
- access to emergency facilities including Fire and Rescue, Police, Ambulance Services and hospitals;
- links to critical infrastructure (ports, power stations, water treatment works etc);
- principal public transport routes, access to rail and bus stations, and to bus garages and other depots; and
- other locally important facilities.

A.6.3.3. When defining the Resilient Network, consideration should be given to engaging with the Local Resilience Forum, or equivalent, key businesses and interest groups to jointly identify routes which are critical to the economic and social life of the area. Neighbouring Highway Authorities should also be consulted to ensure continuity of the Resilient Network at a regional level.

A.6.3.4. The risk of specific asset failure, to the extent that it leads to closure or restriction of the Resilient Network, should be assessed. This should take into account the likelihood of failure due to the asset’s physical attributes and its location (e.g. design capability / capacity, condition, geology, catchment characteristics). The socio-economic consequences of failure should also be considered and include the potential for community severance, the ability to respond to further emergencies, the suitability and length of any diversion route, typical traffic types and volumes, repair / recovery cost and timescale, and damage to statutory utility plant.

RECOMMENDATION 20 – RESILIENT NETWORK

Within the highway network hierarchy a Resilient Network should be identified to which priority is given through maintenance and other measures to maintain economic activity and access to key services during extreme weather.

A.6.4. CLIMATE CHANGE AND ADAPTATION

- A.6.4.1. The [Climate Change Act 2008](#), or equivalent, established a statutory framework for adaptation and set in place a five-year cycle for Government to report on the risks to the UK of climate change and to publish a programme setting out how these impacts will be addressed. The Act also introduced an Adaption Reporting Power which allows the Government to direct public bodies and statutory undertakers to submit a report on their climate risks and their plans to address them.
- A.6.4.2. The key climate changes for the UK are identified within the [UK Climate Projections 09 \(UKCP09\)](#) :
- all areas of the UK get warmer and the warming is greater in summer than in winter;
 - there is little change in the amount of precipitation (rain, hail, snow etc) that falls annually but it is likely that more of it will fall in the winter with drier summers for much of the UK; and
 - sea levels rise – more in the south of the UK than the North.
- A.6.4.3. In 2012 the first national [Climate Change Risk Assessment \(CCRA\)](#) analysed 100 potential impacts of climate change to 11 sectors. For the transport sector the assessment identified flooding, landslides, heat damage and bridge scour as important risks. This has been followed up with the [2016 report](#), which highlights further issues.
- A.6.4.4. The Government released the first [National Adaptation Programme \(NAP\)](#) in July 2013. It contains a series of objectives and associated actions to tackle risks identified in the CCRA. Most notably with regard to highway infrastructure management, objectives 7 and 8 are:
- To ensure infrastructure is located, planned, designed and maintained to be resilient to climate change, including increasingly extreme weather events.
 - To better understand the particular vulnerabilities facing local infrastructure from extreme weather and long term climate change to determine actions to address the risks.
- A.6.4.5. The [Scottish Climate Change Adaptation Programme](#) addresses the risks identified for Scotland in the UK Climate Change Risk Assessment.
- A.6.4.6. Highway Authorities should consider how various climate change variables such as intense or prolonged rainfall; hotter temperatures and higher wind speed will impact on the type of highway assets that they manage and the likelihood of these events occurring. By doing this the greatest generic risks to network closure or restriction can be identified. These are likely to be:
- flooding (pluvial, fluvial, groundwater and coastal);
 - landslips;
 - bridge scour;

- widespread tree fall;
 - carriageway heat damage;
 - falling power and communications lines;
 - falling temporary structures on development sites; and
 - disruption at interchanges with other transport modes such as rail and tram.
- A.6.4.7. Highway Authorities should review and apply the latest UK Climate Projections, as developed by the Met Office and Environment Agency, when assessing future risk and vulnerability. These projections for future changes to both average climatic conditions and also the frequency of extreme weather events, allow for an understanding of where risk levels may change, and the identification of new risks which may emerge as the climate changes. When applied alongside records of past incidents, and other information sources (such as flood maps), climate projections may also help to identify when and what action should be taken to adapt to the risks.
- A.6.4.8. The locations where there is potential for these events to occur on the Resilient Network should be identified. This can be done using the highway asset inventory and records of past incidents of weather related damage or incidents such as flooding or landslips. The local Flood Risk Management Plans, as prepared by the Lead Local Flood Authority, should also be used to identify areas prone to flooding. Where possible, local knowledge should be used to validate the findings.
- A.6.4.9. Some of the risks may have the potential to be reduced by mitigation action. Such action could range from improved routine inspection or maintenance regimes to major asset improvement or replacement works. Options for mitigating the greatest risks should be explored with a view to prioritising those measures that will provide the greatest return on investment in terms of reduced risk. These measures should be integrated with the asset management plan with an appropriate weighting.

RECOMMENDATION 21 – CLIMATE CHANGE ADAPTATION

The effects of extreme weather events on highway infrastructure assets should be risk assessed and ways to mitigate the impacts of the highest risks identified.

A.6.5. PLANNING FOR RESPONDING TO NETWORK DISRUPTIONS

- A.6.5.1. Resilience planning is not just about the physical resilience of the highway infrastructure but also about how disruption is managed and the speed of recovery. Climate change and other rising risks may increase the frequency with which Highway Authorities will have to respond to severe weather emergencies. Authorities should establish, in consultation with others, including service providers, emergency services and relevant agencies such as the Environment Agency, or equivalent, operational plans and procedures to enable timely and effective action to mitigate the effects of such weather emergencies as they affect the highway network. There will also be other weather conditions, such as fog or heavy rain, which although possibly causing danger and operational difficulties, would not be considered as emergencies.

- A.6.5.2. The content of operational plans and procedures could be based on those developed for Winter Service, adapted to suit the particular risks involved. It will be essential to address specific health and safety issues relevant to each emergency.
- A.6.5.3. There are a number of other potential emergency situations which could affect the highway, including those resulting from subsidence, landslip or collapsed walls and oil spills. Although the risk of some such occurrences can be reduced through a risk-based inspection regime, there are likely to be occasional random occurrences and contingency planning should be undertaken.
- A.6.5.4. There is also a wide range of other civil emergencies in which the highway maintenance service may need to become involved. In such cases plans, procedures, and responsibilities will be defined in the Highway Authority's Civil Emergency Plan, maintained by the authority's Emergency Planning Department, and related to more specific plans maintained by the Police and other emergency services. Requirements placed on authorities for emergency planning are set out in the [Civil Contingencies Act 2004](#), or equivalent. Local authorities are Category 1 responders under this Act.
- A.6.5.5. Operational plans and procedures for severe weather and other emergencies will need to be regularly tested and validated for effectiveness against a range of risk scenarios relevant to the authority's area. Consideration should also be given as to whether specific staff training is needed to support people discharging challenging or unusual roles, either due to the emergency situation itself or the role being a change from their normal duties. Training and exercising should be undertaken in accordance with the Authority's emergency plan.
- A.6.5.6. Recent experiences and consequences of flooding have increased the importance placed by local communities on flood protection measures and the need for effective action by authorities in planning and responding to extreme weather conditions. The [Flood and Water Management Act 2012](#), or equivalent, aims to improve both flood risk management and the way that water resources are managed. The Act creates clearer roles and responsibilities and instils a more risk-based approach. This includes a new lead role for local authorities in managing local flood risk (from surface water, ground water and ordinary watercourses) and a strategic overview role for all flood risk for the EA, or equivalent. They will be the key agency in respect of responding to flood emergencies, and authorities will need to work closely with them.
- A.6.5.7. In planning for increased risk of flooding from rivers and sea, authorities should:
- undertake a risk assessment to determine vulnerable highways;
 - define alternative routes and progressively bring them up to appropriate standards of maintenance and signing;
 - consider promotion of improved flood defences by infrastructure owners;
 - consider installation of improved flood protection;
 - prepare contingency plans in consultation with other authorities;
 - ensure bridge openings and culverts are sufficient to deal with predicted levels of flooding; and

- consider if any critical infrastructure on vulnerable routes could be bypassed by a suitable new route.
- A.6.5.8. The contribution of authorities in dealing with flood conditions will depend upon the circumstances but could include:
- signing and maintaining diversions;
 - inspection, clearance and maintenance of drainage systems, including outfalls.
 - provision and operation of land and water transport;
 - encouraging property owners to protect their own property;
 - provision and installation of sandbags and other protection in certain cases;
 - general support to emergency services; and
 - liaising with energy and communications suppliers.
- A.6.5.9. CIRIA produced comprehensive [guidance on the planning, design, construction, operation and maintenance of sustainable drainage systems \(SuDS\)](#).

RECOMMENDATION 22 – DRAINAGE MAINTENANCE

Drainage assets should be maintained in good working order to reduce the threat and scale of flooding. Particular attention should be paid to locations known to be prone to problems, so that drainage systems operate close to their designed efficiency.

- A.6.5.10. The implications of high winds within an authority area are much less predictable, although weather information can help to assess the risk. Authorities should, as part of highway inventory and inspection arrangements, identify those parts of the network most at risk of obstruction due to fallen trees. Any limited sections, not already considered as part of the Resilient Network assessment, where obstruction could have particularly serious consequences for safety or serviceability should be identified. These could include accesses to relatively isolated communities. It may be appropriate to consider, with arboricultural advice, planned removal and replacement with more suitable trees in some cases.
- A.6.5.11. In planning for increased risk of damage from increased wind speeds, Local Highway Authorities should also:
- undertake a risk assessment to identify structures at greatest risk and/or consequences; and
 - undertake structural appraisal and consider implications for strengthening or removal.
- A.6.5.12. The Scottish approach to high winds is set out in the [High Wind Strategy & National Wind Management Guidelines](#).

A.6.5.13. Advice from weather warnings will need to be taken into account in considering a particular response, e.g. to safeguard the health and safety of operatives, which may limit the extent to which any direct assistance can be provided until conditions have eased. The contribution of authorities to dealing with the consequences of high winds will then depend upon the circumstances, but could include:

- signing and maintaining temporary closures and diversions;
- clearance of fallen and potentially dangerous trees;
- clearance and removal of debris;
- assistance with temporary support and repair of buildings;
- general support to emergency services; and
- liaison with energy and communication suppliers.

RECOMMENDATION 23 – CIVIL EMERGENCIES AND SEVERE WEATHER EMERGENCIES PLANS

The role and responsibilities of the Highway Authority in responding to civil emergencies should be defined in the authority’s Civil Emergency Plan. A Severe Weather Emergencies Plan should also be established in consultation with others, including emergency services, relevant authorities and agencies. It should include operational, resource and contingency plans and procedures to enable timely and effective action by the Highway Authority to mitigate the effects of severe weather on the network and provide the best practicable service in the circumstances.

A.6.6. COLLABORATION

- A.6.6.1. An integrated approach to the management of severe weather and civil emergencies forms the basis of the UK’s approach as defined by the Cabinet Office and should be adopted by Highway Authorities.
- A.6.6.2. Working with the community, partner organisations and all parts of the Highway Authority at planning, response and recovery stages, including across boundaries, has been shown to enhance resilience and help to mitigate the impact of threats to network operation. Examples of this approach are agreement of diversion routes, use of community flood wardens and provision of mutual aid between authorities. Lines of communication with other asset owners situated across, over or under the highway may also be useful.
- A.6.6.3. Collaboration with the Local Resilience Forum, or equivalent, can help understand the risk environment, link to other responding agencies and share good practice. Depending on the authority this might be facilitated by an Emergency Planning Officer and engagement with these experts should be part of standard procedure in plan development.

A.6.6.4. Neighbouring property owners can have an impact on the resilience of a highway if they fail to adequately discharge their responsibilities as land owners. Trees from neighbouring land blown over in high winds are a frequent cause of blocked roads and associated disruption. Similarly, poorly maintained neighbouring drains or surface water run-off from adjacent fields are a common cause of road flooding. Neighbouring poles, masts and power lines may also have a potential impact. Contact should be made with owners where the network is vulnerable to disruption emanating from their property to advise them of their responsibilities and liability.

A.6.7. COMMUNICATIONS

- A.6.7.1. Forecasts of extreme weather and flood events have steadily improved in accuracy over recent years and this is helpful in ensuring that adequate resources can be in place and warnings given to highway users of potential disruption.
- A.6.7.2. Authorities should ensure that they have clearly agreed channels for receiving weather and flood forecasts. These should be monitored in real time during periods when extreme weather is expected.
- A.6.7.3. Weather forecast information is crucial and the Meteorological Office will issue severe weather warnings and send messages to authorities, other emergency services and the media. These are based on colour coded descriptions:
- Yellow – Be aware, there is the small chance of...;
 - Amber – Be Prepared, there is likely to be...; and
 - Red – Take Action, there will be...
- A.6.7.4. The Environment Agency or equivalent has established a system of flood warning procedures, together with audible warnings in certain areas:
- Flood Alert – Flooding is possible. Be prepared;
 - Flood Warning – Flooding is expected. Immediate action required; and
 - Severe Flood Warning – Severe flooding. Danger to life.
- A.6.7.5. Highway users judge how well disruption is handled principally by the information they receive from authorities, either directly or via the media. Providing timely, credible and useful information to allow people to make informed decisions before they travel, and give advanced indication of what they can expect if they decide to travel is central to this. Highway Authorities should consider providing real time information using the internet and social media as well as the press, radio and TV to maximise coverage. During periods of disruption, authorities should consider giving prominence to the latest travel information on their websites.

- A.6.7.6. Authorities should communicate with passengers and other stakeholders as clearly as possible (avoiding technical jargon) to explain what is happening and how services are being affected by the weather or as a result of weather induced damage to infrastructure. Achieving this with maximum effect requires an understanding of the available information channels and how those are being used by travellers and freight customers. Openness and honesty in communication helps build confidence. Even if little information is available, letting people know when they can expect an update is helpful. Photographs on the internet or distributed by social media could be used when appropriate, to improve highway users' understanding of the reasons for the disruption. Passengers and users who have confidence in the information they are being given are more likely to act on advice, potentially helping to relieve rather than add to the situation.

RECOMMENDATION 24 – COMMUNICATIONS

Severe Weather and Civil Emergencies Plans should incorporate a communications plan to ensure that information including weather and flood forecasts are received through agreed channels and that information is disseminated to highway users through a range of media.

A.6.8. LEARNING FROM EVENTS

- A.6.8.1. Authorities should regularly review their responses to severe weather, emergency rehearsals and actual responses to identify potential improvement to their severe weather and emergency operational plans and procedures. Where appropriate reviews should be carried out in consultation with other responding organisations and public and businesses affected by the event.

RECOMMENDATION 25 – LEARNING FROM EVENTS

Severe Weather and Civil Emergencies Plans should be regularly rehearsed and refined as necessary. The effectiveness of the Plans should be reviewed after actual events and the learning used to develop them as necessary.

SECTION A.7.

PERFORMANCE MANAGEMENT

A.7.1. PERFORMANCE MANAGEMENT

- A.7.1.1. Performance management is dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Parts B and C.](#)
- A.7.1.2. As part of their asset management strategy, authorities should establish a performance management framework, including performance measures and targets, to enable monitoring of delivery of the strategy and of performance and to identify the cost of meeting the strategy in the short, medium and long term.

RECOMMENDATION 26 – PERFORMANCE MANAGEMENT FRAMEWORK
A performance management framework should be developed that is clear and accessible to stakeholders as appropriate and supports the asset management strategy. (HIAMG Recommendation 4)

RECOMMENDATION 27 – PERFORMANCE MONITORING
The performance of the Asset Management Framework should be monitored and reported. It should be reviewed regularly by senior decision makers and when appropriate, improvement actions should be taken. (HIAMG Recommendation 13)

SECTION A.8.

FINANCIAL MANAGEMENT, PRIORITIES AND PROGRAMMING

A.8.1. FINANCING OF HIGHWAY MAINTENANCE

- A.8.1.1. Financial constraints, lifecycle planning, making the case for investment and investment strategy are all dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Parts A, B and C](#). This document should be referred to and the advice below considered supplementary.
- A.8.1.2. Valuation and financial reporting is dealt with in the [Code of Practice on the Highways Network Asset](#), published by the Chartered Institute of Public Finance and Accountancy. This document should be referred to and the advice below considered supplementary.
- A.8.1.3. There are significant differences in both capital and revenue funding arrangements within the UK. These are not set out in detail in this Code and reference should be made to relevant government advice.
- A.8.1.4. Financial plans should be linked to asset management strategy and prepared both for short term activities, such as routine maintenance, and for medium and long term activities, such as preventative maintenance and asset replacement.

RECOMMENDATION 28 – FINANCIAL PLANS

Financial plans should be prepared for all highway maintenance activities covering short, medium and long term time horizons.

RECOMMENDATION 29 – LIFECYCLE PLANS

Lifecycle planning principles should be used to review the level of funding, support investment decisions and substantiate the need for appropriate and sustainable long term investment. (HIAMG Recommendation 6)

A.8.2. BUDGETING PRINCIPLES

- A.8.2.1. Budgeting principles should provide the necessary level of flexibility to deliver value for money. They should be set out based on the following considerations and principles:
- the differing life expectancies of various treatments and the future implications of these for the balance of capital and revenue funding;
 - the seasonal and weather sensitive nature of many treatments and the service as a whole;
 - the uncertainties in prediction of out-turn costs for Winter Service and the need for financial year-end flexibility;
 - the need for resilience against the increasing trend in weather related incidents; and

- the need to make provision for emergencies.

A.8.3. PRIORITIES AND PROGRAMMING

- A.8.3.1. Priorities and programming are dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Part B](#). This document should be referred to and the advice below considered supplementary.
- A.8.3.2. The highway network should be viewed as a whole when developing priorities, rather than as a series of asset groups such as carriageways, footways, structures, lighting, etc. Consideration should be given to prioritising across asset groups as well as within them.
- A.8.3.3. Authorities should seek to share and coordinate short and long term programmes of work with others undertaking works on the highway for several years in advance.
- A.8.3.4. Authorities should consider the need to minimise long term damage from the installation, renewal, maintenance and repair of underground apparatus, e.g. use of trenchless technology.

RECOMMENDATION 30 – CROSS ASSET PRIORITIES

In developing priorities and programmes, consideration should be given to prioritising across asset groups as well as within them.

RECOMMENDATION 31 – WORKS PROGRAMMING

A prioritised forward works programme for a rolling period of three to five years should be developed and updated regularly.

(HIAMG Recommendation 7)

SECTION A.9. SUSTAINABILITY

A.9.1. SUSTAINABILITY AND HIGHWAY INFRASTRUCTURE MAINTENANCE

- A.9.1.1. Authorities will have their own approach to sustainability and relevant aspects may form part of their asset management strategy. The UK sustainable development strategy, [Securing the Future](#), includes priority areas for shared action as:
- sustainable consumption and production;
 - climate change and energy;
 - natural resource protection and environmental enhancement; and
 - sustainable communities.
- A.9.1.2. Authorities and their partners are pivotal to delivering sustainable communities and to provide focus. Highway infrastructure maintenance has a significant role to play, and impact to make, in the achievement of sustainable development. Authorities should consider developing a policy for sustainable development in highway maintenance. This should form the linkage between the strategic objectives of the authority at the highest level and the materials, practices and processes used on the highway network.
- A.9.1.3. Sustainable development for highway infrastructure maintenance involves working within environmental limits whilst achieving a sustainable economy, and is encapsulated as:
- social progress which recognises the needs of everyone;
 - effective protection of environment;
 - prudent use of natural resources; and
 - maintenance of high and stable levels of economic growth and employment.
- A.9.1.4. Authorities should accommodate and facilitate litter picking and street cleansing activities where these are the responsibility of other authorities.
- A.9.1.5. Carbon management, and in particular reduction of the carbon consumption and associated energy and other costs associated with highway infrastructure operation and maintenance, is an important issue for authorities individually, and also as part of their contribution to wider carbon reduction initiatives.
- A.9.1.6. [PAS 2080](#) provides a common framework for all infrastructure sectors and value chain members on how to manage whole life carbon when delivering infrastructure assets and programmes of work.

RECOMMENDATION 32 – CARBON

The impact of highway infrastructure maintenance activities in terms of whole life carbon costs should be taken into account when determining appropriate interventions, materials and treatments.

A.9.2. MATERIALS, PRODUCTS AND TREATMENTS

- A.9.2.1. Materials, products and treatments used for highway maintenance will need to meet required standards for effectiveness and durability, but should also make a positive contribution to the public realm.
- A.9.2.2. There are a wide range of technical specifications for materials, products and treatments for highway works. Some of these are obligatory, but many provide for significant discretion in their application to particular circumstances. It is important that specifications are fit for purpose otherwise they can increase cost and may also reduce the potential for sustainability, for example by precluding the use of locally sourced materials.
- A.9.2.3. The Department for Transport has published [Sustainable Highways: A Short Guide](#), which provides succinct guidance for local authority highway and material engineers on the choice of sustainable materials and techniques for use in highway and footway maintenance as well as new construction.
- A.9.2.4. Materials and treatments should be consistent with the character of the area and, for example, do not contribute to the ‘urbanisation’ of rural areas. Conversely, in heavily trafficked urban areas materials should be of sufficient durability to avoid premature deterioration and consequent poor appearance. The presence of a speed limit should not be the automatic determinant for the application of ‘urban’ specifications.
- A.9.2.5. The [Planning \(Listed Buildings and Conservation Areas\) Act 1980](#), or equivalent, provides for the protection of conservation areas that have special historical interest. The status can influence the processes required for maintenance in such areas.
- A.9.2.6. Historic England, in conjunction with the Department for Transport has published a series of regional guides [Streets for All](#). The right balance of materials and treatments used in particular circumstances should not merely be a technical or financial issue; it should also be one of sustainability. The guidance suggests that where possible, authorities should set up a townscape ‘Public Realm Management Team’, responsible for overseeing an integrated approach to townscape management and ensuring that policies for the public realm are included in all development frameworks. Whole life costing is also a sustainability issue and should be factored in to the assessment.
- A.9.2.7. Authorities may consider identifying a hierarchy of streets and spaces to prioritise the use of more expensive, natural materials. Each area should have a palette of materials appropriate to its location, which allows new and old work to relate to one another. This could be a subset of the maintenance hierarchies referred to in Section A.4 of this Code.
- A.9.2.8. [Guidance on natural stone surfacing](#) has been produced by SCOTS.

RECOMMENDATION 33 – CONSISTENCY WITH CHARACTER

Determination of materials, products and treatments for the highway network should take into account the character of the area as well as factoring in whole life costing and sustainability. The materials, products and treatments used for highway maintenance should meet requirements for effectiveness and durability.

RECOMMENDATION 34 – HERITAGE ASSETS

Authorities should identify a schedule of listed structures, ancient monuments and other relevant assets and work with relevant organisations to ensure that maintenance reflects planning requirements.

A.9.3. QUALITY MANAGEMENT AND SECTOR SCHEMES

- A.9.3.1. Quality management systems are intended to encourage consistent management and organisational processes. If correctly and flexibly applied, they should support a culture of competence, consistency and enable innovation to flourish.
- A.9.3.2. Highway maintenance operations can be aligned to a quality assurance regime to facilitate continuous improvement, preferably based on the principles of [ISO 9001](#) that integrates systems of client and service provider.
- A.9.3.3. The quantity and cost of maintenance products and materials is relatively easy to determine, but quality can be very variable. A number of [National Highway Sector Schemes \(NHSS\)](#) have been developed to improve the consistency of the products and ensure that they satisfy purchaser requirements. Some sector schemes are administered by the [United Kingdom Accreditation Service \(UKAS\)](#).
- A.9.3.4. [The Highway Authorities Product Approval Scheme \(HAPAS\)](#) provides a means for manufacturers and suppliers to obtain approval for the use of innovative and proprietary products within an agreed performance regime.
- A.9.3.5. There are also a number of relevant documents published by the [Road Surface Treatment Association](#) and [ADEPT](#).

A.9.4. ENVIRONMENTAL MANAGEMENT

- A.9.4.1. In pursuing the objective of network sustainability one of the issues will be maximising the environmental contribution made by highway maintenance. An [Environmental Management System to ISO 14000](#) will help address the range of relevant issues affecting the environment including:
- carbon costs and energy reduction (see Sustainability above);
 - noise;
 - materials utilisation;
 - waste management and recycling
 - air quality and pollution control;
 - nature conservation and biodiversity; and

- environmental intrusion.

A.9.5. NOISE REDUCTION

- A.9.5.1. Road traffic noise is a major environmental consideration, both for those living close to heavily used inter-urban highways and also within urban areas. Legislation is progressively seeking to reduce road noise from vehicles but noise from running surfaces can also be intrusive.
- A.9.5.2. Where running surfaces are renewed or resurfaced, the opportunity exists to mitigate the effects of traffic noise. Whenever major maintenance schemes of this type are being planned, authorities should consider the option of a lower noise alternative.
- A.9.5.3. The statutory duty to ‘secure the expeditious movement of traffic’ imposed by the [Traffic Management Act 2004](#), or equivalent, could place greater emphasis on night working. Close consultation with residents and Environmental Health Officers, particularly in urban areas, is necessary.

A.9.6. MATERIALS UTILISATION

- A.9.6.1. Highway maintenance consumes significant quantities of materials, and policies for materials purchasing and utilisation can make a considerable contribution to sustainability.
- A.9.6.2. Authorities should consider, wherever practicable and cost effective, to maximise the use of:
- local materials to minimise transport costs, support the local economy, and to maintain local character. This will be of particular importance for the use of visible materials in conservation areas; and
 - products made from recycled materials.
- A.9.6.3. Sustainable purchasing and materials utilisation may have cost implications and authorities will need to balance these against the environmental benefits. They should also consider carefully whether some limited reduction in material specification might be acceptable in order to achieve a more sustainable outcome without excessive cost.

A.9.7. WASTE MANAGEMENT AND RECYCLING

- A.9.7.1. Authorities may have statutory or other indicators and targets relating to waste disposal and it is important that highway infrastructure maintenance provides support to these so far as practicable.
- A.9.7.2. [The Waste and Resources Action Programme \(WRAP\)](#) is a Government-funded programme established to promote resource efficiency.
- A.9.7.3. Authorities should seek wherever practicable and cost effective to:
- retain and re-use materials on site to avoid environmental implications of transport and disposal;

- maximise the value of the re-used material rather than utilise for low grade purposes;
- make use of 'recycle in place' processes in appropriate situations;
- support recycled market development through the purchase of recycled products wherever possible; and
- ensure that the quantity of material that cannot be re-used or recycled is minimised and disposed of at licensed sites.

A.9.8. AIR QUALITY AND POLLUTION CONTROL

- A.9.8.1. A number of maintenance operations have the potential to cause noise, air or water pollution and authorities will need to take particular account of statutory requirements. Advice from Environmental Health Departments and the Environment Agency, or equivalent, should also be sought where necessary. In some cases environmental inconvenience to the community may be inevitable, but authorities should seek to mitigate this wherever practicable, for example by phasing and scheduling of works to avoid sensitive periods and potentially difficult weather conditions.
- A.9.8.2. Storage areas for fuel, salt and other materials, both in depots and on site, have the potential for pollution and care should be taken in siting them. Permanent and temporary storage areas should be sited and managed in accordance with requirements of the Local Planning Authority and the EA. In particular, they should not be sited where they could cause damage to landscape or nature conservation or have the potential to pollute watercourses or groundwater.

A.9.9. NATURE CONSERVATION AND BIODIVERSITY

- A.9.9.1. Highway verges and the wider 'soft estate' both have implications for conservation and biodiversity. Specialist advice should be sought on the management of these areas to achieve the correct balance between safety, amenity, nature conservation and value for money. Where landscape management plans, biodiversity action plans, or environmental databases exist they should be consulted before any work is carried out.
- A.9.9.2. Certain named species and habitats are protected by law and all highway infrastructure maintenance works must comply with these requirements. Where designated sites are within or adjacent to the highway boundary, advice should be sought from Natural England, or equivalent, or local wildlife trusts, etc. Legislation requires that Natural England, or equivalent, are informed where important habitats and species may be affected, such as the removal of trees used as bat roosts. This should be done well in advance of maintenance work to allow for seasonal factors.

- A.9.9.3. Authorities should recognise the contribution that trees make to the economic, social and environmental well-being of the community. In urban areas roadside trees have a particular landscape value, are often highly regarded by the community, and should be carefully managed. Authorities should develop a policy for the installation, subsequent condition inspection and maintenance of highway trees. Care should be taken to avoid damage to trees during highway infrastructure maintenance and improvement works and guidance for the planning, installing and maintenance of utility services in proximity to trees issued by [NJUG](#) should be followed.
- A.9.9.4. In 2014, the Tree Design Action Group (TDAG) produced a good practice guide [Trees in Hard Landscapes: A Guide for Delivery](#) in association with the CIHT, ICE, ICF and CIBSE.

RECOMMENDATION 35 – ENVIRONMENTAL IMPACT, NATURE CONSERVATION AND BIODIVERSITY

Materials, products and treatments for highway infrastructure maintenance should be appraised for environmental impact and for wider issues of sustainability. Highway verges, trees and landscaped areas should be managed with regard to their nature conservation value and biodiversity principles as well as whole-life costing, highway safety and serviceability.

A.9.10. PLANTS AND INJURIOUS WEEDS

- A.9.10.1. The [Wildlife and Countryside Act 1981](#) makes it an offence to plant, or otherwise cause to grow any plant in the wild at a place outwith its native range. This can cause restrictions on verge and other maintenance operations. The [Wildlife and Natural Environment \(Scotland\) Act 2011](#) has brought in new provisions governing the introduction of non-native species in Scotland.
- A.9.10.2. The [Noxious Weeds Act 1959](#) places a responsibility on the authorities to take action to inhibit the growth and spread of injurious weeds growing within the highway.
- A.9.10.3. Where injurious weeds on highway land are a nuisance to adjacent landowners, it is advisable to work with the landowner to ensure that weed control measures are undertaken simultaneously to avoid recontamination across the highway boundary. The prescribed weeds are:
- ragwort;
 - broad leaved dock;
 - curled dock;
 - creeping thistle; and
 - spear thistle.

- A.9.10.4. Ragwort, in particular is extremely hard to eradicate and some authorities have bylaws to control it. The seed can survive 20 years in the soil before germinating and any root left behind when dug up will re-grow. It is also highly toxic to horses, cattle and sheep. It is normally biennial producing small rosettes in the spring and flowers in its second year from July onwards. Cutting is used by many authorities for control to prevent the plant flowering and seeding, and two full cuts of the verge by the end of June every year for five years will inhibit seeding and spreading.
- A.9.10.5. Ragwort can be only be completely eradicated by digging out before it flowers, which in most cases will be impractical for authorities with large areas of verge, or by spraying an appropriate weed killer. On ungrazed land such as roadside verges, unselective weed killer use could also destroy many desirable wild species and labour intensive spot treatment may be preferable.

A.9.11. ENVIRONMENTAL INTRUSION

- A.9.11.1. Depots and areas for materials storage will provide the most visible evidence of the extent of environmental awareness in the service. Every effort should be made to ensure that they are located, designed, maintained and operated to the highest practicable environmental standards. In many cases these standards will be required as a condition of planning, but planning conditions are not able to address all operational issues and should therefore be considered as a minimum.
- A.9.11.2. Poorly managed materials and temporary storage areas can rapidly be adopted by others as illegal waste dumps for which authorities may become liable. In any event such poorly managed storage areas would clearly be incompatible with the objective of sustainability.
- A.9.11.3. Increasing emphasis on quality of public space and streetscene brings increased importance to the avoidance of 'clutter'. Excessive and redundant signs and other street furniture can contribute to environmental intrusion and adversely affect overall streetscape. Signing which is inappropriate or no longer necessary is, at best, intrusive and, at worst, a distraction and risk to users. Opportunities should be taken to remove or simplify redundant signing wherever possible in conjunction with planned maintenance works.
- A.9.11.4. The Department for Transport's [Local Transport Note 1/08 Traffic Management and Streetscape](#) aims to enhance streetscape appearance by encouraging designers to minimise the various traffic signs, road markings and street furniture associated with traffic management schemes, and hence minimise clutter.

RECOMMENDATION 36 – MINIMISING CLUTTER

Opportunities to simplify signs and other street furniture and to remove redundant items should be taken into account when planning highway infrastructure maintenance activities.

A.9.12. ENVIRONMENTAL CONSULTATION AND ASSESSMENT

- A.9.12.1. Environmental issues cover a very wide range, each of which is a specialist area and on which experience and good practice continues to develop. There will be a wide range of local environmental and conservation groups having specialist interests. Although engagement with such local groups will present particular challenges to highway infrastructure maintenance managers, including the management of differing points of view, perseverance is likely to bring benefits both in terms of advice and environmental competence and also through greater public understanding of highway maintenance problems.
- A.9.12.2. Environmental assessments may be required for certain works and authorities should be clear on the circumstances where such assessment is necessary.

A.9.13. FACTORS TO CONSIDER FOR SUSTAINABILITY

- A.9.13.1. Tables 6 and 7 provide factors for consideration when undertaking a sustainability appraisal either of individual maintenance schemes or of the maintenance service as a whole. Actions to be taken to address each of the issues are not specified but should be determined locally taking into account local priorities and constraints. The list is not exhaustive but includes a number of the key issues that may need to be addressed.

Table 6 – Factors to Consider for Sustainability (i)

Issue	Check
Local Economy	
Viability and vitality	Does the service or scheme affect the vitality and viability of the local community?
Local employment	What contribution is made to local employment by the service or scheme?
Local materials	Does the service or scheme fully make use of opportunities to use local materials?
Community Value	
Community engagement	Does the service engage well with all sections of the local community?
Meeting community needs	Does the service or scheme meet the needs of all sections of the local community?
Quality of public space	Does the scheme make an effective contribution to the quality of public space?
Noise Pollution	
Offices and depots	Are all opportunities realised to minimise noise pollution at offices and depots?
Works sites	Are all opportunities realised to minimise noise from vehicles and plant at works sites?
Traffic	Are locations of high traffic noise identified and mitigation measures included in schemes where appropriate?
Air Pollution	
Vehicles	Is there a policy and programme for vehicle replacement and modification to minimise air pollution (with targets)?
Plant and machinery	Is there a policy and programme for plant replacement and modification to minimise air pollution (with targets)?
Water Management	
Offices and depots	Are there arrangements in all offices and depots to minimise water use (with targets)?
Works sites	Are there arrangements in all works sites to avoid water wastage (with targets)?
Pollution control	Are there policies and procedures in place at all depots and works sites (with targets) to avoid water pollution especially from oil spills and salt leachate?
Flood management	Are locations of high flood risk identified and mitigation measures included in schemes where appropriate?

Table 7 – Factors to Consider for Sustainability (ii)

Issue	Check
Visual Intrusion	
Depots	Are all depots located and designed to minimise visual intrusion?
Works sites	Are all works sites located to minimise visual intrusion?
Materials Utilisation	
Location	Does the materials selection criteria give priority to local sources?
Design	Does the design process include consideration of minimum materials?
Performance	Do the design criteria allow for reduced specification in order to mitigate environmental affects?
Waste Management	
Minimisation	Do the design process and criteria facilitate the designing out of waste?
Reuse	Does the design process encourage the use of re-used materials as the first option?
Recycling	Does the design process encourage the use of recycled materials as the second option?
Energy Management	
Offices and depots	Are there policies and procedures in place at all offices and depots (with targets) to minimise energy usage?
Works sites	Are there policies and procedures in place at all offices and depots (with targets) to minimise energy usage?
Schemes	Do all works and schemes maximise the use of cold rather than hot technology?
Biodiversity	
Policies	Has the service adopted biodiversity policies and procedures?
Trees and landscaping	Are all policies and practices for maintenance of trees and landscaping designed to maximise nature conservation value?
Works programmes	Are works programmes adjusted to assist biodiversity requirements?

SECTION A.10. PROCUREMENT

A.10.1. PROCUREMENT GUIDANCE

A.10.1.1. Guidance on procurement issues in England can be found through the [HMEP website](#).

A.10.1.2. In Scotland guidance can be found in the [Scottish Road Maintenance Review](#) and in Northern Ireland via the [DfI Procurement Branch](#).

WELL-MANAGED HIGHWAY INFRASTRUCTURE

PART B. HIGHWAYS

SECTION B.1. INTRODUCTION TO PART B – HIGHWAYS

B.1.1. INTRODUCTION

B.1.1.1. Part B of Well-managed Highway Infrastructure covers specific issues and themes regarding highways themselves, and includes the following asset types:

- carriageways;
- footways;
- public rights of way;
- cycle routes;
- highway drainage systems;
- embankments and cuttings;
- landscaped areas and trees;
- fences and barriers;
- traffic signs and bollards; and
- road markings and studs.

B.1.1.2. The overarching principles and common themes of maintaining highway infrastructure are covered within Part A. Asset specific guidance for structures and lighting are covered in Part C and Part D respectively.

SECTION B.2.

LEGAL FRAMEWORK – HIGHWAYS

B.2.1. INTRODUCTION

B.2.1.1. General duties and powers are dealt with in Part A of this Code. This section contains information on duties and powers specifically related to highways.

B.2.2. HIGHWAY SPECIFIC LEGAL CONSIDERATIONS

B.2.2.1. The Highways Act 1980 sets out the main duties of Highway Authorities in England and Wales. In particular, Section 41 imposes a duty to maintain highways maintainable at public expense, and almost all claims against authorities relating to highway functions arise from the alleged breach of this section.

B.2.2.2. Section 58 provides for a defence against action relating to alleged failure to maintain on grounds that the authority has taken such care as in all the circumstances was reasonably required to secure that the part of the highway in question was not dangerous for traffic.

B.2.2.3. In Scotland, the key road maintenance legislation is contained in the Roads (Scotland) Act 1984, Section 1, which provides a duty for local roads authorities to keep a list of 'public roads' and to maintain and manage them. There is no direct equivalent of the Highways Act 1980 Section 58 providing defence against alleged failure to maintain, although case law will have established some basis for this.

B.2.3. WINTER SERVICE

B.2.3.1. The statutory basis for Winter Service in England and Wales is addressed through Section 41 (1A) of the Highways Act on the 31st October 2003, by Section 111 of the Railways and Safety Transport Act 2003. The first part of Section 41(1) reads:

a) 'The authority who are for the time being the Highway Authority for a highway maintainable at the public expense are under a duty, subject to subsections (2) and (4) below, to maintain the highway.

b) (1) In particular, a Highway Authority are under a duty to ensure, so far as is reasonably practicable, that safe passage along a highway is not endangered by snow or ice'.

B.2.3.2. Section 150 of the Highways Act 1980 also imposes a duty upon authorities to remove any obstruction of the highway resulting from '*accumulation of snow or from the falling down of banks on the side of the highway, or from any other cause*'.

- B.2.3.3. In addition, the Traffic Management Act 2004 placed a network management duty on all local traffic authorities in England. It requires authorities to do all that is reasonably practicable to manage the network effectively to keep traffic moving. In meeting the duty, authorities should establish contingency plans for dealing promptly and effectively with unplanned events, such as unforeseen weather conditions, as far as is reasonably practicable.
- B.2.3.4. Given the scale of financial and other resources involved in delivering the Winter Service, it is not considered reasonable either to:
- provide the service on all parts of the Network; and
 - ensure carriageways, footways and cycle routes are kept free of ice or snow at all times, even on the treated parts of the network.
- B.2.3.5. In Scotland statutory responsibilities are defined by Section 34 of the Roads (Scotland) Act 1984 which requires that “a road authority shall take such steps as it considers reasonable to prevent snow and ice endangering the safe passage of pedestrians and vehicles over public roads”.
- B.2.3.6. In Northern Ireland, the Roads (NI) Order 1993 SI 1993/3160 (NI 15) provides, in Article 10, a duty for the Department for Infrastructure to “*remove snow, soil etc which has fallen on a road*”. Section 9 of the Order also enables the authority to “*take such action as it considers reasonable to prevent snow or ice interfering with the safe passage of persons and vehicles using the road*”. However paragraph 7 of Article 10 provides protection from liability and states that “*Nothing in this Article operates to confer on any person a right of action in tort against the Department for failing to carry out any duty imposed on it under the Article*”.

SECTION B.3. ASSET MANAGEMENT INFORMATION – HIGHWAYS

B.3.1. INTRODUCTION

- B.3.1.1. Asset data management is dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Part B](#). This document should be referred to and the advice below considered supplementary.
- B.3.1.2. Asset management systems are dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance, Part C](#). This document should be referred to and the advice below considered supplementary.

B.3.2. PRINCIPLES AND CONSIDERATIONS

- B.3.2.1. A highway asset management system is essential to deliver an effective and efficient approach to asset management. This should typically have the capacity to cover all of the asset types outlined in Section B.1.1.1, with the actual data collected aligning to the authority's own asset data management strategy.
- B.3.2.2. Authorities will require a system to suit particular local needs and responsibilities, procurement arrangements and other factors. It may include specialist applications indirectly related to highway maintenance, for example traffic and accident analysis.
- B.3.2.3. Compatibility between highway asset management systems and those for structures and lighting will support a holistic approach to managing the network.
- B.3.2.4. UKPMS is the national standard for pavement management systems, where the usage of the word 'pavement' refers to the technical definition of 'the collective term for all hardened surfaces within the highway, including carriageways, footways and cycle routes'.
- B.3.2.5. Other asset management systems that operate outside of the UKPMS accreditation system may also provide suitable functionality and value for Highway Authority users. The specifications and performance of such systems should be reviewed and assessed against both user requirements and areas where national consistency is required.
- B.3.2.6. Systems that are accredited to the UKPMS standard have successfully demonstrated that they meet the current national standards with respect to:
- Loading network, inventory and condition data, including data collected by:
 - Visual surveys (CVI and DVI);
 - SCANNER and TRACS Type Surveys (TTS);
 - Footway Network Surveys (FNS);

- SCRIM;
 - GripTester; and
 - Deflectograph.
 - Data processing
 - Condition reporting, including national reports for England, Northern Ireland, Scotland and Wales and local reports for unclassified roads and footways
 - Financial reporting to support asset management, including
 - Inventory reports;
 - Accumulated and annual depreciation of carriageways; and
 - Supporting information for footways, cycletracks and paved verges.
- B.3.2.7. UKPMS accreditation is governed by the Road Condition Management Group (RCMG) on behalf of the UK Roads Board. More information about UKPMS – including a current list of accredited systems - is available from the [RCMG page on the UKRLG website](#).

SECTION B.4. ASSET CONDITION AND INVESTIGATORY LEVELS – HIGHWAYS

B.4.1. INTRODUCTION

B.4.1.1. This section deals with asset condition for each element of the network and its contribution to safety, serviceability and sustainability.

B.4.2. PRINCIPLES AND CONSIDERATIONS

B.4.2.1. Each element of the network could have different condition requirements, a minimum one to satisfy the need for safety, and higher ones, designed to meet local requirements for serviceability or sustainability, as part of the asset management strategy adopted by the authority. These different higher levels have previously been given a range of names including ‘warning levels’, ‘intervention levels’ and ‘investigatory levels’. In this Code the term has been referred to as ‘investigatory levels’, as failure to reach the defined level in most cases could give rise to a range of responses each of which needs to be further investigated, prior to action being taken. There will be certain circumstances, of course, primarily for safety reasons, where an immediate response is necessary.

B.4.2.2. The term ‘intervention level’ has been retained only for use with the automatic treatment selection criteria used in UKPMS, as the system does actually ‘intervene’ at the defined level of condition. It will, however, always be referred to as system intervention level (SIL) for the avoidance of confusion.

B.4.2.3. The following paragraphs set out the suggestions for the nature of contributions made by each element of the network towards safety, serviceability and sustainability.

B.4.2.4. Each element of the network will contribute differently to the objective of customer service and possibly within different timescales. For example, good surface condition or signing will have an immediately positive effect, whilst the effect of good quality drainage will probably be imperceptible for most of the time.

B.4.2.5. As outlined in Section A.4.1.4, the level of customer service is generally more relevant when applied to the whole of the network and it is therefore not dealt with by this Code under each of the individual elements in the following sections.

B.4.3. CONDITION OF CARRIAGEWAYS

B.4.3.1. The condition of the carriageway fabric can contribute to the core objectives as follows:

Network Safety nature, extent and location of surface defects;

nature and extent of edge defects; and

nature and extent of surface skidding resistance.

Network Serviceability nature and extent of surface defects;

ride quality of the surface; and

resilience of the network.

Network Sustainability surface noise attenuation characteristics;

nature and extent of surface defects;

nature and extent of carriageway deflection; and

usage and verge creep.

B.4.4. CONDITION OF FOOTWAYS

B.4.4.1. The condition of footways can contribute to the core objectives as follows:

Network Safety nature, extent and location of surface defects; and
nature and extent of kerb and edging defects.

Network Serviceability nature and extent of surface defects;
extent of encroachment and weed growth;
the level of friction provided by the surface;
the quality of the surface; and
integrity of the network.

Network Sustainability convenience and ease of use;
nature extent and location of surface defects;
extent of damage by over-running and parking; and
rural footways being lost to grass ingress.

B.4.4.2. Securing improvement in the safety and serviceability of footways and cycle routes, in particular network integrity, will be a necessary component for encouraging active travel, e.g. walking as an alternative to the car. It will be important for maintenance strategy positively to address this.

B.4.4.3. It will also be important in determining priorities for footway maintenance to ensure that opportunities are taken to aid social inclusion, particularly improving accessibility for older and people with disabilities and also the use of prams and pushchairs. This should be included as part of the Value Management process described in Section B.6.9. Proposed treatments may include the provision of dropped kerbs in suitable locations and textured paving adjacent to crossing points at marginal cost during the course of works. There is a statutory duty on service providers under the [Equality Act 2010](#) to take reasonable steps to remove or alter physical features to improve access for people with disabilities, or provide an alternative method of making services available.

- B.4.4.4. Although ensuring the safety of footways for users will be a priority, in some cases the presence of roadside trees may complicate the provision of footway surface regularity. The radical treatment or complete tree removal necessary to ensure surface regularity may not be possible or desirable and reduced levels of surface regularity may be a more acceptable outcome.
- B.4.4.5. Where footways are remote from carriageways, safety and security of users will be an important consideration, both from the point of view of unauthorised vehicular use and quality of lighting. Maintenance strategy should pay particular attention to this.

B.4.5. CONDITION OF CYCLE ROUTES

- B.4.5.1. The condition of cycle routes can contribute to the core objectives as follows:

Network Safety nature, extent and location of surface defects; and
nature and extent of kerb and edging defects.

Network Serviceability nature and extent of surface defects;
extent of encroachment and weed growth;
the level of friction provided by the surface particularly with regard to ironwork;
the quality of the surface; and
integrity of the network.

Network Sustainability convenience and integrity of the network;
nature extent and location of surface defects;
extent of damage by over-running and parking; and
cycle routes being lost to grass ingress / verge creep due to usage.

- B.4.5.2. Securing continuous improvement in the safety and serviceability of cycle routes, in particular network integrity, will be a necessary component for encouraging cycling as an alternative to the car. It will be important for maintenance strategy positively to address this.

- B.4.5.3. Network integrity is a particularly important consideration where cycle routes are segregated for part of their length, but intermittently rejoin the carriageway. In these circumstances a reasonably consistent level of maintenance should be provided and attention paid to carriageway edge condition in the un-segregated sections.

B.4.6. CONDITION OF PUBLIC RIGHTS OF WAY

- B.4.6.1. The condition of PROW can contribute to the core objectives and to the broader quality of life objectives associated with leisure and recreation.
- B.4.6.2. The requirements for PROW will be determined as part of a Rights of Way Improvement Plan (ROWIP), in consultation with the Local Access Forum established by the Countryside and Rights of Way Act 2000.
- B.4.6.3. PROW are not a Roads Authority function in Scotland.

B.4.7. CONDITION OF HIGHWAY DRAINAGE SYSTEMS

- B.4.7.1. The condition of highway drainage systems can contribute to the core objectives as follows:

Network Safety	accumulation of water on carriageways, footways and cycle routes.
Network Serviceability	accumulation of water on carriageways, footways and cycle routes.
Network Sustainability	<p>polluted effluent from clearing of highway drainage should not be directed into watercourses;</p> <p>authorities have a duty to prevent nuisance and danger to adjoining landowners by flooding and should also work with others in the wider community to minimise the future risk of flooding;</p> <p>inadequate drainage of the highway structure will reduce effective life and increase maintenance liability; and</p> <p>integrity of systems, root ingress, blockage / collapse, exceedance.</p>

- B.4.7.2. Highway drainage elements fall into five main categories:

- gullies, grips and ditches, which may be obstructed by the growth of vegetation or damaged by traffic. In most cases the responsibility for maintenance of ditches will rest with the adjoining landowner;

- culverts under roads which may be affected by blockage, subsidence or structural damage;
- other piped drainage which may be affected by blockage or subsidence;
- sustainable urban drainage systems, which may require special maintenance attention for maximum effectiveness; and
- surface boxes and ironwork for both drainage and non-drainage applications, which may be affected by subsidence or obstructed access.

B.4.7.3. More information on culverts can be found in Section C.2 of this Code.

B.4.7.4. [HMEP](#) has produced guidance on the management of highway drainage assets. Authorities should consider this guidance when making decisions on the management of drainage assets.

B.4.7.5. Material arising from all road drainage emptying and cleansing operations has potential implications for pollution and should be disposed of correctly in accordance with Environment Agency, or equivalent authority, requirements.

B.4.7.6. Where despite effective maintenance operations, flooding of the highway occurs, with implications for safety or serviceability, relevant warning signs should be placed in position as quickly as possible and users advised through local media. The cause of the flooding should be determined and addressed as appropriate, in order to restore the highway to a reasonable condition.

B.4.7.7. The highway may flood if the surrounding land is in flood and there are limitations to the action that can be reasonably taken. If it is subsequently determined that the flooding is attributable to deficiencies in infrastructure or the maintenance regime, given the nature of the weather conditions under which it occurred, then action to permanently relieve the problem should be considered. If the event is attributable to the actions of a third party, the matter should be taken up with them at the earliest opportunity.

B.4.7.8. Ironware comprising covers, gratings, frames and boxes set in carriageways, footways and cycle routes has the potential to compromise safety and serviceability, and in certain cases cause noise and disturbance to local residents.

B.4.8. CONDITION OF PRIVATELY OWNED INFRASTRUCTURE

B.4.8.1. Responsibility for defective infrastructure, e.g. ironwork, cabinets and poles, where this is part of the apparatus installed by a utility company lies with the company. Defects identified during inspection or from users should be formally notified to the utility, with a follow up procedure to ensure that dangerous defects are remedied within a specified timescale. However, authorities need to be mindful of their duty to maintain and the circumstances in which they can be held liable for defective privately owned infrastructure.

B.4.9. CONDITION OF EMBANKMENTS AND CUTTINGS

B.4.9.1. The condition of embankments and cuttings can contribute to the core objectives as follows:

Network Safety risk of loose material falling to injure users or damage facility.

Network Serviceability risk of damage or service interruption.

Network Sustainability damage or loss of habitat;

interruption or pollution of watercourse;

extent of damage and reduced life; and

integrity of structure.

B.4.9.2. The probability of failure will be affected by soil conditions and drainage. The impact of embankment or cutting failure will generally be high in all situations, but particularly so on important high speed links, or where dwellings could be affected. In such circumstances, the condition of embankments and cuttings will require a robust regime of inspection, and possibly continuous condition monitoring.

B.4.9.3. Slips and rock-falls from embankments and cuttings are relatively infrequent but the frequency and severity of such events may be affected by climatic change. Authorities should have records of relevant locations and should establish an inspection and maintenance regime based on a local risk assessment. In higher risk locations, or where ground conditions are difficult, specialist geotechnical advice should be obtained.

B.4.10. CONDITION OF LANDSCAPED AREAS AND TREES

B.4.10.1. The condition of landscaped areas and trees can contribute to the core objectives as follows:

Network Safety	obstruction to user visibility and legibility of traffic signs;
	fallen trees or overgrown vegetation that physically obstructs part of the highway;
	falling branches from trees;
	leaf fall from trees causing slippery surface; and
	root growth affecting surface regularity.
Network Serviceability	potential for service interruption; and
	quality of user experience.
Network Sustainability	landscape conservation;
	mitigation of climate change effects;
	support for habitat and biodiversity;
	problems of root growth for surface, structure and highway drainage; and
	maintaining healthy trees, root severance, ivy clearance.

B.4.10.2. The probability of landscaping and tree failure will generally be low but is likely to increase as a result of climate change and during periods of severe weather. Probability of failure will increase with a rise in the incidence of disease such as ash dieback. The impact will generally be related to safety or damage to road surfaces or property, and will increase on higher speed roads, areas with higher pedestrian levels and the proximity to property. The inspection and maintenance regime should identify high risk locations.

- B.4.10.3. The condition of landscaped areas has major implications for all of the core objectives. The maintenance regime will therefore require particularly careful consideration to ensure that the necessary balance continues to be achieved. It is also possibly the most visible aspect of the highway, of wide interest to both public and special interest groups, and provides the opportunity to demonstrate sensitivity and flexibility in maintenance policy.
- B.4.10.4. The obstruction of street lighting and traffic signs can be a major safety risk to users. A risk based inspection process should be developed to identify such obstructions. Trees and other foliage should be trimmed back to allow the lighting to function and the signs to be legible, while maintaining the shape of the tree wherever possible. More details can be found in Section D.5 of this Code
- B.4.10.5. The soft estate includes areas of land having various functions, for example habitat, nature conservation interests, screening, planting, and wild flower diversity. The verge serves a safety and refuge function and to a lesser extent and in certain situations an amenity. The soft estate can be included in highway maintenance strategy but it requires a specialist expertise.
- B.4.10.6. Dealing first with requirements for safety, vegetation either on verges, other parts of the soft estate or on private land, should not restrict visibility at junctions, access points and bends. Many highways have evolved rather than being formally designed and visibility and sight lines do not always exist. However, where they do, these should be kept clear and signs, lights, and marker posts should not be obstructed. It may also be necessary for vegetation to be cut back in order to enable inspections or surveys.
- B.4.10.7. Authorities should provide for flexibility in applying judgement in urban and rural areas, and these should take account of the character of the area rather than be determined solely by speed limit considerations.
- B.4.10.8. The growth of weeds in footways and cycle routes, hardened verges, central reserves filter drains and along kerb lines, may cause structural damage, drainage issues and the general perception of such growth is that it is untidy. Indeed, in some circumstances weeds have been considered to have implications for pedestrian safety. Weed growth is also a source of significant community interest and service requests. Weed treatment should therefore be undertaken according to traffic and pedestrian usage and to a level of usage that takes account of local concerns. The use of weed-killers should be the minimum compatible with the required results.
- B.4.10.9. It will be important to co-ordinate arrangements for weed spraying with street cleansing arrangements, which may be the responsibility of other authorities and it may be possible to facilitate co-operative arrangements.
- B.4.10.10. Specialist environmental guidance should be adhered to regarding the materials used for weed spraying and the frequency of application, in the light of developing levels of usage. Noxious weeds should be dealt with on an ad hoc basis. All weed spraying should be carried out in accordance with the [Control of Pesticides Regulations 1986](#). Only approved pesticides may be used, these are chemicals listed in the [Plant Protection Products \(Sustainable Use Regulations\) 2012](#).

- B.4.10.11. In 2015, the Department for Environment, Food and Rural Affairs (Defra) published their [Best Practice Guidance Notes for Integrated and Non-chemical Amenity Hard Surface Weed Control](#), which aims to minimise the use of pesticides in public places. Following this release, APSE issued a briefing note on [The Need for Integrated Weed Control](#).
- B.4.10.12. Cutting of trees should be considered where there are special requirements in visibility areas or across central reserves, and owners of private hedges should be requested to adopt similar levels of cutting. Significant pruning or felling of trees, even for safety reasons, can be the subject of significant local concern and should only be done with specialist advice and support. [BS8545](#) demonstrates that if the right trees are properly planted and given correct structural pruning at the right time, the trees should not need any further significant pruning.
- B.4.10.13. Trimming of hedges should ensure that visibility sight lines and road signs are not obscured, and will often be the responsibility of adjoining landowners. Any action taken must be in accordance with the requirements of the [European Birds Directive \(2009\)](#) and the [Wildlife and Countryside Act 1981](#), which includes protection for birds, their nests and other relevant legislation. Significant nature conservation benefits will result from this practice. Any trimming should, as far as possible, be done in late winter, to avoid the bird-nesting season and to allow birds and mammals the maximum opportunity to take advantage of any fruits or seed present.
- B.4.10.14. The requirements for tree maintenance can be greatly reduced by the careful selection of trees when planning planting or replacement operations. Pruning after planting should only be necessary where it is required to enhance or guide the shape of the tree. Trees which require pollarding should be avoided as it is costly, time consuming and unattractive. Expert advice should always be sought in the management of any tree within the highway environment, whether on highway land or not. Proposed tree planting should consider proximity to existing or planned street lighting, to minimise the risk of shrouding the street lights, or casting shadows on the highway.

B.4.11. CONDITION OF FENCES AND BARRIERS

- B.4.11.1. The condition of fences and barriers can contribute to the core objectives as follows:

Network Safety integrity and location of safety fencing for vehicles, pedestrians and all road users.

Network Serviceability risk of livestock disrupting traffic.

Network Sustainability appearance and condition of fencing.

- B.4.12.3. Traffic signs and bollards represent a highly visible component of the highway network, highly valued by users. At best they can significantly affect both network efficiency and the convenience of users. At worst they can be intrusive, confusing and capable of detracting even more significantly from the local environment, if in poor condition.
- B.4.12.4. Although in many circumstances illuminated signs are essential, the use of high-reflectivity, non-illuminated signs can bring benefits in terms of sustainability. This should be a consideration where legally permitted, both for new signs and on replacement, and should also be considered during any network integrity inspections.

B.4.13. CONDITION OF ROAD MARKINGS AND STUDS

- B.4.13.1. The condition of road markings and studs can contribute to the core objectives as follows:

Network Safety route delineation, particularly in darkness and poor weather; and

potential for damage and injury if loose.

Network Serviceability ease of use, particularly in darkness and bad weather.

Network Sustainability support of sustainable transport modes;

edge delineation to reduce edge damage; and

movement of wheel tracking to reduce localised damage.

- B.4.13.2. The impact of failure will be greater for mandatory markings than others. The probability of sign failure is generally low, but the probability of marking wear is higher and increases with traffic volume.
- B.4.13.3. Many road markings are used to give effect to regulatory provisions and it is important that their legal status is not affected by undue wear or damage. A high proportion of road markings are essential for road safety or fundamental to the implementation of integrated transport policy, for example traffic calming schemes, bus priority measures and the delineation of cycle routes. If such markings are not kept in good order, the measures may lose effectiveness and the success of transport integration compromised. Where road markings become obscured by mud or spillages action should be taken to clean the road surface.

- B.4.13.4. All mandatory road markings existing before resurfacing or surface dressing should either be masked during treatment or replaced as soon as reasonably practicable after the completion of work. If it is not possible to restore immediately in permanent materials, temporary markings should be used at sites where their absence is likely to give rise to dangerous conditions, taking into account the type of new surface laid. During resurfacing 'No Road Markings' boards should be displayed until all markings have been replaced.
- B.4.13.5. Road studs that are either missing, or have become defective, should be replaced individually or by a bulk change, depending on the individual highway circumstances. Displaced road studs lying on the carriageway, hard shoulders or lay-bys, and loose studs if considered to be a hazard, should be removed immediately if reasonably practicable.

B.4.14. REGULATORY FUNCTIONS

- B.4.14.1. Regulatory functions such as traffic orders associated with parking and vehicle movement can contribute to the core objectives as follows:

Network Safety risk to users and adjoining property.

Network Serviceability minimising and signing of obstruction.

Network Sustainability inconvenience to disabled people; and

structural damage from parked heavy vehicles.

- B.4.14.2. In England the introduction of the statutory duty for network management introduced by the Traffic Management Act has significantly increased the emphasis on regulatory activity. A range of Codes of Practice also provide fairly clear guidance on required levels of service.
- B.4.14.3. In Scotland, the Scottish Road Works Commissioner has a range of performance indicators for both Roads Authorities and utility companies. These are generated from the Scottish Road Works Register.

B.4.15. USER AND COMMUNITY RESPONSE

- B.4.15.1. User and community responses can make a significant indirect contribution both to safety and serviceability by ensuring that service requests and complaints are dealt with appropriately and converted into actions. Adequate provision of information will also enable users to obtain better serviceability from the network. Authorities may consider whether community action and self-help might be encouraged and promoted.
- B.4.15.2. User and community responses can be considered at three levels:
- user and community satisfaction with arrangements for their engagement in the policy development process;

- user and community satisfaction with the delivery of the highway maintenance service; and
 - authority response to user and community contact in person, or by phone, mail and email.
- B.4.15.3. Authorities should have an effective public communications process that provides clarity and transparency in their policy and approach to repairing potholes. This should include a published policy and details of its implementation, including the prevention, identification, reporting, tracking and repair of potholes.
- B.4.15.4. To provide clarity, authorities should adopt dimensional definitions for potholes based on best practice as part of their maintenance policy.

SECTION B.5. INSPECTION, ASSESSMENT AND RECORDING – HIGHWAYS

B.5.1. INTRODUCTION

- B.5.1.1. The general principles to be applied to inspections, assessment and recording are outlined in Section A.5 of this Code. This section covers guidance for each category of inspection relating to highways assets.
- B.5.1.2. The approach adopted locally should be documented fully, and approved by the appropriate senior decision makers within each authority. All inspection and assessment results should also be recorded and accessible, preferably via a suitable asset management system.

B.5.2. SAFETY INSPECTIONS

- B.5.2.1. Authorities should determine the most appropriate way to undertake inspections in order to clearly observe any defects for each asset type. This may include inspections from a slow moving vehicle or, in busy urban areas, and particularly when inspecting footways, it may be difficult to obtain the necessary level of accuracy from vehicle-based inspections and walking should be used. It would seem logical for cycle routes to be inspected by cycle, although inspection of parts of some shared routes may be possible by walking or by vehicle as appropriate.
- B.5.2.2. Authorities may choose to carry out combined inspections including safety, obstruction and all network management functions. These may be planned or responsive following user complaints.
- B.5.2.3. Frequencies of safety inspections should be derived using the principles outlined in Section A.4 this Code (categorising the network into an appropriate hierarchy) and Section A.5 (covering risk based approach for inspections).
- B.5.2.4. In urban areas, it may be desirable to combine footway and carriageway inspections to mitigate against problems associated with heavy traffic and parked cars.
- B.5.2.5. Where carriageway and footway hierarchies intersect, for example at pelican or zebra crossings, bollards, or other defined crossing points at junctions, the higher inspection frequency should take precedence in determining of inspection frequency, defect definition and responses. This principle should also apply to intersections between carriageways and cycle routes and between cycle routes and footways.
- B.5.2.6. Where footways or cycle routes remote from carriageways form part of an integrated route or network intended to encourage walking and cycle use, or are promoted by the authority, consideration should be given to adopting a consistent safety inspection frequency for the route or network as a whole.

- B.5.2.7. Authorities have not generally established specific systems for safety inspections for PROW based on hierarchy. The Statement of Action required by ROWIPs provides the opportunity for authorities to consider the relevance of a more formal system of safety inspections, for at least some parts of the network.
- B.5.2.8. Section A.4 of this Code advises where certain PROW are considered part of the footway hierarchy, safety inspections should be carried out accordingly.

B.5.3. DEFECT RISK ASSESSMENT

- B.5.3.1. Risk management is dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance, Part C](#), and Section A.5 of this Code.

B.5.4. SAFETY INSPECTION OF HIGHWAY TREES

- B.5.4.1. Trees are important for amenity and nature conservation reasons and should be preserved but they can present risks to highway users and adjoining land users if they are allowed to become unstable, cause obstruction or create visibility issues.
- B.5.4.2. In England and Wales the Highway Authority is also responsible for ensuring that trees outside the highway boundary, but within falling distance, are safe. Section 154 of the Highways Act 1980 empowers the authority to deal, by notice, with hedges, trees and shrubs growing on adjacent land which overhang the highway, and to recover costs.
- B.5.4.3. In Scotland, Sections 88 and 92 of the Roads (Scotland) Act 1984 give roads authorities the responsibility to remove projections which impede or endanger road users, and provide restrictions on planting of trees near carriageways.
- B.5.4.4. Safety inspections should incorporate highway trees, including those outside but within falling distance of the highway. For trees off highway limits inspections should only be made so far as can be seen without trespassing. Owners' permission should be obtained to enter property where suspect trees are observed. Inspections should take note of any encroachment or visibility obstruction and any obvious damage, ill health or trip hazards.
- B.5.4.5. Authorities should include some basic arboricultural guidance in training for inspectors but it is important that arboricultural specialists should advise on the appropriate frequency of inspections and works required for each individual street or mature tree that is considered to hold a high risk to users of the network. A separate programme of inspections for such trees, should also be undertaken by arboricultural advisors. LANTRA have produced a [training course for professional tree inspection](#).
- B.5.4.6. Extensive root growth from larger trees can cause significant damage to the surface of footways, particularly in urban areas. A risk assessment should therefore be undertaken with specialist arboricultural advice on the most appropriate course of action, if possible to avoid harm to the tree. In these circumstances, it may be difficult for authorities to reconcile their responsibilities for surface regularity, with wider environmental considerations and a reduced level of regularity may be acceptable.

- B.5.4.7. Overhanging branches may present a risk to high vehicles and also buildings adjoining the highway. In such circumstances, the necessary comprehensive consideration of respective risks and liabilities of the authority and landowner will require specialist technical, arboricultural and legal advice to determine the most appropriate course of action.

B.5.5. COMPETENCE

- B.5.5.1. Competence of staff is dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Part C](#). This document should be referred to and the advice below considered supplementary.
- B.5.5.2. The Institute of Highway Engineers (IHE) administers the [UK Highway Inspectors training and certification scheme](#) approved by the UK Roads Board in 2010. It established the Highway Inspectors Board in 2011. Candidates who successfully complete the courses run by an approved centre are eligible for inclusion on the National Register of Highway Inspectors for a period of five years.
- B.5.5.3. Registration with the Highway Inspectors Board can contribute positively to risk management and defence of compensation or liability cases.

B.5.6. SKIDDING RESISTANCE SURVEYS

- B.5.6.1. The maintenance of adequate levels of skidding resistance on carriageways, footways and cycle routes is a most important aspect of highway maintenance, and one that contributes significantly to network safety, particularly for cyclists, motorcyclists and equestrians. However, whilst the frequency of accidents is expected to increase as skidding resistance falls, the effect will be more pronounced for more 'difficult' sites and there is no skidding resistance boundary at which a surfacing passes from being 'safe' to 'dangerous'. Difficult sites are those where the geometry, for example, bends, junctions, roundabouts, steep gradients, pedestrian crossings and traffic signals increase the risks of skidding accidents.
- B.5.6.2. Authorities should publish their Skid Resistance Strategy as part of their Asset Management Framework. The strategy, which should be informed by risk assessment, should define:
- the network to which it applies taking account of traffic flow and characteristics and accident risk;
 - the test equipment to be used, i.e. SCRIM or Grip Tester. Authorities should state if they will use the Pendulum Skid Tester for detailed investigations;
 - the method of survey to be used to provide an estimate of the summer skid resistance, referred to as the Characteristic SCRIM Coefficient (CSC). Authorities can choose between the Single Annual Survey Method, Mean Summer SCRIM Coefficient Method, or Annual Survey with Benchmark Method;
 - quality assurance procedures for data collection;
 - frequency of surveys;

- the approach to setting investigatory levels, including the range of investigatory levels which are to be used for different categories of site;
 - frequency of re-assessment of investigatory levels;
 - competence levels of staff authorised to set or approve investigatory levels;
 - the approach to be followed in site investigation, including prioritisation of investigations, and staff competent to undertake site investigations. Each site investigation should be undertaken or led by suitably competent personnel;
 - intervention criteria;
 - how remedial works will be prioritised in relation to available funding in the overall context of the Asset Management Framework;
 - whether they will follow existing highway design guidance (HD 28/15) or produce their own strategy for dealing with early life skid resistance;
 - a realistic/achievable timetable for each part of the strategy;
 - responsibilities for delivering each part of the strategy; and
 - the documentation to be retained to enable implementation of policy to be demonstrated (in court if necessary).
- B.5.6.3. The decisions taken when setting investigatory levels should be recorded, dated and signed. Investigatory levels should be reassessed whenever a significant change to the network is made, for example the installation of traffic lights, a pedestrian crossing, or roundabout. The investigatory levels for each category of hierarchy of the network should be reviewed as a result of risk assessment.
- B.5.6.4. Authorities need to decide whether to use SCRIM or Grip Tester for network testing and whether they will use Grip Tester or the Pendulum Skid Tester (recommended for localised investigations only). Research has been undertaken into the [correlation between Grip Tester and SCRIM](#).
- B.5.6.5. All sites where the skid resistance is at or below investigatory level should be identified as soon as is practicable.
- B.5.6.6. The results of the investigations, including whether further action is required, should be documented and retained, together with the identity of the assessor and other parties consulted.
- B.5.6.7. Where the skid resistance is considerably below the Investigatory Level (an appropriate figure should be determined locally), “Slippery Road” signs should be erected as a matter of urgency.
- B.5.6.8. In other cases “Slippery Road” signs should be erected at locations where a site investigation has shown that there is a need for treatment to improve skid resistance.

- B.5.6.9. “Slippery Road” signs should be removed as soon as they are no longer required. This should be after the remedial action has been taken and maintenance engineers are satisfied that skidding resistance levels have been returned to an appropriate level. In some cases this will not be immediately after treatment, for example at sites where surface binder has to be worn off before the skid resistance becomes adequate.
- B.5.6.10. Where skidding resistance is determined as being substantially below the Investigatory Level (an appropriate figure should be determined locally) and there are clear indications that improving the condition of the surfacing is likely to significantly reduce the risk of accidents occurring, remedial treatment should be prioritised as a relatively urgent task.
- B.5.6.11. Priority should then be given to the following sites:
- where the skid resistance is below the investigatory level by a certain degree (an appropriate figure should be determined locally);
 - where low skid resistance is combined with low texture depth; and
 - where the accident history shows there to be a clearly increased risk of wet or skidding accidents.
- B.5.6.12. Where investigations show that treatment is necessary, consideration should also be given to other planned maintenance works programmes to ensure that potential efficiencies are identified and actioned where possible. Surface treatment may not always be a necessary response and other measures to reduce the accident risk of the site may be both more cost effective and consistent with local transport policy.

B.5.7. SERVICE INSPECTIONS – GENERAL

- B.5.7.1. Service inspections should be strongly focused on ensuring that the network meets the needs of users and comprise more detailed specific inspections of particular highway elements, to ensure that they meet the levels of service defined within the Asset Management Framework. These surveys are dependent upon the asset management regime adopted by the authority to determine programmes of work. Any safety defects encountered during service inspections should be assessed and dealt with in accordance with the requirements of the safety inspection regime.
- B.5.7.2. This category also includes inspections for regulatory purposes, including NRSWA, which are also primarily intended to maintain network availability and reliability, and inspections for network integrity.
- B.5.7.3. Risk assessments for service inspections are dealt with differently to safety inspections. In regard to safety related defects, risk assessments are based purely on the safety aspect and defects must be rectified in accordance with the timescales appropriate to their risk and local policy. Serviceability related defects, however, are mainly related to network reliability and integrity and the ability of the network to meet the needs of users. Risks should be assessed by reference to the Asset Management Framework by taking due consideration of levels of service, relative priorities and available budget.

- B.5.7.4. As part of developing their asset management regime, authorities may develop individual risk assessments for each service inspection by following a similar procedure to that identified for safety inspections. This risk based approach to service inspections, together with any condition surveys, will contribute to identifying the need, frequency and period for remedial action for each of the service inspection items.

B.5.8. SERVICE INSPECTIONS FOR CARRIAGEWAYS, FOOTWAYS AND CYCLE ROUTES

- B.5.8.1. Service inspections for carriageways, footways and cycle routes should be undertaken at a frequency determined on a local basis. This should be based on local user and community requirements for network serviceability and identified as part of the Asset Management Framework. They may be undertaken separately, or in conjunction with other inspection types. These surveys may be undertaken either by slow moving vehicle, on foot or by utilising data such as video depending upon the circumstances.

B.5.9. SERVICE INSPECTION OF HIGHWAY DRAINAGE SYSTEMS

- B.5.9.1. In general inspection of drainage has proved problematic to authorities for a variety of reasons, including inaccurate records of drainage locations, uncertainty of ownership and lack of resources. In 2012 HMEP produced Guidance on the management of Highways Drainage Assets, which provides advice to Highway Authorities on how to prioritise 'at risk' areas and make interventions. It provides a baseline for authorities to review current practices against and to identify potential improvements, and is freely available to download from the [HMEP website](#).
- B.5.9.2. [Guidance on the maintenance and inspection of Sustainable Urban Drainage Systems for Roads](#) has been developed by SCOTS and the SUDS Scottish Working Party, along with [an Excel tool](#).

B.5.10. SERVICE INSPECTION OF EMBANKMENTS AND CUTTINGS

- B.5.10.1. Significant embankments and cuttings should be defined and an inspection regime identified based upon the geological characteristics and the potential risk of slippages or rockslides. Service inspection arrangements should be based on specialist geotechnical advice, but should usually be programmed wherever possible to follow periods of extreme or severe weather, including heavy rain, severe frost or prolonged dry weather. A risk based approach should be adopted to identify any issues critical to network performance, after which an enhanced service inspection regime should be adopted.

B.5.11. SERVICE INSPECTION OF LANDSCAPED AREAS AND TREES

- B.5.11.1. Highway trees contribute to amenity and nature conservation and in urban areas can enhance the space between buildings, reinforcing the area's character and appeal. Close co-operation between arboriculturists, highway engineers, landscape architects and urban designers is essential to preserve and enhance the range and quality of street trees, ensuring that a considered approach has been taken to supporting sufficient species diversity to make the overall town or neighbourhood tree population more robust to the advent of disease/and or more resilient to climate change. Avenues, boulevards, town squares and formal spaces, and informal rural locations all require the application of different planting principles. Trees and planting may reflect the history, architecture and tradition of places. Small pockets of poor quality planting can undermine the quality of the streetscape.
- B.5.11.2. Street trees and planting are not appropriate in every instance. Trees and planting should always form part of the overall urban context, and not be added or preserved without question. Trees may be planted where trees have not been planted previously particularly in urban areas that have changed use (e.g. warehousing to residential) or in areas where historically they were considered unworthy of tree planting.
- B.5.11.3. Authorities should develop, with advice from arboriculturists, landscape architects and urban designers, a local policy for the installation, management, removal and replacement of highway trees and landscaping. The policy should recognise the amenity and nature conservation value of trees, along with benefits such as air pollution removal, carbon storage or stormwater attenuation, and also seek constructively to manage ongoing risk to the authority. The policy should include the approach to service inspections, to be undertaken by arboriculturists, including frequency, for various types of tree.

B.5.12. SERVICE INSPECTION OF FENCES AND BARRIERS

- B.5.12.1. Steel and wire road restraint systems should be inspected at intervals determined through risk assessment in respect of mounting height, surface protective treatment and structural condition, to ensure that they remain fit for purpose. Tensioning bolts of tensioned safety fences should be checked and reset to correct torque at intervals determined by risk assessment. Safety barriers adjacent to bridges should be inspected as part of the highway asset, as well as part of General and Principal Inspections for structures.
- B.5.12.2. Inspection and testing of safety barriers with respect to mounting height and integrity should be undertaken at a frequency determined locally using a risk based approach.
- B.5.12.3. Pedestrian safety fences, boundary fences and environmental barriers for which the authority is responsible, should be also inspected in respect of integrity, and where appropriate stock proof qualities, during the course of service inspections of carriageways, footways and cycle routes. A higher frequency may be necessary in some locations (e.g. in areas with known higher incidence of vandalism). Inspections of structural condition and protective treatment should be carried out at regular intervals. All inspection intervals should be determined using a risk based approach.

- B.5.12.4. Vehicle restraint systems should be inspected in accordance with an authority's strategy based upon the UKRLG/DfT October 2011 document – [Provision of Road Restraint Systems for Local Authorities](#).
- B.5.12.5. Safety barriers and fences adjacent to railway lines should be inspected by the Highway Authority irrespective of liability, with inspection intervals determined using a risk based approach. The DfT publication *Managing the Accidental Obstruction of the Railway by Road Vehicles* provides more guidance on this (see Section B.4.11 of this Code).
- B.5.12.6. [The Road Restraints Risk Assessment Process \(RRRAP\)](#) has been developed as an Excel based tool, which allows the need for a vehicle restraint to be established for individual sites/schemes and, if so, its performance requirements:

B.5.13. SERVICE INSPECTION OF TRAFFIC SIGNS AND BOLLARDS

- B.5.13.1. Traffic signs are the most visible elements of the highway network, highly valued by users, and contribute significantly to network serviceability through facilitating efficient and effective use of the network.
- B.5.13.2. The primary objective is to keep all traffic signs legible, visible and effective as far as possible at all times in relation to the road use and traffic speeds. The following defects in signs and bollards should be considered as factors in a local risk assessment. The speed of permanent repair will depend on the degree of danger but important warning and regulatory signs should be replaced as a matter of urgency:
- matters affecting the legality of important warning and regulatory signs;
 - damage, deterioration, or vandalism to signs and bollards leaving either the sign or situation to which it applies in a dangerous condition; and
 - missing traffic cylinders across gaps in central reserve fence at emergency crossing points.
- B.5.13.3. Vegetation potentially obscuring road signs should be recorded during safety inspections and service inspections of carriageways, footways and cycle routes, and treated accordingly. The level of risk associated with such vegetation may change during periods of maximum growth.
- B.5.13.4. Special signing schemes, for example blockwork chevron treatments at roundabouts and traffic calming schemes using special signing may deteriorate more quickly than conventional signing. They are also likely to have been installed to improve network safety. Inspection arrangements should reflect this via risk assessment.
- B.5.13.5. The condition of non-illuminated road signs should be inspected in daylight, and also at night for degradation of colour, retro-reflectivity, deteriorating fittings, legibility distance, and average surface luminance, after cleaning. The frequency of cleaning required will be influenced by the risk of soiling in local areas.

- B.5.13.6. Inspections should initially be visual and condition assessed. Any suspect areas identified by the visual inspection should be noted and further testing instigated. The coefficient of retro-reflection of sign face sheeting is a specialist site test that may require the services of a specialist organisation. Authorities should choose sign performance levels depending on the overall risk assessment and road hierarchy. Highways England have published [TD25/01 which contains more information on the inspection and maintenance of traffic signs](#).
- B.5.13.7. Inspection of “Stop and Give Way” signs at minor roads should be included in the inspections of signs on the major road to which they control entry.
- B.5.13.8. Service inspections should ideally identify signing that is inappropriate or no longer necessary and may be a distraction to users, or detrimental to the streetscene. Such signing should be noted for removal or replacement either as part of future programmed works or more urgently, if necessary.
- B.5.13.9. The Department for Transport published a [Traffic Advisory Leaflet \(TAL 1/13\) which gives practical advice on reducing sign clutter](#). It emphasises that designers should use their engineering judgement and local knowledge to complement guidance to ensure signing solutions are effective.

B.5.14. SERVICE INSPECTION OF ROAD MARKINGS AND STUDS

- B.5.14.1. Inspections in respect of wear, spread, colour, skid resistance and retro-reflectivity shall be undertaken for paint markings and for thermoplastic markings, at frequencies determined by risk assessment. Inspections for reflective conspicuity should be carried out during the hours of darkness and programmed to enable maintenance works to be completed before the onset of winter.

B.5.15. SERVICE INSPECTIONS FOR NETWORK INTEGRITY

- B.5.15.1. Although each element of each component within each category of network hierarchy might be well maintained within the framework of an overall asset management strategy, the network might still not deliver best value, as the asset might not be performing to optimum efficiency. Operational efficiency is primarily a network management consideration but aspects of it are closely related to the maintenance function, for example:
- traffic signs or markings may be poorly sited or the legend may be either incorrect, confusing or not reflect current priorities;
 - traffic signs or markings may be redundant;
 - facilities for walking, cycling or public transport might be discontinuous or poorly defined. Opportunities for installation of dropped kerbs or textured paving should be taken; and
 - opportunities might be taken to modify layout as part of future relevant maintenance schemes.
- B.5.15.2. Such network deficiencies are unlikely to be noted as part of safety, or condition inspections, but are nevertheless relevant to network efficiency. Authorities may undertake service inspections of network integrity at intervals determined by risk assessment, or prior to planning of network maintenance and improvements.

B.5.16. CONDITION SURVEYS – GENERAL

- B.5.16.1. The most significant financial investments in highway maintenance will be in repairing, reconditioning and reconstructing carriageways, and to a lesser degree, footways and cycle routes. Condition surveys identify the current condition of the network and from this condition, both long-term and short-term maintenance funding decisions can be made. Repeatable condition surveys allow trend analysis to be used to confirm the original decisions or allow for changes as a result of the changing network condition, and inform lifecycle planning.
- B.5.16.2. There are a number of types of survey, each providing information from a differing perspective, and which in combination can provide a comprehensive picture of the condition of the asset. These surveys may broadly be sub-divided into network level and project level. At network level surveys may include:
- SCANNER (Surface Condition Assessment of the National Network of Roads);
 - Coarse Visual Inspections (CVI);
 - skidding resistance (SCRIM or Grip Tester);
 - Detailed Visual Inspections (DVI) or Footway Network Surveys (FNS) for footways; and
 - other locally developed surveys.
- B.5.16.3. Network level surveys may be supplemented at a local or project level by further investigation. The nature of this investigation will depend on the circumstances of the case. Survey methods include:
- Deflectograph;
 - Falling Weight Deflectometer (FWD); and
 - Ground Penetrating Radar (GPR).
- B.5.16.4. SCANNER surveys are traffic speed surveys that collect data on transverse and longitudinal profiles, texture and cracking of carriageways. These are fast surveys with real time processing of condition information, that were introduced with the aim of providing both reliable and repeatable information, for the assessment of carriageway condition. They can support national requirements for reporting where applicable.
- B.5.16.5. CVI is normally carried out from a slow moving vehicle, complemented in some cases with machine measured rut depth data. It is a fast, cost-effective survey that enables authorities to cover large parts of their road network on a regular basis. Rather than recording detailed measurements of individual defects, the survey identifies and categorises lengths of features having generally consistent defectiveness.

- B.5.16.6. DVI may be used on carriageways where more detailed information is required to support and validate treatment decisions and scheme identification (supplementing CVI data), and also on a cyclical basis for those parts of the network where a more detailed routine visual assessment is required (e.g. in urban areas). DVI can also be used for concrete carriageways. Segregated cycle routes may also be surveyed by DVI.
- B.5.16.7. Network surveys such as SCANNER and CVI provide regular whole network coverage and are used to target more detailed investigations of provisional treatments, using more detailed project level surveys.
- B.5.16.8. The Scottish Road Maintenance Condition Survey (SRMCS) is an annual survey which assesses the condition of the entire Scottish Local Authority road network. It provides roads authorities with performance information required for Statutory Performance Indicator 3.
- B.5.16.9. Guidance on SCANNER, CVI and DVI condition surveys can be found on the [UKRLG website](#).
- B.5.16.10. The Footway Network Survey (FNS) is intended to provide a cost effective, efficient and consistent approach to footway surveys, based on a linear basis. The survey is carried out by a single surveyor walking along the footway, referenced to chainage within a UKPMS section. Further details on the survey may be found on the [UKRLG website](#).
- B.5.16.11. An alternative methodology is used in Scotland which Scottish Local Authority staff can access via the RAM Knowledge Hub.
- B.5.16.12. The Deflectograph is a tool to indicate the structural condition of the whole carriageway, particularly on local authority roads which are not deemed long life. (A long life carriageway is defined as a carriageway with over 300mm of bituminous materials and a low deflection.)
- B.5.16.13. SCANNER only measures surface condition. Where defects have been identified by SCANNER, the Deflectograph may be used at project level to augment this condition information by providing the structural condition of the defective section for flexible and flexible composite carriageways. This will assist in supporting treatment decisions. Where SCANNER and Deflectograph show that remedial works can be limited to the surface, no strengthening is required. However where the Deflectograph shows that the structure needs to be strengthened, the Deflectograph results provide recommendations for overlay thickness or reconstruction. At this stage, other tools such as FWD, GPR, coring and trial pitting can also be employed to provide useful data.
- B.5.16.14. With SCANNER data giving a good indication of the overall condition and deterioration pattern for long life carriageways, there is a potentially reduced need for Deflectograph surveys. However, for roads which are not long-life, SCANNER surveys will not take into account structural condition until it has manifested itself as rutting or cracking.
- B.5.16.15. CSS (now ADEPT) have produced a [guidance note for local authorities on the future use of the Deflectograph](#).

B.5.16.16. The analysis should take into account the reduction in residual life since the survey. Authorities should bear in mind that deleting short lengths (i.e. part sections) of the network is unlikely to be economic or practical. Other techniques such as FWD, GPR, coring and trial pitting may be more cost effective.

B.5.17. INSPECTIONS FOR REGULATORY PURPOSES

B.5.17.1. A significant element of highway maintenance comprises regulation and enforcement of activities on or affecting the highway, which vary across the UK. The most significant of these involves responsibilities under the New Roads and Street Works Act 1991 (NRSWA). In England, most of these issues are now incorporated within the statutory duty for Network Management imposed by the Traffic Management Act 2004, and are the responsibility of the authority's Traffic Manager.

B.5.17.2. The [JAG\(UK\) website](#) contains a range of guidance, information and assistance.

B.5.17.3. Other regulatory activities include:

- ensuring 'expeditious movement of traffic';
- management of the Highway Register or equivalent;
- management of the Definitive Map for PROW;
- dealing with encroachment on the highway;
- dealing with obstruction on highways or PROW;
- dealing with illegal and unauthorised signs;
- issuing permits or permissions for utilities, skips, hoardings, temporary closures and other authorised occupation of the highway;
- construction of vehicle crossings;
- dealing with illegal parking on verges and footways; and
- adoption of new highways.

B.5.17.4. Although each of these are separate duties, many of them have wider implications for highway maintenance, for example:

- many of these items, for example illegal signs or encroachment, may have the potential to contribute to accidents; and the details of how the occurrence was dealt with (or not dealt with) by the authority may be a material consideration in legal proceedings; and
- illegal parking on verges and footways, especially by heavy vehicles, could cause considerable damage and where this has occurred it might be relevant to increase inspection frequency and consider new materials or prevention.

B.5.17.5. It will therefore be important to establish a regime for regulatory inspection on the basis of risk assessment.

B.5.18. RELIABILITY OF DATA

- B.5.18.1. Asset data management is dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance, Part B](#). This document should be referred to and the advice below considered supplementary.
- B.5.18.2. Opportunities to ensure quality and reliability of data occur at a number of levels including:
- survey instructions and documentation;
 - selection and appointment of inspectors;
 - training and accreditation;
 - specification and procurement of surveys;
 - audit procedures;
 - survey procedures;
 - data capture software;
 - processing software;
 - maintenance and calibration of equipment; and
 - record keeping.
- B.5.18.3. Considerable care should be taken in the derivation of locally enhanced versions of surveys to ensure that data can be extracted, without bias from the survey.
- B.5.18.4. In the case of machine surveys, where these are used, such as SCANNER, Deflectograph, SCRIM, FWD, GPR and Grip Tester, these should be carried out by accredited surveyors using accredited software. Further information on accreditation can be found on the [UKRLG website](#).
- B.5.18.5. Care should also be taken in the specification of surveys when deciding whether these are to be carried out in house or by contract, to ensure that appropriate quality provisions are included in the specification that address:
- selection and training of inspectors;
 - survey procedures and documentation; and
 - quality management procedures, audit and error correction.
- B.5.18.6. Competence is especially important in the case of inspections and surveys where the quality and treatment of data could have significant legal and financial implications. All training, experience and other forms of staff development should be recorded and documented.

- B.5.18.7. Audit and quality control procedures are essential, and where highways staff change role within an authority, competence for the new position should be reviewed and any required training or development should be provided if necessary.

B.5.19. RECORDING OF INFORMATION

- B.5.19.1. Information from all inspections and surveys, together with any immediate or programmed action, including nil returns, should be accurately and promptly recorded, monitored, and utilised with other relevant information in regular reviews of maintenance strategy and practice. This is particularly relevant in the case of safety inspections.

B.5.20. DEVELOPMENTS IN SURVEY TECHNOLOGY

- B.5.20.1. Authorities should consider using proven technology and systems for the effective identification and management of defects. Regular reviews of survey strategy should take account of new technologies and methods. This could include the use of in-vehicle location and communications technology to record the position of defects and to ensure that they are instantaneously recorded with the works gang. This may also provide opportunities to change the number, type and quantity of inspections and thus generate efficiencies.
- B.5.20.2. New survey techniques may also be considered to improve quality of data and increase efficiency. An example is Light Detection and Ranging (LiDAR), a technique that uses multiple scanning lasers to collect spatially referenced point clouds, which can be used to produce high resolution panoramic imagery that is fully synchronised and geo-referenced

SECTION B.6. PROGRAMMING AND PRIORITIES – HIGHWAYS

B.6.1. INTRODUCTION

- B.6.1.1. Programming and priorities are dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Part B](#). This document should be referred to and the advice below considered supplementary.
- B.6.1.2. The general principles to be applied to programming and priorities are outlined in Section A.8 of this Code, with this section covering guidance relating to highways assets.

B.6.2. BALANCING PRIORITIES BY TYPE

- B.6.2.1. The broad priorities for the respective types of highway maintenance will largely be determined by the outcome of safety and service inspections and condition surveys, assessed against local risks and policies specified by the authority in the light of this Code. In general it will be important to establish priorities and programmes for each of the following:
- emergency / reactive maintenance – attending to defects and other safety matters that require urgent action arising from inspections or user information;
 - planned maintenance – attending to defects and other less urgent matters that may benefit from further planning leading to permanent repairs ;
 - programmed maintenance – providing lifecycle / road condition based work streams;
 - routine maintenance – providing locally defined levels of service;
 - regulatory functions – regulating occupation, interference or obstruction of the network; and
 - Winter Service – providing locally defined levels of service of salting and clearance of ice and snow.
- B.6.2.2. The determination of priorities and programmes for items within the categories of regulatory functions and Winter Service will tend not to require any special consideration and will largely arise out of the design of the services. For the other four categories listed above, it will be helpful to establish a more structured approach as outlined in the following paragraphs.
- B.6.2.3. In 2012, [the Potholes Review](#) was published by HMEP and provides guidance on areas including preventative maintenance and delivering “right first time” repairs:
- B.6.2.4. The Potholes Review also recommended that authorities should consider the guidance provided in the ADEPT report [Potholes and Repair Techniques for Local Highways](#) and adopt as appropriate to their local circumstances.

- B.6.2.5. The Scottish Roads Research Board have also published a [Best Practice guide for the selection of pothole repair options](#).

B.6.3. PRIORITIES FOR EMERGENCY / REACTIVE MAINTENANCE

- B.6.3.1. Emergency / reactive maintenance involves attending to the rectification of defects and other safety matters that require urgent action arising from inspections or user information in accordance with the locally determined levels of response. Although all such matters will by definition have a degree of urgency, some may have potentially even more serious consequences, and priorities will usually be determined exclusively on the basis of risk assessment.
- B.6.3.2. The option selected, together with relevant follow up, will largely be determined by operational practicalities and also whether the site is already part of a programme for more comprehensive treatment, in which case a temporary repair may be an appropriate course of action.
- B.6.3.3. Authorities may use 'Highway Wardens', 'Community Wardens' or 'Care Teams' to provide an integrated service of safety inspection, signing and temporary repair. In some cases, these are also extended to provide 'Integrated Street Management' services, and teams will need clear guidance on the application of priorities as well as appropriate training to ensure competency.
- B.6.3.4. Examples of emergency / reactive maintenance are given below:
- all assets – sign and make safe for safety purposes;
 - all assets – provide initial temporary repair for safety purposes; and
 - all assets – provide permanent repair for safety purposes.
- B.6.3.5. Authorities should adopt permanent repairs as the first choice. Temporary repairs should only be used where safety cannot be managed using alternative approaches and in emergency circumstances.

B.6.4. PRIORITIES FOR PLANNED MAINTENANCE

- B.6.4.1. Planned maintenance involves attending to the rectification of defects and other less urgent matters that do not require immediate action and where further planning may lead to the opportunity for permanent repairs.

B.6.5. PRIORITIES FOR PROGRAMMED MAINTENANCE

- B.6.5.1. Programmed maintenance is undertaken primarily in the interests of providing for a sustainable outcome, seeking to minimise cost over time and to add community value to the network or to the environment. It can also be for safety purposes by, for example, improving skidding resistance or contributing to serviceability by, for example, improving ride quality.
- B.6.5.2. It will be necessary to develop priorities and programmes for the structure, surface and edge of carriageways, footways and cycle routes, using data such as age, condition, hierarchy and lifecycle planning.
- B.6.5.3. HMEP has developed a lifecycle planning toolkit for use by Local Highway Authorities to provide planning level decision support, including the following:

- assessing the impact of different levels of funding on asset performance and asset maintenance needs;
 - investigating current and future levels of funding required to sustain or improve the condition or performance of the asset;
 - identifying the level of funding required to minimise whole life costs; and
 - allocating resources to assets and treatments that provide the best whole life costs.
- B.6.5.4. Three different versions have been published, namely for carriageways, footpaths and ancillary assets. The carriageway model incorporates work that was carried out to develop default deterioration models for bituminous carriageways suitable for the local road network in England. The lifecycle planning toolkit, together with a user guide and information on the carriageway deterioration models, may be downloaded from the [HMEP website](#).
- B.6.5.5. In Scotland and Wales, guidance and lifecycle planning tools are available to members of the SCOTS/CSSW Roads Asset Management Project group via the RAM Knowledge Hub. Cost projection tools are available for carriageways, footways, street furniture and other asset types.
- B.6.5.6. Programmed maintenance schemes may be more expensive than routine or reactive treatments in initial cost, but should be designed to have a lower whole life cost, therefore providing value for money. The determination of priorities between competing schemes needs to be based more objectively, utilising processes such as Value Management.
- B.6.5.7. One method of identifying programmed maintenance schemes for carriageways, footways and cycle routes is through a highway asset management system, using the following stages:
- the information obtained from condition surveys should be processed by a UKPMS accredited system to establish a preliminary programme; and
 - the preliminary programme should then be developed into individual schemes that meet the levels of service in the Asset Management Framework. The schemes may then be prioritised using a process of Value Management (Section B.6.9). Schemes should not necessarily be prioritised on the basis of 'worst first' as this is unlikely to provide the best value for money in terms of whole life cost. In some circumstances a 'just in time' approach may provide better value.
- B.6.5.8. Examples of programmed maintenance are given below, but this list is not exhaustive:
- carriageways – minor works, resurfacing or reconstruction;
 - footways – minor works, resurfacing or reconstruction; and
 - cycle routes – minor works, resurfacing or reconstruction.

B.6.6. PRIORITIES FOR ROUTINE MAINTENANCE

- B.6.6.1. Routine maintenance is primarily for the purpose of providing defined levels of network serviceability, maximising availability, reliability, integrity and quality. The priorities and programmes will be determined largely, but not exclusively, from non-urgent defects identified during service inspections together with items from safety inspections not requiring urgent attention and user requests.
- B.6.6.2. Priorities and programmes will need to be defined for all routine maintenance categories. Routine maintenance for each category may be undertaken separately, according to the frequency defined in each case, but it will usually be more efficient to combine a number of operations into a co-ordinated programme. It may also be convenient in central urban areas to consider co-ordination with other related street activities.
- B.6.6.3. Particularly in rural areas, it will be helpful to prepare a regular programme of visits to local council areas for the purpose of undertaking the widest possible range of routine maintenance activity and to inform the local council and community in advance. Such arrangements may also be appropriate for neighbourhoods within urban areas.
- B.6.6.4. Examples of routine maintenance are given below, but this list is not exhaustive:
- carriageways, footways and cycle routes – minor works and patching;
 - drainage systems – cleansing and repair;
 - embankments and cuttings – drainage and stability;
 - landscaped areas and trees – management;
 - verges – grass cutting;
 - fences and barriers – tensioning and repair;
 - traffic signs and bollards – cleansing and repair; and
 - road markings and studs – replacement.

B.6.7. REGULATORY FUNCTIONS

- B.6.7.1. Examples of regulatory functions are given below, but this list is not exhaustive:
- maintenance of Highway Register and Definitive Map;
 - co-ordination of road and street works (responsibility of Traffic Manager or equivalent);
 - charging schemes and permits for highway occupation (responsibility of Traffic Manager or equivalent); and
 - other regulatory functions – encroachment, illegal signs, parking.

B.6.8. WINTER SERVICE

B.6.8.1. Winter Service is covered in Section B.7.

B.6.9. VALUE MANAGEMENT

B.6.9.1. Value Management is a process that may be used to prioritise the competing needs of highway schemes, identified through condition and economic prioritisation. It provides a structured, consistent and quality controlled approach for assessing the benefits of undertaking maintenance and the associated risks of not undertaking maintenance. The outcome should be a prioritised programme of schemes that will be entered into the Asset Management Framework. An example of this process is summarised in Part B of the [HIAMG](#).

B.6.9.2. Before an authority may establish a Value Management regime, it will need to identify the frequency of review and the overall approach to be adopted. It is important that this takes into consideration the corporate and transport priorities within the authority and the overall context of the Asset Management Framework. For example, the regime should identify:

- Value Management frequency - it is possible that some activities would be performed on a continuous basis. However, it is anticipated that a Value Management review would be held annually in order to determine the programme of works to be included in the Asset Management Framework for the following years; and
- prioritisation criteria – the criteria considered under Value Management to be used to prioritise needs. It is important that the prioritised needs should align with the levels of service and the volumes of work identified in the Asset Management Framework.

B.6.9.3. Each category (e.g. safety, socio-economic and environmental, value for money, risk) is assigned a weighting to represent its importance in the delivery of the objectives of the authority and the context of the Asset Management Framework. While it is recognised that safety will be of primary importance, other issues should also be addressed; otherwise the process may focus solely on safety and fail to address serviceability, sustainability and customer service. Clearly, assigning weights to the various criteria is not an easy task, particularly when it is evident that the preference on the criteria may be conflicting. A number of systems are available to establish preferences for a number of criteria, taking into account the views of interested stakeholders. One of these is the Analytic Hierarchy Process (AHP). The system should also provide robust justifiable scores.

B.6.9.4. The Value Management process is usually conducted in the form of workshops with a number of interested parties from various departments within the authority. The process involves the assessment of the performance of each of the programmed maintenance schemes under the various criteria. The outcome of the Value Management process should be an outline programme prioritised on scores obtained from the process. The work volumes and cost estimates should align with the work volumes and the funding estimates in the Asset Management Framework. The process should also highlight the risks related to the programme.

- B.6.9.5. The overall aim of the Value Management process is to ensure that maintenance schemes are assembled into programmes of work that align with the objectives of the authority and deliver value for money. Value of these schemes will be maximised by co-ordination with other highway improvement programmes and integrated transport schemes on related parts of the network, thus minimising disruption to users and maximising benefits to the community.

B.6.10. VALUE ENGINEERING

- B.6.10.1. Value Engineering is a refinement of the Value Management process. It is a second stage process that is conducted on an individual scheme, to optimise both the design and construction phases. In principle, it reduces the risk associated with unforeseen issues at the time of scheme development. Value Engineering also provides the authority with a further chance to explore potential opportunities for innovation. Key individuals from works teams and specialists from each discipline should be present during this process.

B.6.11. MATERIALS, PRODUCTS AND TREATMENTS

- B.6.11.1. The importance of materials, products and treatments in meeting the core objectives of customer service, safety, serviceability, sustainability and the agreed levels of service is outlined in Section A.9. This section contains information specifically related to highways.
- B.6.11.2. [The Road Surface Treatments Association \(RSTA\)](#) has developed numerous guidance documents that aim to raise awareness of the range and benefits of road surface treatments, and to encourage product and process innovation. Many of these have been produced in conjunction with the ADEPT Soils and Materials Design Group, and cover topics including service lives, surface dressing, innovative patching products and systems, high friction surfacing, structural road recycling, crack sealing and slurry surfacing, geosynthetics and steel meshes, asphalt preservation systems, grouted macadam, retexturing and ironwork installation.
- B.6.11.3. [Best Practice Guidelines for Specification of Modern Negative Texture Surfaces](#) provides a methodology for site evaluation and material selection to ensure that the right material is installed in the right site together with a structural approach to the factors which may have a bearing on distress mechanisms.
- B.6.11.4. The Waste and Resources Action Programme (WRAP) is a major Government-funded programme established to promote resource efficiency and provide information resources such as [The Quality Protocol for Recycled Aggregates](#).

SECTION B.7. WINTER SERVICE

B.7.1. INTRODUCTION

Background

B.7.1.1. Although sometimes termed “Winter Maintenance”, the particular network management requirements during winter are not “maintenance”, in the traditional sense, but specialist operational services. The term “Winter Service” has been adopted by this Code.

B.7.1.2. Winter Service deals with regular, frequent and reasonably predictable occurrences like low temperatures, ice and snow, as well as with exceptional events. Whilst the effects of climate change are likely to result in an increased frequency and intensity of severe winter events, these can be taken into account in Winter Service planning. Therefore Winter Service can and should be subject to the same regime of plan, deliver, review and improve as other aspects of the highway maintenance regime.

Policies and plans developed for Winter Service are likely to have relevance in emergency planning for dealing with extreme weather conditions including flooding, high winds and high temperature. The incidences of such events may be affected by climate change. They are also likely to have some relevance to the wide range of non-weather related emergencies that could affect the highway network.

B.7.1.3. Although a very specialised area, Winter Service is a significant aspect of network management both financially and in terms of its perceived importance to users. It can also have significant environmental effects. The organisation of the service is likely to have considerable implications for the overall procurement and management of other highway maintenance services. This Section of the Code should therefore be read in conjunction with other sections dealing with these issues.

B.7.1.4. This section of the Code provides the background and higher level policy aspects of the Winter Service. Guidance relating to practical issues and the delivery of the Winter Service is contained within the [National Winter Service Research Group \(NWSRG\) Practical Guide for Winter Service](#). Authorities may wish to consider the content of the NWSRG Practical Guide in conjunction with the information contained within this section of the Code.

Objectives

B.7.1.5. Winter Service can contribute significantly to each of the core objectives set out in this Code as described below:

Safety

B.7.1.6. Safety is a consideration for Winter Service, even though statutory obligations and users’ needs vary in different parts of the UK.

Customer

- B.7.1.7. There are, in all parts of the UK, very considerable user needs and expectations and these can be a major influence on customer satisfaction through demonstrating an efficient, effective and proportionate response to winter conditions.

Serviceability

- B.7.1.8. Maintaining availability and reliability of the highway network is a key objective for Winter Service and one where user judgements of performance will be immediate rather than longer term.

Sustainability

- B.7.1.9. Low temperatures and the formation of ice can cause serious damage to the fabric of carriageways, footways and cycle routes and accelerated damage of the network. Effective Winter Service can contribute to a reduction in whole life costs and minimise damage to the environment.

B.7.2. WINTER SERVICE POLICY

- B.7.2.1. Authorities should formally approve and adopt policies and priorities for Winter Service, which are coherent with wider objectives for transport, integration, accessibility and network management, including strategies for public transport, walking and cycling. They should also take into account the wider strategic objectives of the authority.

- B.7.2.2. Issues for consideration in developing policy should include:

- network resilience;
- treatment of facilities for public transport users;
- treatment of facilities for road users;
- treatment of facilities for walking and cycling;
- treatment of transport interchanges;
- treatment of promoted facilities such as community or leisure centres;
- extent of priority for emergency services;
- extent of priority for key public services and critical infrastructure;
- extent of priority for vulnerable users;
- resilience of Winter Service resources; and
- other local circumstances.

- B.7.2.3. Authorities should develop local service levels for Winter Service which define the Overall Winter Period, the Core Winter Period, the level of resilience and treatment networks.

- B.7.2.4. These local policies and service levels should be developed as far as reasonably possible with users and key stakeholders and should also be based on a risk assessment to define the scope of the service. The documents should be designed and drafted to be used by staff at all levels. Authorities should utilise the time outside the winter season to put these policies and plans in place.

B.7.3. RESILIENT WINTER SERVICE

- B.7.3.1. Better planning will result in a more resilient Winter Service and reduce the risk in the delivery of the service during normal and severe winter conditions. It also has the potential to deliver the service in a more efficient way. This includes not only the management of salt stocks, but other resources such as fuel, plant and labour.
- B.7.3.2. Winter Service should be regarded as part of the authority's wider resilience planning. More detail on this can be found in Section A.6 of this Code.

Minimum Winter Network

- B.7.3.3. As part of their contingency planning, authorities should define a minimum winter network. This network is likely to have a close relationship to the Resilient Network, see Section A.6, and may be a subset of their normal treatment network.
- B.7.3.4. The trigger point and protocol for activating the minimum winter network should be agreed within the authority, documented and communicated as appropriate. In doing so agreement should be made with the emergency planning department and senior officers. The decision to activate the minimum winter network may also be made in conjunction with other authorities. The overall approach should be detailed within the Winter Service Plan.

Winter Service Resilience Levels

- B.7.3.5. Authorities should consider, consult on and formally adopt local service levels for resilience of their Winter Service in terms of number of days' continuous severe conditions salting on a defined Minimum Winter Network for the Overall Winter Period and for the Core Winter Period.

Establishing a local Winter Service level of resilience requires consideration of the number of days' resilience to be adopted, definitions of the Overall Winter Period and Core Winter Period, whether it should refer to the normally salted network or to a smaller locally determined Minimum Winter Network.

- B.7.3.6. Recommendations on winter resilience for English Local Highway Authorities were provided by [The Quarmby Report of 2010](#) and the UKRLG report [Lessons from the Severe Weather February 2009](#).
- B.7.3.7. Delivery of the Winter Service relies on suitable resources being available, including salt, fuel and trained staff and operatives. Any one resource in short supply puts additional strain on service delivery.
- B.7.3.8. The number of days' resilience during the Core Winter Period should be based on a number of days' severe conditions plus replenishment time and taking into account weekends, and combinations of public holidays and weekends such as Christmas and the New Year.

- B.7.3.9. This approach based on a reasonable number of days' resilience in the ability to deliver a defined Winter Service should ensure that Highway Authorities hold or have easy guaranteed access to sufficient salt, gritters and drivers and other essential resources to deal with severe winter weather conditions.
- B.7.3.10. Some Highway Authorities may already have a good level of resilience, but if individual authorities decide they need to increase resources, they will need to consider the practical implications and a reasonable implementation period. Implications may include any new arrangements or facilities required and cost.
- B.7.3.11. In developing their local level of service based on days' resilience, authorities should assess the risks that are faced in the delivery of the Winter Service. The assessment should cover all items of policy and management including:
- network for treatment;
 - adjoining highway networks;
 - salt management policies;
 - operational resources (including equipment, salt stocks and fuel);
 - access to Winter Service depots and salt storage areas;
 - staff training; and
 - availability of operational staff.
- B.7.3.12. An example of how authorities may express and apply their Winter Service level of resilience is included in the NWSRG Practical Guide.
- B.7.3.13. The Department for Transport has put in place a year-round salt stock monitoring system to ensure optimum resilience of salt supply, through a nationally severe winter. Authorities should provide to the Department for Transport the information required for this system in a timely manner.

B.7.4. CO-ORDINATION AND COLLABORATION

- B.7.4.1. Authorities should consider whether collaborative arrangements such as shared services, lead authority arrangements, collaborative service procurement, and sharing depots and salt stock, would provide an effective and value for money approach to Winter Service resilience.
- B.7.4.2. Co-ordination and co-operation between authorities in Winter Service planning including defining treatment routes, response, and treatment times is of crucial importance. This should be a formal process between the adjoining local authorities and with the authority responsible for the strategic network. The intention should be to negotiate effective service integration across administrative boundaries and to enable operation of the plant and vehicles required to achieve adequate resilience. Consideration should be given to Section 8 of the Highways Act 1980 regarding agreements between Local Highway Authorities for doing of certain works.

- B.7.4.3. In these circumstances close liaison both with public transport operators and local authority transport co-ordinators is essential, at the annual review, on an ongoing basis throughout the season and on a continual basis in severe weather conditions. This is particularly important as, although changes to public transport routes and frequencies will be made throughout the season, it will not usually be practical or desirable for consequent changes to the treated network during the season. This may influence the nature and timing of changes to public transport routes.
- B.7.4.4. The efficient operation of many essential services may be dependent upon ice or snow removal from key areas of private land, which is fundamentally the responsibility of land owners.
- B.7.4.5. Authorities should determine critical areas and infrastructure in conjunction with key public services and other stakeholders and seek to ensure that appropriate winter treatment has been considered by the appropriate party.
- B.7.4.6. Authorities should explore the potential for sharing depots as this may provide opportunities for efficiencies. Other areas where collaboration should be considered include decision support services for weather particularly where authorities have similar climatic conditions.

B.7.5. WINTER SERVICE PLANNING

- B.7.5.1. Planning and preparation is fundamental to delivering a successful Winter Service. Careful planning in advance of the winter season will greatly assist in adequate resources and contingency arrangements being put in place by authorities to improve their overall resilience.

Communication

- B.7.5.2. It is good practice to communicate effectively with the public, key public services, stakeholders and other Highway Authorities. However, communication within the authority is also critical. Preparation and planning of communication in advance will assist in the effective delivery of the service.

Setting Expectations

- B.7.5.3. It is important to ensure that the public, elected members and senior management are engaged in the Winter Service. The Department for Transport (DfT) has produced a leaflet titled “Are You Ready for Winter?” with important information for councillors and senior officers about preparation for winter. Public leaflets, websites and briefing notes all contribute to setting expectations with a low associated cost and time requirement.
- B.7.5.4. Clearly setting out what will and will not be done as part of the delivery of Winter Service can reduce the number of complaints and questions raised by the public and stakeholders. Improved communication and understanding may therefore improve time available for the Winter Service delivery team to focus on delivery of the service.
- B.7.5.5. Members of public may travel across boundaries of several different authorities, thus treatment regimes should align across boundaries to provide a seamless service. Simple measures such as comparing treatment routes and decision making criteria between authorities will assist with this, especially within urban areas.

- B.7.5.6. Authorities should ensure that there is appropriate consultation and communication with other Highway Authorities, key public services and other stakeholders to ensure improved service for the public.
- B.7.5.7. Information should be provided directly to key stakeholders, including adjacent Highway Authorities, all emergency services, public transport operators, motoring organisations, the education authority, schools, their bus operators, and key local organisations. This information could include:
- sharing Winter Service Plans;
 - a non-technical summary of the Winter Service Plan;
 - maps of treatment routes;
 - operational decisions on a timely basis;
 - diversion routes in the event of closure of major routes; and
 - salt stock information via the Salt Portal.
- B.7.5.8. Liaison between Highway Authorities should be routine throughout the winter season. Communication of treatment decisions provides useful information that may inform future decision making, promotes seamless service and can potentially generate efficiency savings.
- B.7.5.9. Collaboration with other authorities can be as simple as arranging an informal meeting to discuss the respective Winter Service policies and plans on an annual basis. Other topics could include resource availability, mutual aid or joint training and exercising.
- B.7.5.10. It is good practice to liaise with the relevant trunk road and motorway operator (where appropriate) to confirm current route planning. This will minimise duplication of treatments where the two networks cross and avoid sections being missed at complex intersections.

Contact Information

- B.7.5.11. Staff contact details and other stakeholders involved in the Winter Service need to be updated before the start of the winter season. A contact check is a simple and effective means of ensuring that staff can be contacted when required. The contact check also facilitates a refresh of communications with other authorities and stakeholders.

Media Information

- B.7.5.12. Authorities should establish effective working arrangements with local press and broadcast media. This should enable the presentation of timely and accurate information and advice on network condition and use. Information could include travel information, network availability and risk of severe conditions such as snow and black ice. These arrangements should include in-season proactive media output to engage the public with the Winter Service. This is especially important during prolonged cold weather and is likely to involve television, radio and the internet. Local radio in particular considers this to be a most important aspect of their service to the community and it therefore provides the opportunity to build good working relationships over wider issues. Many authorities have specialist press and public relations personnel and it will be important to clarify and agree respective service and specialist responsibilities.
- B.7.5.13. Whilst every severe weather event poses its own unique issues, the baseline media information required remains relatively constant. Statistics such as the number of spreaders, ploughs and salt stored are popular requests. The structure of messages to be relayed is generally similar.
- B.7.5.14. Robust processes should be in place to ensure a rapid and accurate issue of media information is possible. It is suggested that pre-prepared media briefs are developed in advance of the winter season for use during times of severe weather.
- B.7.5.15. It is important to define and agree key contacts with press and broadcast media and also establish a clear understanding of the most effective timings for information to be provided, in order to reach necessary audiences and broadcast schedules. It may be helpful to arrange joint workshops or training sessions to build understandings and relationships. Advance compilation of commonly requested information will reduce the media workload during a severe weather event.
- B.7.5.16. There may also be a need in more widespread and extreme conditions to provide information to the public using national press and broadcast. This may be undertaken either directly or by arrangement with local media, and arrangements should be discussed with them. It may also be possible to utilise variable message signs.
- B.7.5.17. Where possible, authorities should use their media relations staff to prepare generic statements and press releases for rapid issue at the onset of winter conditions. These can be pre-approved for use during periods of severe conditions, when both Winter Service delivery teams and the press team will be busy. Consequently authorities may identify the need to provide media training to winter staff. This will help to ensure that the right message is put across in the correct manner at all times.
- B.7.5.18. When severe weather is forecast the media rapidly start requesting information and it is important that correct and accurate information is available to them. If information is not provided by an authority the media will attempt to source it from elsewhere, which may not be accurate.
- B.7.5.19. Experience has shown that some individuals will take heed of advice issued to the public for or avoiding travelling during severe conditions. If sufficient advanced warning is provided, drivers will be able to change their plans.

Information for the Public

- B.7.5.20. Authorities should ensure effective communication of information for the public before and during both normal and severe winter conditions.
- B.7.5.21. Authorities should make widely available for users and the community a non-technical summary of the Winter Service Plan, including plans of the treated network, together with guidance on safe use of the network. They should also establish arrangements for local radio and web based information.
- B.7.5.22. Section A.6 of this Code deals with arrangements for community involvement in highway maintenance and the importance of information and publicity. This provides opportunities and challenges, which should be positively addressed by authorities and provide an important opportunity to demonstrate understanding of users' needs, and a strong service commitment.
- B.7.5.23. It is of crucial importance that policies and levels of Winter Service provided by authorities are widely available and understood by users and the community. As far as possible highway users should be made familiar with treatment routes, particularly in severe weather conditions. This will help in ensuring that expectations are realistic and consistent with the resources available as well as maintaining public safety.
- B.7.5.24. Many authorities provide leaflets summarising policies and service levels, including maps showing routes treated, contact information and advice on safe network use. The leaflets should be reviewed annually and made available through the internet, libraries, information centres, schools and a wide range of outlets. Further details on the content and use of leaflets are included in the NWSRG Practical Guide.

Public Self Help

- B.7.5.25. Guidance to the public has been published by DfT on how they can assist their communities in [clearing snow and ice without fear of litigation](#).
- B.7.5.26. Many authorities have provided salt bins and shovels to parish councils and other stakeholders in order to help them keep local areas free of ice and snow. Ensuring suitable risk assessments and method statements are in existence will minimise the risk of accidents occurring.
- B.7.5.27. Local volunteer groups may provide support to local communities and the vulnerable for clearing footways. This needs careful management to ensure the safety and welfare of all involved. This is an area that emergency planning departments are likely to have experience of, either directly or through involvement with Local Resilience Forums.
- B.7.5.28. One means by which authorities can assist the local community in areas not on priority routes or at known trouble spots, including gradients and sharp bends is by the provision of public access salt bins. Where these are provided authorities should make arrangements for their replenishment as necessary and to ensure that they do not become unsightly or used for the unauthorised disposal of waste.

Winter Service Plan

- B.7.5.29. It is important that the Winter Service Plan is designed to be used by staff at all levels and that those that require it have ready access to the document.
- B.7.5.30. Authorities should formally approve, adopt, and publish, in consultation with users and key stakeholders, a Winter Service Plan based on the principles of this Code.
- B.7.5.31. Once the policy and plan documents are complete, those involved in delivering the Winter Service should be aware of the current approach. Ideally, a briefing should take place at the start or early in the season to disseminate this information to staff involved in the delivery of the Winter Service. The briefing should also remind staff of the critical role they play in mitigating the impact of winter weather on the road network.
- B.7.5.32. The Winter Service Plan should be reviewed annually in consultation with a wide range of stakeholders.
- B.7.5.33. It is good practice to monitor compliance with the Winter Service Plan throughout the season. Simple audits on decisions made and short debriefs of snow events will achieve this. These audits should be regular and clearly documented to ensure maximum benefit can be achieved.
- B.7.5.34. Suggested contents of the Winter Service Plan are detailed in the NWSRG Practical Guide. The Plan should recognise the fundamental differences between the main components of Winter Service for carriageways, cycle routes, footways and any critical areas and infrastructure as follows:
- pre-treatment - “precautionary” salting;
 - post-treatment - continuing salting following the formation of ice;
 - clearance of ice and snow; and
 - dealing with continuous severe conditions.

Treatment Routes

- B.7.5.35. Authorities should define treatment route plans for carriageways, cycle routes and footways for pre-treatment and snow conditions, based upon the general maintenance hierarchy, but adapted to take into account the factors identified by this Code.
- B.7.5.36. The treatment routes for Winter Service should take as a starting point the hierarchy developed for other maintenance purposes but this is likely to require extensive modification to consider:
- wider transport and other policy priorities referred to above;
 - the Resilient Network;
 - special requirements of carriageways, footways and cycle routes;
 - safe and reliable access to emergency facilities including Fire and Rescue, Police, Ambulance Services and hospitals;

- other public services access needs and critical infrastructure where the maintenance of access may be critical;
 - public transport routes and access to stations, bus garages and depots;
 - safe and reliable access to main industrial and business centres of key importance to the local and regional economy;
 - any significant variation between summer and winter traffic;
 - accessibility dependencies of remote communities for example Scotland's island and peninsular communities;
 - the special needs of disabled people or older people particularly where these can be effectively targeted;
 - known problems, including significant gradients, exposed areas and other topological factors;
 - climatic and thermal capacity differences within the area; and
 - co-ordination and co-operation with other authorities.
- B.7.5.37. Consideration of these issues is likely to suggest differences in networks adopted for each element of Winter Service. Such decisions will usually not be clear cut. For example treatment of footways will differ from carriageways and for low traffic roads it may be difficult to justify high priority for service provision.
- B.7.5.38. Risk assessments should be undertaken to establish which routes should be included in a programme of treatment during winter. In particular, the treatment of carriageways, footways and cycle routes must be considered taking account of risk to all highway users and consideration of the available resources.
- B.7.5.39. Where the authority is actively promoting facilities, or there are clear trends of increasing use, a more proactive approach to Winter Service may send an important message.
- B.7.5.40. Transport interchanges perform a key role in the delivery of integrated transport, which should be reflected in Winter Service policies and priorities. These include airports, rail and bus stations and the means of access to them whether by main routes for walking, cycling, public transport or car. Parts of the interchange may be subject to differing management regimes and it will be important to agree common levels of service and ensure effective co-ordination of resources.
- B.7.5.41. It should be recognised that many authorities will have difficulty treating all bus routes as part of their precautionary salting routes. The treatment of bus routes should be based on risk assessment of local circumstances such as service frequency and their importance to integrated transport services. It is important that treatment routes include the access roads to bus garages.
- B.7.5.42. Similar considerations apply to school bus routes where, although authorities should endeavour to provide Winter Service support, there may be practical difficulties in wide spread treatment of such a diverse network.

- B.7.5.43. Network Rail recommends that salting should not be undertaken between the stop lines of level crossings, even when covered with snow. Before ploughing over a level crossing the driver must stop and telephone the signalman for permission to proceed and then inform the signalman when past the crossing. Snow blowers must not be used on level crossings.
- B.7.5.44. Consideration should be given in certain circumstances for the temporary erection of snow fencing to reduce the effect of drifting snow. The legal powers to provide snow fences in England and Wales are contained in Section 102 of the Highways Act 1980. Where no agreement can be reached with the landowner, Sections 239, 240 and 250 of the Act provide for compulsory powers. The power to provide snow fences in Scotland is in Section 30 of the Roads (Scotland) Act 1984. There is no equivalent of these specific powers in Northern Ireland but Article 100 of the Roads Order, which deals with the acquisition of land, could be used in these circumstances.
- B.7.5.45. In periods of especially severe weather in certain parts of the UK, temporary road closures may be necessary. Where roads are known to be particularly vulnerable consideration should be given to the installation of permanent flap down or variable message signs. These signs should be located well in advance of any anticipated obstruction and should be operated in conjunction with the Police. In determining the optimum location consideration should be given to the availability of alternative routes and, if necessary, holding areas. With manually operated signs, and in more remote areas, it is essential that the signs are easily accessible and can be quickly operated by authority or police to give timely information. Consideration should be given to the merits of remotely controlled matrix signing.

Contingency Planning

- B.7.5.46. Winter Service procedures should be designed to provide a planned response during even exceptionally severe weather. Through careful planning it is possible to reduce the need for reactive response. It is important to ensure that the Winter Service Plan contains details of the escalation procedures, alternative resources and minimum winter (resilience) networks.
- B.7.5.47. The delivery of a more resilient Winter Service should enable local communities, business, public transport and emergency services to function in more severe conditions prior to the need to implement contingency arrangements. Effective contingency planning is therefore a key element of delivering a more resilient service.
- B.7.5.48. Authorities should prepare contingency Winter Service Plans for severe weather conditions which include possibilities such as salting a Minimum Winter Network. Authorities should seek agreement on plans in advance with other Highway Authorities and key public services such as hospitals and public transport providers. There should be a co-ordinated approach to implementing Minimum Winter Networks across adjacent Highway Authorities.
- B.7.5.49. When weather is sufficiently severe, a contingency plan should be activated. The success of this plan is dependent on advance planning and co-ordination, including treatment routes, resource needs, mutual aid and communications.

- B.7.5.50. With improved resilience of Winter Service, the normal response is likely to cope with more severe conditions before the need for escalation. Once escalated, the response will then be likely to mitigate the effects of more extreme conditions. Providing winter decision makers with well-designed contingency arrangements allows them to escalate an issue before it becomes a significant threat to continuity of service and to have the tools available to best manage the situation.
- B.7.5.51. When resilience measures and processes have been developed and incorporated into the Winter Service Plan, relevant staff and stakeholders will need to be trained. Resilience planning should be tested through exercises. This will resolve any potential problems in the approach prior to it being used operationally.
- B.7.5.52. Local authorities, as Category 1 responders under the Civil Contingencies Act 2004, will already have emergency plans in place. Authorities should benefit from these plans in developing a more resilient approach to Winter Service. Business continuity planning with respect of severe conditions is also important to ensure that Winter Service can be delivered and other critical functions can be adequately supported.
- B.7.5.53. Resources such as salt, fuel, spreaders, depots and labour are finite. Plans therefore need to demonstrate how the service will be delivered if one or more of these resources is in short supply. Shortages of fuel, spreaders or operators may not coincide with severe weather.
- B.7.5.54. Where practicable, authorities should make arrangements for obtaining reserve supplies of key resources to support their minimum level of resilience. This should include salt, fuel, power and labour.
- B.7.5.55. Mutual aid is a pre-agreement between one or more organisations to assist each other, as far as practicable, to overcome disruptive challenges. Mutual aid between authorities is often used in the response to “wide” area emergencies, as the impact on the local authorities, emergency services and other resources can be overwhelmed. Sharing, e.g. depots and salt stocks, through mutual aid may be helpful. Where planning to do so authorities should make contingency arrangements in advance.
- B.7.5.56. Mutual aid can be an informal or formal process having written agreements. Arrangements are usually between organisations that work closely together on a regular basis or as part of local resilience forums. Both approaches work well if they are flexible enough to change in response to the dynamics of a situation. [Guidance on mutual aid](#) is available online.
- B.7.5.57. Authorities should explore the potential for mutual aid in salt supply and other aspects of Winter Service and should make contingency arrangements in advance.
- B.7.5.58. During a salt shortage there may be various potential mechanisms to reduce salt consumption bearing in mind the issues discussed in the NWSRG Practical Guide. Each has its own implications which the authority must carefully consider prior to implementation.

- B.7.5.59. During a severe weather event increased levels of communication are likely to be required. Communication during a 'crisis' is not simply about media output. Proactive internal communication and keeping the numerous stakeholders informed is also critical. It is important to ensure that good communication is achieved both with internal staff and external stakeholders. Media liaison is a relatively straightforward task once suitable contacts are made. The use of authority websites is a good way to get accurate information to the public without reliance on the media.

B.7.6. WINTER SERVICE DELIVERY

Decisions and Management Information

- B.7.6.1. Authorities should take full advantage of decision support systems and services to enable timely, efficient and accurate decision making.
- B.7.6.2. The decision support information will be used by the authority's designated Winter Service controller, or similar, together with local experience, and against the background of a range of pre-determined scenarios, in deciding the action to be taken. The decision should usually be delegated to a single person, although in larger authorities with varying climatic conditions the role may be delegated to two or more persons. Controllers will of course need to maintain close consultation with others both within and adjoining the authority and also those dealing with the strategic network.
- B.7.6.3. Information to aid decision making is included in the NWSRG Practical Guide.
- B.7.6.4. The quality of decisions made by the controller will be the key factor in determining both the effectiveness of the Winter Service and also how it is perceived by users and the community. Instigating a decision check process ensures high quality decisions are acted upon and is good practice.

Information Recording and Monitoring

- B.7.6.5. Authorities should continually monitor performance during service delivery and respond effectively to changing conditions or network incidents.
- B.7.6.6. Comprehensive and accurate records should be kept of the all Winter Service activity, including timing and nature of all decisions, the information on which they were based, and the nature and timing of all treatment. Note that time taken running dead mileage at end of salting run is not included in treatment time. It is preferable to record both the time at the end of actual salting and the time of return to depot. Where the dead mileage at the end of a salting run is significant this should be considered when planning for severe conditions as it will prevent rapid redeployment of resource.
- B.7.6.7. Authorities should make use, wherever possible, of electronic vehicle location systems together with automatic recording of salt spreading. This will simplify and improve the accuracy of records as well as provide corroboration of service delivery in cases where failure to salt is alleged.
- B.7.6.8. The condition of routes should be monitored following treatment in order to confirm that the treatment has been effective. If it has not been fully effective, contingency treatments should be considered to achieve the required condition.

Resources

- B.7.6.9. Winter Service requires numerous staff, a significant amount of plant and large volumes of consumables such as salt for de-icing and fuel. It is important that supplies and suppliers are planned and managed to ensure these resources are available when required. Sufficient trained and experienced staff are required for the delivery of an effective Winter Service. This includes winter managers, decision makers, supervisors, spreader drivers and other equipment operators.
- B.7.6.10. Authorities provide Winter Service through combinations of their own resources and those of service providers contracted to them. There is a wide variety of approaches. Many Highway Authorities provide some of their own facilities with others provided by the private sector. In all cases, service providers' activities are governed by their contract with the Highway Authority.
- B.7.6.11. In some authorities refuse collection, street cleansing and grounds maintenance services often provide support to the Winter Service, especially in times of prolonged ice and snow. Arrangements should be made and documented well before the commencement of the season.
- B.7.6.12. Detailed route planning and for each aspect of Winter Service will need to be optimised to ensure economic, efficient and effective resource allocation. This will depend on:
- spreading vehicle characteristics and capacity;
 - depot and salt location;
 - response times (the period between decisions being taken to begin treatment and vehicles leaving the depot. It is suggested that authorities should adopt a target response time of no more than one hour. This should apply both within and outside normal working hours);
 - treatment times (the period between vehicles leaving the depot and the completion of treatment on all priority routes. Authorities should adopt target treatment times based on risk assessment of local circumstances that provide for the completion of pre-treatment before ice forming. They should however recognise however that treatment times might vary in different weather conditions); and
 - turnaround times (the period between a vehicle completing salting on its route and being ready to recommence salting having reloaded at the depot)
- B.7.6.13. A key factor in ensuring that response and treatment times are met once a decision has been taken to treat is the availability of appropriately trained personnel. Identifying the extent of resources needed under various scenarios and the potential source of these will be an important aspect of pre-season planning. This planning should cover the whole range of requirements and conditions likely to be encountered, including:
- pre-season preparation;
 - precautionary treatment;
 - footway and cycle route treatment;

- post treatment;
 - snow clearance;
 - continuous severe conditions; and
 - post snow emergencies (flooding etc).
- B.7.6.14. Planning of resources should cover the entire workforce involved in the Winter Service. It is particularly important not to overlook:
- the need for staff to be available throughout defined risk periods;
 - the need for the treatment operations to be co-ordinated and supervised;
 - resources and equipment for treating carriageways, footways and cycle routes;
 - resources for dealing with vehicle breakdowns, problems with fuel supply and communications failure; and
 - resources for the storage, delivery and loading of salt.
- B.7.6.15. In planning resources, the following issues regarding personnel also need to be addressed:
- implications of Drivers' Hours Regulations;
 - extent and nature of double manning and driver support;
 - shift system arrangements; and
 - provision for holidays and sickness.
- B.7.6.16. It is important that a realistic assessment of the resources required has been made to ensure the continued treatment of the Minimum Winter Network during exceptional conditions. Authorities in planning their resources should ensure that they are compatible with the wider level of resilience adopted by the authority.
- B.7.6.17. Authorities often place reliance in times of prolonged ice and snow on temporary contracts with contractors, farmers and others to supplement resources for snow clearing. Arrangements should be documented and the necessary insurance cover should be put in place.
- B.7.6.18. In rural areas, authorities should examine the potential for using local council snow wardens, who may have an effective role in gathering information and providing Winter Service Managers with details of specific local problems. If snow warden schemes are adopted clear terms of reference should be established.

Training and Development

- B.7.6.19. Delivery of a successful Winter Service is dependent on the individual decisions made and actions taken by all those involved. These actions and individual decisions must be supported by adequate training of the staff and operatives involved.
- B.7.6.20. To ensure appropriate level of competence, the training and development needs of all personnel should be established and reviewed annually, including health and safety and appropriate vocational qualifications. Training should then be provided where appropriate before the Winter Service season.
- B.7.6.21. Issues where training is required are described below. This is not an exhaustive list and will largely be based on local circumstances:
- the content and operation of the Winter Service Plan;
 - route familiarisation (as appropriate);
 - driving in difficult and hazardous road conditions including duty of care to other road users;
 - circumstances where special safety considerations apply;
 - snow ploughing, in particular around rail level crossings, tramways, partially segregated areas,
 - dealing with emergencies; and
 - dealing with post ice and snow emergencies especially flooding.
- B.7.6.22. In addition to such specific training it will be necessary to ensure that all personnel are provided with information during operational periods on current network characteristics and constraints, including:
- traffic management in place; and
 - network unavailability.
- B.7.6.23. Authorities should prepare specific health and safety policies, guidance, and risk assessments with their service provider. These should be issued and discussed with all personnel, including temporary contractors, and should form the basis of further training as necessary.
- B.7.6.24. Training provided to service delivery personnel should also include specific reference to the health and safety needs of users, including:
- avoidance of spraying pedestrians, cyclists and vehicles where practicable with salt or slush when salting or ploughing;
 - avoidance of risks to pedestrians and cyclists when using vehicles in segregated or partially segregated areas and in treating footways;
 - ploughing and manoeuvring in restricted circumstances; and

- other road vehicles that may not be under proper control.

- B.7.6.25. Authorities should consider qualifications and practical experience training. Examples of currently available training courses include the IHE Professional Certificate in Winter Highway Maintenance and various City & Guilds and CITB courses, as well as courses provided by independent training organisations and providers of equipment and services. Many authorities have found it useful for those personnel involved in Winter Service management and decision making to undertake training in familiarisation and interpretation of weather forecast information.
- B.7.6.26. Authorities are encouraged to have a system to plan and record all Winter Service related training. This may form part of a wider training management system. This system can then be checked prior to winter to ensure any necessary refresher training is undertaken.
- B.7.6.27. There are several groups of individuals that comprise an authority's resources to deliver the Winter Service. These individuals require training to fulfil their duties within an authority's Winter Service. These are listed below:

Winter Decision Maker and Manager

- B.7.6.28. The appropriate experience required to deliver the service can only be gained through involvement in decision making and service delivery, over a number of years, initially under supervision. Good practice requires that novice decision makers should undergo briefings on the Winter Service Plan, meteorological training, experience of operational delivery and mentoring by more experienced staff. This should continue until their experience and competence is proven. It is essential that such training is validated by appropriate testing and well documented to ensure that competence can be demonstrated. Weather forecast providers are able to provide training on meteorology and providers of road weather sensors provide training relating to the use of their equipment, as well as on some wider issues relating to the weather and road surface condition. Exercises can provide decision makers with experience of the management of severe conditions.

Drivers and Operators

- B.7.6.29. Any operative involved in the use or operation of any plant or machinery should receive relevant formal training to do so. Where reserve drivers are available as part of an authority's contingency plans it is essential that they are trained to an equal level of competence.

Winter Supervisors

- B.7.6.30. The first tier of management should be aware of their duties and sufficiently competent to fulfil them. City & Guilds 6159 includes a specific module for winter maintenance supervisors.

Senior Management and other Key Stakeholders

- B.7.6.31. Authorities may benefit in providing basic training to senior management and certain key stakeholders in delivery of Winter Service. This can be valuable in managing the expectations in delivering the service during both normal and severe winter conditions.

Training Plan and Records

- B.7.6.32. Authorities are encouraged to ensure they have a system of formal training records. The purpose of the system is to record and monitor the training and competence of each individual involved in Winter Service. The system should use the data within it to help identify those people whose training requires refreshing and renewing. Where authorities contract out Winter Service they should require their suppliers to maintain similar records.
- B.7.6.33. The system should comprise a development action plan for each individual and record progress in meeting that plan. This will enable training sessions to be targeted, planned and executed in a cost efficient manner.
- B.7.6.34. Before commencement of the winter season training records should be checked to identify whether out of season training has occurred and individual training records have been updated. Additionally any mentoring schemes or similar experience-based learning should also be consulted to avoid any issues later in the season.

Route and Equipment Familiarisation

- B.7.6.35. Relevant staff and operatives should undertake familiarisation training with winter arrangements, treatment routes and equipment. This is especially important for operational staff that may be new to the authority's Winter Service. Tool box talks and dry runs of treatment routes are useful approaches to deliver this training. Records of this training should be recorded on the training management system as described above.

Exercising

- B.7.6.36. Planning and preparing for the winter season are essential activities, but often the measures implemented are only tested in a live situation. Exercising and testing aims to confirm that the plans and procedures are suitably robust to cope with conditions in a safe and non-consequence environment. Authorities and relevant organisations should provide training and conduct periodic exercising to test plans for responding to severe weather events.
- B.7.6.37. Authorities and relevant organisations should provide training and conduct periodic exercising to test plans for responding to severe weather events.
- B.7.6.38. The Civil Contingencies Act 2004 requires Category 1 responders to exercise their plans to validate and test them. Although winter planning does not necessarily fall into the plans that must be exercised it is clear from recent winter events that severe snowfall will result in the invoking of various other emergency plans via local and regional resilience fora.
- B.7.6.39. It would be beneficial for authorities to build severe weather conditions into regional or local training exercises or to develop specific Winter Service exercises involving adjacent authorities and relevant partners. Such testing of plans and personnel associated with the Winter Service would ensure authorities are fully prepared. It would also assist with ensuring that resilience of Winter Service is addressed and communication networks developed and improved. The NWSRG Practical Guide contains further guidance regarding the design and delivery of winter exercises.

Plant and Vehicles

- B.7.6.40. A range of vehicles, plant and equipment is used to deliver Winter Service, which should be well maintained, calibrated and reliable. This Code does not deal in detail with the equipment used for Winter Service, but refers to certain more strategic issues relating to procurement and sustainability.
- B.7.6.41. In assessing the required plant and vehicles authorities should ensure that sufficient resources are available for the delivery of the Winter Service during severe and prolonged ice and snow. This should be compatible with the level of resilience adopted by the authority.
- B.7.6.42. It is unlikely that, with the level of investment involved, authorities will be able to make frequent changes to the fleet, other than replacement or renewal. It is important however, that opportunities are taken when overall service procurement changes are being contemplated to thoroughly review Winter Service and equipment procurement.
- B.7.6.43. There have been significant advances in the equipment available on the market in recent years. Vehicles are now capable of delivering a range of treatment types and can have sophisticated technology. The procurement of such technology potentially allows a more targeted and effective approach to treatment of the road network and an improved audit trail of where treatments have been undertaken.
- B.7.6.44. It is often extremely difficult and inefficient to remove significant depths of snow using only salt and therefore consideration should be given to the use of snow ploughs mounted on spreaders or other suitable vehicles. Snow ploughs are durable, require little maintenance and should therefore prove very cost effective. However, in urban areas there may be considerable difficulties in utilising snow ploughs, for instance where traffic calming schemes have been implemented, and in this situation any consideration should be on a risk based approach.
- B.7.6.45. It is also important to consider equipment requirements for dealing with footways and cycle routes. Specialist equipment, such as footway ploughs and footway salt spreaders, may be necessary for this purpose.
- B.7.6.46. The location of depots should be kept under review and specifically addressed when consideration is being given to procurement arrangements. It would be unlikely if all present depots from which authorities undertake Winter Services are ideally located, and significant financial and operational savings can often be achieved from re-location.
- B.7.6.47. The environmental effects of highway maintenance depots and operations are dealt with in Section A.9 of this Code, and these can be particularly significant in the case of the Winter Service, where operations will inevitably involve unusual hours of working. Every effort should be made to minimise the environmental intrusion of depots and so far as is practicable the effect of Winter Service operations.
- B.7.6.48. A significant contribution to minimising environmental effects can be made by providing covered storage for all vehicles, equipment and materials, which can also reduce waste and maintenance problems.

- B.7.6.49. Purchase and ownership of vehicles and equipment will also be a key issue for consideration in relation to the procurement of services. Private sector partners may be able to assist with financing arrangements and authorities will need to balance the financial advantages of this against the contractual and operational risks involved.
- B.7.6.50. The need to ensure vehicles are correctly calibrated, well maintained and repaired quickly is essential to the delivery of the service. Whatever arrangements are used the response time, speed of repair, availability of spare parts, quality of repair and audit trail should be carefully established and documented.

Precautionary treatments

- B.7.6.51. These are the application of de-icers to road surfaces before the onset of freezing conditions (i.e. frost, snow or freezing rain). The purpose of precautionary treatments is to prevent the formation of ice, or to weaken or prevent the bond of freezing rain or snow to road surfaces.
- B.7.6.52. It is usually impractical to spread sufficient salt to melt freezing rain or more than a few millimetres of snow. Therefore, in advance of forecast snow or freezing rain, salt is spread to provide a debonding layer so that:
- snow is more readily removed by ploughing; and
 - compacted snow and ice are more easily dispersed by traffic.
- B.7.6.53. It is very difficult to remove a layer of compacted snow or ice that is bonded to the road surface, so precautionary treatments are essential before heavy snowfall.

Salt and De-icing Materials

- B.7.6.54. Rock salt is the prime material for dealing with ice and snow on roads but can have environmental consequences. It can adversely affect vegetation, pollute watercourses and leave a residue on footways. It can also damage the road structure, bridges and structures, utility apparatus and vehicles. However, used responsibly it can have minimal environmental impact. In the interests of sustainability therefore authorities should ensure that only the minimum of salt is used to deal with the prevailing conditions. Suggested rates of spread are given in the NWSRG Practical Guide.
- B.7.6.55. The NWSRG Practical Guide lists a number of alternative materials that authorities could consider using in place of rock salt in particular circumstances. The costs of some of these are extremely high and particular materials also have some environmental consequences. They may prove, however, to be cost effective in specific locations, such as the treatment of footways, where the need for additional sweeping can be avoided, and bridges, where the damage caused by the use of salt can be avoided.
- B.7.6.56. As rock salt requires the passage of traffic to improve effectiveness, it may be necessary to use brine in some cases for example some cycle routes.
- B.7.6.57. Care should be taken in Winter Service operations, particularly in salting footways, to avoid excessive amounts of salt being washed or swept into tree pits or piled around trees.

Salt management

- B.7.6.58. Salt is a finite resource and UK suppliers are constrained by mining operations amongst other factors as to how much may be produced and supplied. Supply can therefore be outstripped by demand during severe weather. It is therefore important to make optimum use of salt for de-icing and make every effort to store and use it efficiently, regardless of the weather conditions, in order to minimise consumption. In addition there can be significant financial benefits to be gained adopting such an approach.
- B.7.6.59. Salt is consumed in significant quantities during the winter season, so even small percentage savings in salt use through accurate calibration of spreaders, considered decision making and appropriate treatments is important. These measures will help to minimise the overall consumption of salt on a national basis. The NWSRG Practical Guide contains further information regarding spreader calibration. Ultimately, authorities should consider ways of reducing overall salt consumption while maintaining agreed levels of service on their network. Considerable savings can be made in the amount of salt used to treat carriageways if the salt is maintained in good condition and spreaders are correctly calibrated.
- B.7.6.60. Many authorities award salt supply contracts to a single supplier on a call-off basis. Contracts are often awarded on a balance of quality and price, with price usually being the driving consideration. This approach has resulted in a price driven market where salt supply is often treated as a commodity purchase. Authorities carry the risk of being able to obtain the salt they require when they require it. Suppliers carry the risks involved in producing and stock piling salt before sale. Commodity purchase arrangements do not necessarily embrace the service relationships between authorities and their salt suppliers which should lead to improved reliability, and knowledge and anticipation through good communications, and which are facilitated by contemporary procurement arrangements.
- B.7.6.61. Authorities and salt suppliers should treat the supply of salt as a service rather than a simple commodity purchase.
- B.7.6.62. Authorities should place orders for summer restocking, and make arrangements for in-season restocking. It may be beneficial to consider the option of changing de-icing material to minimise consumption and improve resilience.
- B.7.6.63. It has become common to restock at intervals during the winter season using salt management systems based upon predicted use of salt and delivery times. The salt shortage in winter 2008/09 demonstrated that it is difficult for salt supply arrangements to accommodate significantly increased short term demand. Authorities should therefore ensure sufficient resilience in their salt stocks.
- B.7.6.64. Authorities should develop close working relationships with salt suppliers and ensure that initial salt quantities and reorder triggers are set to achieve their local level of resilience.
- B.7.6.65. It may not be easy for some authorities to achieve an appropriate level of resilience through storing salt at their own depots. Salt suppliers may be able to hold dedicated stock at locations around the UK and authorities should consider whether such an approach is possible.

- B.7.6.66. Communications and relationships with salt suppliers may be improved by the development of supplier user groups and authorities should consider participation in such groups.
- B.7.6.67. The salt shortages in winter 2008/09, 2009/10 and 2010/11 prompted various local, regional and national salt stockpiling arrangements. This has significantly increased salt stockholding nationally and therefore added resilience. However it is important that Authorities do not routinely rely upon these stockpiles as they are intended only for use during sustained severe winter weather. The Department for Transport Salt Portal plays a key role in managing reserve stocks as it allows early visibility of potential salt supply issues and also enables continual assessment of current stockholding across England.

Salt storage

- B.7.6.68. Moisture content can have a significant impact on spreader calibration with over or under spreading possible. Authorities may therefore achieve more consistent spreading of salt through maintaining a constant moisture content in the salt throughout the entire season. The NWSRG Practical Guide contains further details regarding the moisture content of salt.
- B.7.6.69. As part of pre-season preparation, authorities should review how their salt is stored in order to identify how greater efficiency may be attained in its use. This may include developing the business case for salt barns or covering open storage facilities. Moisture content of salt is a critical factor in determining spreading rates and distribution.
- B.7.6.70. The correct storage of salt is essential to minimise environment damage and storage in salt barns helps to prevent leaching, eases handling, helps in maintaining low salt moisture content, and is of particular value where additives are used. Detailed advice is available on alternative types and construction methods available. Where open stockpiles are used these should be covered with sheeting, which can provide an effective alternative. Some authorities spray their open stockpiles with bituminous emulsion in order to reduce the effects of the weather.
- B.7.6.71. Both permanent and temporary salt storage areas should be sited and managed in accordance with requirements of the Local Planning Authority and the Environment Agency. In particular they should not be sited where they could cause damage to landscape or nature conservation or have the potential to pollute watercourses or groundwater. Authorities should be aware of the deterioration in the quality of salt stored for long periods and the need for effective stock rotation. The NWSRG Practical Guide contains further details regarding salt storage options.
- B.7.6.72. Where grit is used for treatment, for example in the more extreme conditions applying in Scotland, storage requirements may be less stringent and local advice should be sought.
- B.7.6.73. As a means of enhancing local salt storage capacity, authorities and salt suppliers may wish to jointly consider supplier owned salt stocks held on a short or long term basis in a number of widely distributed locations around the country. A joint approach may include agreements such as purchase of some or all stock by the end of a season or provision of land.

Reserve Stockpiles

- B.7.6.74. In addition to operational stock, local authorities and strategic road operators have created reserve stockpiles. These stockpiles can be categorised into three different types:
- local reserves – held by a single authority for its own use during times of limited operational salt stocks;
 - regional reserves – held on a regional / consortium basis whereby reserve stocks have been made available for use by more than one authority; and
 - national reserves – stockpiles held across the UK for use by any authority during times of shortage. In England this is currently being delivered via Highways England and is likely to have certain conditions of use. Transport Scotland and Transport for London have their own arrangements.
- B.7.6.75. These stockpiles are not used during normal Winter Service but will be available if salt suppliers are unable to maintain operational stocks at an acceptable level. Release of salt should be subject to agreed protocols with the relevant operators. Authorities should put these arrangements in place before the start of the winter season.
- B.7.6.76. Identifying the size, location and storage type of these stockpiles is important. Salt is a bulk commodity, but a reserve stockpile is still a significant investment. It should be stored in a location to allow convenient access to the area it serves and of course remain accessible during times of severe weather. The site should be secure to avoid trespass and theft of salt. Provision should be made in planning for loading facilities although there is unlikely to be a need for permanent on site plant.
- B.7.6.77. Reserve stocks are unlikely to be barn stored. However, they should be well covered to prevent leaching and deterioration of the salt. To avoid any gaps in planning any jointly held reserve stocks should have a salt stock management plan specific to that stockholding.

Salt Procurement

- B.7.6.78. Authorities should seek a broad approach to salt supply, for example establishing framework contracts with more than one supplier.
- B.7.6.79. Ideally, the suppliers should be geographically separated to reduce the risk of them being impacted by the same high demand situation.
- B.7.6.80. Authorities should consider whether efficiency benefits can be obtained from collaborative salt procurement and should also consider ways to improve the balance of risk between salt suppliers and themselves, e.g. longer contracts, performance contracts with minimum guaranteed purchase and supply, and contracts that include supply of salt and investment in facilities.

Post Snow Inspection and Maintenance

- B.7.6.81. Immediately following the completion of snow clearance operations priority should be given to the clearance of gullies and offlets to ensure that melt water from snow on verges and island or central reservations can quickly drain away. However, it may be especially difficult to prevent melt water which is running across the carriageway from freezing and several applications of salt may be necessary.
- B.7.6.82. It is recognised that following severe weather a degree of flexibility may be required to enable Highway Authorities to re-establish inspection regimes. It will also be necessary to inspect the network to ensure that any damage is dealt with either as an urgent defect or as programmed maintenance as appropriate. The inspection should be treated as a special safety inspection and deal with the items usually included. Special attention should be given to the routes treated and the following items:
- removal of accumulations of grit from carriageways, footways, cycle routes and drainage channels;
 - inspection and clearance of all bridges, culverts and drainage systems liable to flooding;
 - inspection for frost effects and any damage caused by Winter Service equipment;
 - check and replenish salt stocks in depots and grit bins; and
 - inspect, clean, lubricate, check and repair all vehicles and plant.
- B.7.6.83. In addition, it will be important to debrief all personnel involved to ensure that their experience and observations are recorded. These should be used to inform the Annual Service Review and contribute to the process of continuous improvement. It will also be useful in a less formal way for authorities to invite observations from snow wardens and others that may have also contributed to the operations.

B.7.7. REVIEW

- B.7.7.1. All aspects of the Winter Service Plan, including service delivery arrangements, should be reviewed annually in consultation with key stakeholders to take account of changing circumstances.
- B.7.7.2. All vehicles, plant, fuel provision, equipment and maintenance arrangements should be checked annually and in accordance with manufacturers' requirements to ensure that any necessary action can be taken to ensure full operational service status prior to the Winter Service season. This should include checking the calibration of all de-icing equipment and spreaders.
- B.7.7.3. Authorities should review the administrative and management arrangements for Winter Service annually. This should include the role of the private sector in delivering highway services, and the use of support services such as refuse collection, street cleansing and grounds maintenance services.

- B.7.7.4. As part of the Annual Review authorities should consult with bus operators regarding changes to routes. In doing so and where practicable bus operators should be encouraged not to change routes throughout the winter season where there would be an effect on treatment routes.
- B.7.7.5. The Annual Review should include an analysis on whether service delivery meets the Winter Service policy and plan. It should also include a review of the current thinking with regards to the impact of climate change. Service efficiency improvements such as route optimisation should also be considered.
- B.7.7.6. Following any significant winter weather event, a formal review involving representatives from all levels of the management and delivery of Winter Service should be carried out. The review should specifically identify the successful elements of the service as well as potential improvements and actions to be taken. Where applicable, other stakeholders should be involved. The review process should be documented to ensure all learning is captured, considered and actioned. This should feed into the Annual Review.

WELL-MANAGED HIGHWAY INFRASTRUCTURE

PART C. STRUCTURES

SECTION C.1.

INTRODUCTION TO PART C – STRUCTURES

C.1.1. INTRODUCTION

C.1.1.1. Part C of Well-managed Highway Infrastructures has been drawn up specifically for highway structures associated with the adopted road network which meet the dimensional criteria defined in Section C.1.1.4. In addition, the general principles apply to structures associated with all other highways that are used by the public, e.g. segregated footpaths and cycle routes, and the Public Right of Way network. The types of highway structure covered by the Code are those within the boundaries of the highway or which otherwise materially affect it and include:

- bridges including footbridges, cycle route bridges, bridleway bridges, accommodation bridges, occupation bridges, subways, underpasses and culverts;
- retaining walls;
- sign/signal gantries;
- cantilever road signs; and
- tunnels.

C.1.1.2. The overarching principles and common themes of maintaining highway infrastructure are covered within Part A. Asset specific guidance for highways and lighting are covered in Part B and Part D respectively.

C.1.1.3. The term ‘highway structures’ is used throughout the Code to refer collectively to all of the above structure types.

C.1.1.4. The following definitions are aligned with the [Code of Practice on the Highways Network Asset](#) definitions. Authorities may include similar structures outside the dimensions listed for the purposes of management of highway structures at an operational level.

- bridge – a structure with a span of 1.5m or more spanning and providing passage over an obstacle, e.g. watercourse, railway, road, valley. This category also covers subways, footbridges and underpasses;
- cantilever road sign – a structure with a single support that projects over the highway in order to carry a traffic sign;
- cellar or vault – an underground room or chamber with a maximum plan dimension of 1.5m or more;
- culvert – a drainage structure with a span of 1.5m or more passing beneath a highway embankment that has a proportion of the embankment, rather than a

bridge deck, between its uppermost point and the road running courses.
Culverts are normally rectangular or circular in cross section;

- retaining wall – a wall associated with the highway where the dominant function is to act as a retaining structure, and with a minimum retained height of 1.35m;
- road tunnel – a tunnel with an enclosed length of 150 metres or more through which a road passes; and
- sign/signal gantry – a structure spanning the highway, the primary function of which is to support traffic signs and signalling equipment.

C.1.1.5. Bridge Managers should be aware that BD 2 (Technical Approval of Highway Structures) applies to all highway structures with a clear span or internal diameter greater than 0.9m, and to retaining walls of height greater than 1.5m.

C.1.2. THE ROLE OF HIGHWAY STRUCTURES

C.1.2.1. Bridges and other highway structures are fundamental to the transport infrastructure because they form essential links in the highway network. It is not therefore in the public interest to allow highway structures to deteriorate in a way that compromises the functionality of the highway network, be it through restrictions or closures caused by unsafe structures or the disruption of traffic through poor planning of maintenance work.

C.1.2.2. Highway structures represent a significant national investment, with most being publicly owned and many being prominent features in the local environment. In the UK the management of highway structures is undertaken by a variety of owners/agencies. In the Code they are collectively referred to as 'owner' or 'authority' as appropriate.

SECTION C.2.

LEGAL FRAMEWORK – STRUCTURES

C.2.1. INTRODUCTION

- C.2.1.1. General duties and powers are dealt with in Part A of this Code. This section contains information on duties and powers specifically related to highway structures.
- C.2.1.2. There is a statutory obligation on Highway Authorities to maintain the public highway, Highways Act 1980, or equivalent.
- C.2.1.3. Where “failure” of a structure is described below, it refers to an inability to meet either or both of the functions outlined in C.1.2.
- C.2.1.4. Most highway structures are readily accessible by the public. Numerous instances have occurred where specific structures have a high incident rate for suicides. Bridge owners should consider these occurrences in any management planning for the associated structures and thus give due consideration to restricting access to the means of suicide at certain high risk bridge sites. A [Personal Safety Incidents at Bridges](#) briefing sheet has been produced, however this is a developing area and latest good practice should also be reviewed.
- C.2.1.5. In Wales, reducing access to the means of suicide is one of the objectives of [Talk to Me 2 – Suicide and Self Harm Prevention Action Plan for Wales 2015-2020](#). The Welsh Government is promoting a multi-stakeholder approach involving Public Health Wales, asset owners, Samaritans and other health specialists to tackle this issue.

C.2.2. STRUCTURES SPECIFIC LEGAL AND PROCEDURAL REQUIREMENTS

- C.2.2.1. The Highways Act 1980 sets out the main duties of Highway Authorities in England and Wales. In particular, Section 41 imposes a duty to maintain highways that are maintainable at public expense. Where a highway passes over a bridge, Section 328(2) vests the bridge as part of the highway and the normal duty to maintain under Section 41 of the 1980 Act applies under these circumstances. However this does not preclude bridges under highways being in private ownership and rightly the responsibility of the private owner. Issues regarding retaining walls are covered below.

Bridges

- C.2.2.2. The majority of bridges are maintainable at public expense unless they were built under an Act of Parliament for the construction of the canal and railway networks or built by private owners under the authority of a Royal Charter or an Act of Parliament in consideration for being allowed to charge tolls. Where a bridge carries a road, but is not maintainable by the Highway Authority (e.g. Network Rail), it is important for the Highway Authority to have an agreement with the owner of the bridge to clarify the demarcation of maintenance responsibilities.
- C.2.2.3. Other possible exceptions are bridges built by private land owners as a means of access over or under the highway. These are often covered by agreements with the Highway Authority. Section 176 of the Highways Act covers licences for bridges over the highway, whilst bridges under the highway are generally covered by agreements under the general provisions of the Highways Act and Section 111 of the Local Government Act 1972.
- C.2.2.4. Section 7 of the Trunk Roads Act 1946 and later Section 55 of the Highways Act 1980 led to the adoption by the strategic Highway Authority of all private bridges when a road was trunked. These bridges have generally been passed to the Local Highway Authority if the road was subsequently de-trunked in accordance with Section 2 of the Highways Act 1980.
- C.2.2.5. Between 1989 and 1999 as the result of a European Directive, authorities were charged by Central Government with assessing the strength of bridges carrying the adopted road network and, where appropriate, with strengthening to ensure adequacy for the introduction of the 40 tonne European Standard to roads in the UK on 1 January 1999.
- C.2.2.6. The British Railways Board, the London Board, and the British Waterways Board, now the Canal & River Trust (or their successors in title) are referred to as “the Boards” throughout the following section.
- C.2.2.7. In the case of bridges owned by the Boards and their successors, an initial assessment was required to the new code BD21 The Assessment of Highway Bridges and Structures and its successive developments and, in the event of the assessment indicating inadequate strength, a further assessment generally to BE4, to determine whether or not the owner’s load bearing obligation for the structure was met. A programme of strengthening was implemented to deal with any shortfalls of strength with cost sharing determined on the degree of shortfall, the form of strengthening and the desired loading requirements for the route. Schemes are progressed under national templates for works agreements prepared by the Boards and ADEPT Bridges Group. Further details are provided in [Strengthening of Railtrack owned highway bridges](#), published jointly by CSS (now ADEPT) and Railtrack, March 1999.
- C.2.2.8. [BS EN 1991-2](#) defines models of traffic loads for the design of road bridges, footbridges and railway bridges.
- C.2.2.9. References to the London Board are to be construed as reference to Transport for London. See also the Channel Tunnel Act 1987, s6(3), Sch.2, Pt III, para 21(4) for the application of this section to the concessionaires as defined by that Act. Other enabling legislation has been introduced to empower replacement organisations, such as London Underground Limited, to retain similar powers.

Retaining Walls

- C.2.2.10. Most retaining walls, which directly support the highway or support land carrying the highway (“highway retaining walls”) and are within the highway boundary, are maintainable at public expense. Occasionally such retaining walls have been built by adjoining landowners to create a more level site and so afford more useable space, e.g. for a mill, these are generally owned by, and should be maintained by, the landowner. Whilst this cannot be insisted upon by the Highway Authority unless covered by an agreement, the highway does have a right of support under Common Law and this can be used if the wall starts to collapse.
- C.2.2.11. The responsibility for the maintenance of retaining walls which support property adjacent to the highway (“property retaining walls”) is more difficult to determine. These walls may have been built as part of the highway and as such are maintainable at public expense unless built as accommodation works for the adjoining landowner with an agreement that the landowner would maintain them in the future. Some retaining walls may have been built by the adjoining landowner to create a more useable area and as such are maintainable by the landowner. In this case, if an existing wall is liable to endanger highway users, the Highway Authority can serve notice, under Section 167 of the Highways Act, on the owner or occupier requiring them to carry out repair work to remove the danger. This can be a protracted process and the authority needs to consider their general duty of care to the public. Serving of such a notice imposes a duty on the Highway Authority to act in default of action by the owner. Section 167 also states that no new retaining wall shall be built of height greater than 4 feet 6 inches (approximately 1.37m) within 4 yards (approximately 3.66m) of a street unless it is approved by the local council following consultation with the Highway Authority.
- C.2.2.12. The ownership and maintenance of retaining walls can be a complex issue and it is suggested that authorities produce and maintain a guidance note to clarify retaining wall responsibilities.

Railway and Canal Bridges

- C.2.2.13. The Transport Act 1968 (Part VIII Bridges and level Crossings etc) sought to clarify responsibilities for maintaining the structures that carry highways over the railways of the British Railways Board or the London Board, and over waterways of the British Waterways Board, now the Canal & River Trust (or their successors in title).
- C.2.2.14. Part VIII of that Act states that where, at that time, any of the above Boards were responsible for maintaining the highway on the bridge or giving access to the bridge, they remain responsible for all but the surfacing of the highway which from that time becomes the responsibility of the Highway Authority as highway maintainable at the public expense. The Act provides that the authority is not responsible for any defect in the surface that is attributable to the failure of the Boards to discharge their responsibility. There are similar obligations on the authority to afford access to the Boards to carry out their maintenance work and to seek the consent of the Boards to works which might affect the loading and/or parapet height on the bridge.

C.2.2.15. The Transport Act 1968 imposed upon the Boards the need to provide bridges with the required load-bearing capacity and to maintain or improve their bridges as appropriate. Except for special cases where standards are specified by a Minister, the capacity was defined as the weight of traffic which ordinarily uses or may be reasonably expected to use the highway carried by the bridge on or about the day on which the section of the Act came into force for existing bridges or, if the bridge is constructed subsequently, when it is opened to traffic. In the case of railway bridges this was further defined by The Railway Bridges (Load Bearing Standards) (England and Wales) Order 1972 (SI 1072 No. 1705) where five standards of loading are applied depending on the age of the bridge or when it was reconstructed (special provision is made for specific bridges listed in Schedules 2 and 3 to this order). The five standards of loading are:

- Technical Memorandum (Bridges) No. BE4 The Assessment of Highway Bridges for Construction and Use Vehicles;
- Type HA (equivalent lane loading) standard;
- HA and 37.5 units of HB (abnormal loading);
- HA and 45 units of HB; and
- for bridges that were or were about to be weight restricted, the load bearing obligation was limited to the weight restriction.

Overbridges

C.2.2.16. Bridges carrying railways or waterways over highways are usually owned by the respective Boards or their successors. Adequate consultation and liaison should take place before either the other owner or the Highway Authority does any work that could impact upon the interests of the other.

C.2.2.17. Over-bridge strikes may result in fatalities, and cause substantial disruption and delays to the railway industry and road users arising from even the slightest impact, as the effect of which always needs to be checked before trains can be cleared to use the bridge again. However, the issue of striking bridges over roads is not just related to railway bridges. Many over-bridges are struck from time to time, the effect varying from simple scrapes to complete demolition, including those over the 5.0m minimum headroom threshold. To seek to combat the problem the DfT has set up a group, the Bridge Strike Prevention Group (BSPG), to raise awareness of the issues and identify and action initiatives to reduce the incidences of bridge strikes. The Group includes representatives of DfT, ADEPT, Network Rail, TfL (LUL and Surface), LoBEG, Railways Inspectorate/HSE, Freight Transport Association, Road Haulage Association, Association of Chief Police Officers, Highways England, Transport Scotland, Welsh Government, Transport NI and others. As part of the BSPG activities, ADEPT in collaboration with Network Rail have developed a [protocol for highway managers and bridge owners to minimise the risk of bridge strikes](#).

Privately Maintainable Bridges

- C.2.2.18. There are provisions in Sections 93 to 95 of the Highways Act 1980 for the Highway Authority to enter into agreements with the owners of private bridges for the transfer of ownership of the structure and responsibility for its improvement and maintenance. These agreements normally contain financial provisions or commuted sums to cover any outstanding liabilities. Equally Section 271 of the Act provides for agreement of transfer of tolls and subsequent compensation if necessary.
- C.2.2.19. In the event of failure to agree future responsibilities either party can apply to the Secretary of State for an order under Section 93 of the Act. Such an order can require the owner or Highway Authority to reconstruct or improve the bridge, can determine who should maintain/operate the bridge in the future and can require the transfer of ownership.

Low, Narrow or Weak Bridges

- C.2.2.20. [The Traffic Signs Manual](#) Chapter 4 contains guidance for the signing of low, narrow and weak bridges.
- C.2.2.21. All bridges over highways with less than 5.0m headroom at any point over the carriageway are referred to as 'low bridges'.
- C.2.2.22. Sections 1 and 2 of the Road Traffic Regulation Act 1984, as amended, are used by a Highway Authority to make a TRO (called a "Weight Restriction Order" although actually a TRO) prohibiting certain vehicles from using a bridge which has a load bearing capacity less than that required to safely carry all vehicles permitted under The Road Vehicles (Construction and Use) Regulations 1986 or The Road Vehicles (Authorised Weight) Regulations 1998. "Weak Bridge" warning signs should be erected in accordance with Traffic Signs Manual Chapter 4 using guidance in BD 21 and BA 16 to determine the appropriate weight restriction with appropriate advance signing.
- C.2.2.23. Load Mitigation Interim Measures should be imposed on weak structures in order to reduce the effects of the loading on the structure to an acceptable level, either by reducing the magnitude of the loading or by altering the response of the structure. These include weight restrictions, lane restrictions, propping, use of a temporary structure and closure.
- C.2.2.24. Bridges with the members supporting central reserves, outer verges and footways, which are not protected from vehicular traffic by an effective barrier, should be assessed for accidental wheel or vehicle loading in accordance with BD 21, and if necessary appropriate mitigating solution, e.g. 'effective barriers', should be implemented.
- C.2.2.25. Bridges can often create narrow pinch points along the highway network. These pinch points create hazards with an increased risk of collision. "Road Narrows" signs (Sign 516 and 517 from Traffic Signs Manual Chapter 4) should be used. At sites where the bridge parapets are subject to repetitive impact damage the use of speed control measures and bollards including additional hazard signage to highlight the presence of parapets/bollards (sign 528.1) should be considered as risk reduction measures. .

Culverts

- C.2.2.26. Culverts, if constructed as part of a highway scheme, are maintainable by the Highway Authority. In doing this the authority may have interfered with the natural capacity of the watercourse upstream, and might as a result have some responsibility if flooding occurs because the culvert is not large enough to take all the flow. Depending upon the size of storm causing the flooding, this may be an actionable nuisance, as in the case of *Bybrook Barn Centre v Kent CC*, and should be duly considered, where relevant. This is also relevant to bridges over watercourses. As this is a complex issue, it is suggested that a Highway Authority produce and maintain a guidance note to clarify how the matter of flooding should be considered. The Environment Agency or equivalent, Lead Local Flood Authority (LLFA) or Internal Drainage Board (IDB), where appropriate, should be consulted when producing the guidance note and when undertaking work on culverts/bridges that may interfere with the natural capacity of a watercourse.

Tunnels

- C.2.2.27. [The Road Tunnel Safety Regulations \(2007, amended 2009\)](#) apply to tunnels over 500 metres in length that form part of the trans-European road network.

Other Highway Structures

- C.2.2.28. Other structures, such as gantries and cantilever traffic signs, constructed as part of a highway, are also maintainable at public expense and are usually managed by the Bridge Manager of the authority.
- C.2.2.29. If a highway runs along a river or the seashore then an embankment, river wall, seawall and/or groyne may be necessary for protection. They will therefore need to be maintained by the Highway Authority as part of their duties to maintain under the Highways Act 1980, (see the case of *Sandgate UDC v Kent County Council 1898*). However, each case should be considered on its merits depending on the particular circumstances, as maintenance could be the responsibility of or shared with the District Council or Unitary Authority as Coast Protection Authority. More information on embankments can be found in Section B.4 of this Code.

Cellars and Vaults

- C.2.2.30. The majority of cellars and vaults associated with the highway are privately owned and their maintenance and management is largely outside the remit of the authority. Nevertheless, when a private cellar or vault collapses it is frequently the responsibility of the authority's Bridge Manager to oversee initial investigation and subsequent repairs. In order to minimise the risk to the public and the length of time taken to return the highway to public use, the Bridge Manager may wish to implement procedures or protocols to mitigate the risk of collapse and deal with subsequent investigation and repair. Guidance is provided in the following paragraphs on developing such a protocol.

- C.2.2.31. Sections 179 and 180 of the Highways Act 1980 give procedures for the control of the construction of cellars and vaults under the street, of the provision of openings under the street, and of pavement lights and ventilators. The duty to maintain and repair a cellar or vault is on the owner or occupier, whereas the Highway Authority has a right of support of the highway and has powers to enter and maintain existing structures if the owner or occupier fails to act. The Act does not necessarily impose an obligation on the owner or occupier to carry out works that enhance or improve, e.g. strengthening to carry current accidental wheel loads or vehicle loading, if the carriageway needs to be extended over the cellar or vault. In Scotland, Section 66 of the Roads (Scotland) Act 1984 applies.
- C.2.2.32. Authorities should implement a procedure for dealing with cellars and vaults that reflects the nature and number of cellars and vaults associated with their highway. The procedure should take into account current data and knowledge (e.g. number of recent failures), the resources needed to collect further data (e.g. a survey to identify all cellars and vaults) and the benefits provided by this data. The following approaches should be considered:
- ad hoc approach – after a collapse the authority liaises with the owner/occupier regarding the repair. There is no set protocol for dealing with collapse/repair but the principles outlined within Section 6 (Network Resilience) of Part A should be followed.
 - re-active protocol – after a collapse the authority follows a set protocol.
 - The protocol may include:
 - secure the site, e.g. site safety, traffic management, initial inspection and structural analysis;
 - identification of relevant parties, e.g. owner, occupier, highway and other authorities;
 - investigation, e.g. nature of the cellar/vault, extent and cause of damage, scope and cost of works required and constraints; and
 - repairs, e.g. establish who will carry out the repairs, identify work required to meet current standards and agree how costs will be shared between the parties.
 - This approach may be suitable for authorities that have a large number of cellars and vaults associated with their highway, but have had few collapses in the past and the risk of collapses in the future is assessed to be small.
 - Pro-active protocol – based on the re-active protocol but add to this a pro-active approach to collapse mitigation using risk assessment. The authority, in agreement with cellar/vault owners, develops a risk assessment procedure that identifies those cellars and vaults most at risk. These structures should be inspected/assessed by the authority or the owner's engineering representative (as agreed) and the need for repairs and strengthening identified. Identification, inspection and assessment of all cellars and vaults are likely to be difficult and expensive tasks. This approach should be justified on the basis of minimum whole life costs (to the owner and authority) and may be suitable for authorities that have a large number of cellars and vaults

associated with their highway and have had a significant number of collapses in the past.

Improvements and Reconstruction

- C.2.2.33. Sections 62 to 105 of the Highways Act 1980 give general powers to the authority to improve the highway by widening, junction improvements or safety aspects. Improvements can include highway structures. Section 75(2) requires consent of the railway, canal, inland navigation, dock or harbour undertakers concerned, if affected.
- C.2.2.34. Sections 91 and 92 of the 1980 Act respectively state that an authority can construct a bridge to carry the highway and that a bridge can be reconstructed either at the site or within 200 yards (approximately 183m) of the existing one. Section 93 of the Act permits the authority to apply to the Minister of State for an order to provide for reconstruction, improvement or maintenance of privately maintained bridges if they are considered dangerous or unsuitable for the requirements of road traffic.
- C.2.2.35. The authority has the power under the 1980 Act, Section 110 to divert non-navigable watercourses if necessary or desirable as part of improvement or alterations.
- C.2.2.36. Construction of bridges over, and of tunnels under, navigable waterways, requires an order from the Minister under Section 106 of the Highways Act 1980. If the waterway is also tidal, consent is required under the Coast Protection Act 1949 as amended by Section 36 of the Merchant Shipping Act 1988. If material is to be deposited in the tidal waterway, consent is also required in accordance with the [Food and Environmental Protection Act 1985 Part II](#).
- C.2.2.37. Each of these processes involves a statutory consultation process which includes the Environment Agency, Marine Management Organisation, navigation authorities, Trinity House, etc as necessary. For works required on highway structures within areas covered by a "Harbour Order" permission is required from the Harbour Authority.

Structures Over or Adjacent to Watercourses or Flood Defences

- C.2.2.38. If highway structure works are required in, over, under or near a watercourse or flood defences (including sea defences), it is essential to contact the appropriate agency, for consent to work in watercourses. Consents can take a minimum of two months to obtain and should therefore be sought as early in the planning process as feasible. Consents to cover both temporary and permanent work are required.
- C.2.2.39. Consents are the means of meeting requirements that the works do not endanger life or property by increasing the risk of flooding or cause harm to the water environment. Consents are given by the Environment Agency under the Water Resources Act 1991 in England for main rivers and by the lead local floods authority under the Land Drainage Act 1991 for works on or near 'Ordinary Watercourses'. In some areas there are Internal Drainage Boards who deal with these matters on behalf of the Environment Agency.

- C.2.2.40. Watercourses in Scotland are the responsibility of the Scottish Environment Protection Agency (SEPA), and local authorities. SEPA have produced a [Practical Guide to The Water Environment \(Controlled Activities\) \(Scotland\) Regulations 2011 \(as amended\)](#).

Party Wall Act

- C.2.2.41. The Party Wall Act 1996 requires the issue of statutory notices when work affects adjacent properties within 3 metres of any construction works or within 6 metres if affecting foundation support. The Act is only considered applicable if the land is owned by the authority rather than 'simply' highway land. However, the authority still has a duty to maintain support of the highway under Common Law. Condition surveys should be undertaken prior to any major works and in some instances the processes prescribed within the Party Wall Act may prove beneficial. The process may lead to an affected party appointing an Independent Party Wall Surveyor to act on their behalf and thus later disputes may be avoided. Further information may be obtained from the website of the [Pyramus and Thisbe Club](#), which is the organisation for professionals specialising in party wall matters.

National Variations

- C.2.2.42. The Roads (Scotland) Act 1984, similarly sets out the main duties for roads authorities in Scotland. Sections 1 to 4 set out the general powers and duties and state that a local roads authority shall manage and maintain all such roads entered on the list of public roads. Sections 75 to 82 deals with bridges, tunnels and diversion of watercourses in a similar manner to Sections 106 to 111 in the Highways Act 1980 for bridges in England and Wales. Part V covers roads and building control, in particular Section 66 covers maintenance of vaults and cellars and requires owners to maintain and repair such structures, and gives the authority powers to serve notice on the owner to undertake repairs.
- C.2.2.43. Section 90 of the Roads (Scotland) Act 1984 gives powers to the authority to consent to structures or apparatus constructed over the road. This is similar to Section 176 of the Highways Act 1980.
- C.2.2.44. The equivalent legislation in Northern Ireland is The Roads (Northern Ireland) Order 1993 where the duty to maintain is contained in Article 8.

C.2.3. ENVIRONMENTAL REQUIREMENTS

- C.2.3.1. Maintenance work and inspections on highway structures should be undertaken giving due consideration to the environment. Highway structures provide habitats for some species, such as reptiles, nesting birds, bats and plants especially lichens, mosses, and liverworts. They are often situated in and over key biodiversity corridors – i.e. rivers, streams and estuaries. Whilst they facilitate the passage of vehicles, cycles and pedestrians, over or under obstacles, bridges can also be a barrier to the migration of animals, which can result in conflict with traffic. Brief details of the requirements are given in Section 9 of Part A of this Code.
- C.2.3.2. On 1 April 2013 the Environment Agency Wales was merged with the Countryside Council for Wales and Forestry Commission Wales into a single environmental body, [Natural Resources Wales](#), which is the statutory drainage and flood defence authority for Wales.

C.2.3.3. [Scottish Natural Heritage](#) and [Scottish Environment Protection Agency](#) are the statutory bodies in Scotland that have responsibility for the environment.

C.2.3.4. Environment matters in Northern Ireland are dealt with by several departments: [Department for Communities \(DfC\)](#), [Department for Infrastructure \(DfI\)](#) and [Department of Agriculture, Environment and Rural Affairs \(DAERA\)](#).

C.2.4. SUSTAINABILITY REQUIREMENTS

Guiding Legislation

C.2.4.1. [The Climate Change Act 2008](#) empowered the government to set national targets for the year 2050 for the reduction of greenhouse gas emissions and to encourage energy users to meet the objectives of the act, such as reducing such emissions or removing greenhouse gas from the atmosphere.

C.2.5. CONSERVATION REQUIREMENTS

C.2.5.1. The Planning (Listed Building and Conservation Areas) Act 1990 requires each authority to compile a list of buildings of special interest, either historic or architectural. Listed building consent is required to demolish such a structure, or to alter or extend it in a manner affecting its architectural or historic interest. The Act also provides for the protection of conservation areas that have special historical interest. The status can influence the processes required for structure maintenance in such an area.

C.2.5.2. There are different grades of listing, depending on the historical or architectural importance of the structure, ranging from Grade 2 through Grade 2* to Grade 1, with a further level of Scheduled Ancient Monument, which is covered by The Ancient Monuments and Archaeological Areas Act 1979. Secretary of State (Department of Culture, Media and Sport) approval of proposals for work on a Scheduled Ancient Monument is required before any works are carried out, except emergency works. The Ancient Monuments (Class Consents) Order 1994 gives consent in Class 5 for works which are urgently necessary in the interests of safety or health, provided that the works are limited to the minimum measures immediately necessary and notice in writing justifying in detail the need for the works is given to the Secretary of State as soon as reasonably practical. This would allow the replacement of the odd damaged stone or realignment of a displaced parapet, but not repair of more extensive damage. The Secretary of State relies heavily on the advice of Historic England and any proposals for work on such structures should involve early consultation with the local representative of Historic England. Proposals for works on structures recorded at the lower (listed) levels are usually approved by the planning department of the local authority. However, if the work will require complete or partial demolition, or if the work will alter or extend a Grade 1 or 2* structure in any manner which would change its character as a building of special architectural or historical interest, the planning department of the local authority has to consult English Heritage.

C.2.5.3. There are currently 25 World Heritage sites within the UK designated by [UNESCO \(United Nations Educational, Scientific and Cultural Organization\)](#).

- C.2.5.4. Although these sites have no greater legislative protection, local planning authorities are encouraged to have management plans in place. Planning applications for works in these areas are likely to require greater consultation with Historic England and thus lengthier programmes should be accommodated. Details of the sites in England are provided on the Historic England website.

<https://historicengland.org.uk/>

- C.2.5.5. As the requirements for the conservation of historic structures are specified in a number of disparate documents and there was a need to bring them together in a bridge-orientated publication, Highways England sponsored the publication of Conservation of Bridges and issued [BD89 The Conservation of Highway Structures](#). Both these publications should be consulted before work is proposed on historic structures. The website [Maintain our Heritage](#), although primarily for historic buildings, has information on various aspects of maintaining these structures.

National Variations

- C.2.5.6. In Scotland, [Historic Environment Scotland](#) has been set up by the Scottish Executive to undertake a similar role to that of Historic England for ancient monuments. The same legislation is applicable for ancient monuments, except for listed buildings. They are covered by Planning (listed buildings and conservation areas) (Scotland) Act 1997.
- C.2.5.7. [Cadw](#), created in 1984, is the historic environment service within the Welsh Government and deals with the preservation of ancient monuments in Wales.
- C.2.5.8. The Department for Communities, [Historic Environment Division](#), established in May 2016 is the authority in NI for determining conservation matters.

SECTION C.3. ASSET MANAGEMENT INFORMATION – STRUCTURES

C.3.1. INTRODUCTION

- C.3.1.1. Asset data management is dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Part B](#). This document should be referred to and the advice below considered supplementary.
- C.3.1.2. Asset management systems are dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Part C](#). This document should be referred to and the advice below considered supplementary.

C.3.2. PRINCIPLES AND CONSIDERATIONS

- C.3.2.1. A structures asset management system should provide/support the following list of functions.
- collection, storage and retrieval of inventory data and condition data;
 - works management and prioritisation;
 - asset valuation – both gross replacement and depreciated replacement cost to support Whole of Government Accounting requirements;
 - production and reporting of national and local performance data;
 - deterioration modelling and life cycle planning; and
 - management and storage, in electronic format, of drawings, photographs and reports.
- C.3.2.2. The UK Bridges Board has developed a methodology for Structures Asset Management Planning, referred to as the Structures Toolkit (SAMPt). New versions are published annually on the [CIPFA website](#), and are used to produce the required figures for the Whole of Government Accounts.
- C.3.2.3. Commercial software systems should implement the methodology of the valuation module in a consistent manner, in order that the valuation figures produced by any one system are comparable and auditable regardless of the system used.

C.3.3. MANAGEMENT OF ASSET INFORMATION

- C.3.3.1. Asset data should be held in a format that allows it to be easily entered, analysed and manipulated during the planning process, preferably in a computerised format. Data entry may be performed by administration staff or engineers. In the latter case data entry, especially for General Inspections, should be combined with the identification of needs in order to produce a more time and cost efficient approach. The highway structures stock should be divided into groups and sub-groups that have similar deterioration characteristics and maintenance.
- C.3.3.2. Consistency is vital to current and developing Bridge Management Techniques and to ensure that these are suitably supported, it is essential that element inventories are created and maintained in a consistent manner.
- C.3.3.3. The London Bridges Engineering Group (LoBEG) has published a [Good Practice Guide on Creating Consistent Element Inventories for Highway Structures](#). This describes the approach for creating consistent element inventories and provides guidance on the consistent evaluation of Bridge Condition Indicators.
- C.3.3.4. The extent of data held depends on the particular requirements of the authority but the following should be considered:
- **basic inventory data** – the basic information about each highway structure, including structure name/reference, structural type, location, route carried, obstacle crossed (where relevant) and key dimensions;
 - **legal data** – details of contracts, licences, legal agreements, letters, etc. that define who is responsible for management, e.g. authority, other owner, third party, maintaining agent;
 - **condition data** – an up-to-date General Inspection pro forma should be held for all structures as a minimum. Holding additional more historic condition data will assist in monitoring and developing trends;
 - **structural assessment and review data** – the assessment rating, date of latest structural review, details of a planned assessment, or details of why the structure is excluded from the review/assessment programme. See also Section C.5; and
 - **Health and Safety File** – an H&S file should be maintained for each highway structure as construction work is carried out.
- C.3.3.5. The data collected and managed by particular authorities may depend also on imposed requirements arising from government/corporate policy and targets (current and future, if known) relating to the environment and sustainability, resource accounting and budgeting, Best Value, asset valuation etc.

Inventory Data

C.3.3.6. The inventory should hold the basic data and information on the stock of highway structures in terms of descriptive parameters such as structural type, form, construction material and geometry (dimensions, span, width, skew etc). Attributes held in the inventory should enable management to operate at a number of levels, e.g. stock, groups or individual structures.

C.3.3.7. Suggested fields for a highway structures inventory are listed below:

- structure type, e.g. bridge, culvert, retaining wall;
- owner and, where appropriate, management, maintenance and inspection responsibilities;
- structure identifier – reference, name, key number, etc;
- route carried, e.g. Principal A road, B road, footway;
- structure location, e.g. map reference (easting and northing), GPS, section of road, local position reference;
- year of construction/reconstruction, designer and design code;
- location of drawings, photographs, design details, etc;
- headroom envelopes, minimum headroom, navigation clearance;
- historic listing or scheduled ancient monument;
- special access requirements, including details of confined space working, permit to entry or work, maintenance access needs etc;
- details, including date, of major upgrades and/or modifications, e.g. widening or strengthening;
- presence of utility services (stats) – a field indicating ‘yes’ or ‘no’ may be sufficient rather than specific details. This is for information only and a live search should be carried out to confirm stats prior to any works;
- external considerations and/or constraints, e.g. social, geographical, environmental, conservation, etc;
- structure arrangement, e.g. number and location of widenings, number of spans/panels, skew;
- structural form, e.g. arch, beam and slab;
- general material of construction, e.g. masonry, steel, concrete;
- obstacle crossed, e.g. road, watercourse, railway;
- dimensions, e.g. length, width, height;

- list of components, e.g. primary deck element, joints, bearings. The inspection pro forma developed by CSS (now ADEPT) provides an appropriate list;
- materials of construction;
- year of construction/installation;
- manufacturer and unit specifications, e.g. for parapets, bearings and joints;
- presence of asbestos; and
- capacity rating/abnormal load rating.

Inspection, Condition and Performance Data

- C.3.3.8. General and Principal Inspections provide the majority of condition data. These are supplemented by Special Inspections, testing and monitoring, as appropriate, where the data sought is often focussed on a particular part of the structure or aspect of performance. Such data is often obtained on a “one-off” basis and may include measurements which cannot be conveniently entered into a paper based or electronic system. The database should indicate the location of the full report in such instances.
- C.3.3.9. Condition data from previous inspections should be retained as the evolution of this data over time gives a clear indication of the rate of deterioration and residual service life. This data can be used to estimate deterioration rates for different element and structure types which may be used to develop lifecycle plans.

C.3.4. PERFORMANCE MEASUREMENT FOR HIGHWAY STRUCTURES

- C.3.4.1. Setting targets and measuring performance are dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Part B](#). This document should be referred to and the advice below considered supplementary.
- C.3.4.2. The following should be considered when identifying performance measures for use in asset management planning:
- performance measures for highway structures that are already in use, e.g. Condition PI;
 - performance measures that have been developed, or are under development, for highway structures, e.g. Availability and Reliability PI, see below; and
 - additional performance measures that may be needed to reflect the levels of service for the overall network and for measuring the effectiveness and efficiency of the planning and delivery processes.
- C.3.4.3. The Government paper on [Choosing the Right Fabric: A Framework for Performance Measurement](#) provides useful further guidance for the identification, development and use of performance measures.
- C.3.4.4. [Performance Measures for Highway Structures: Part A](#) provides guidance on performance reporting.

SECTION C.4. ASSET CONDITION AND INVESTIGATORY LEVELS – STRUCTURES

C.4.1. INTRODUCTION

- C.4.1.1. All maintenance work should preferably be designed to current standards, although there may be situations where lesser standards are acceptable, e.g. repair of part of an element, repair of accident damage. Each case should be considered on its merits. Where lesser standards are accepted, the designer should check that the load carrying capacity of the structure at both serviceability and ultimate limit states and the durability of the repaired area are not less than that of the rest of the structure. Lesser standards may be unavoidable, e.g. maintenance of a listed bridge or scheduled monument. In this situation it is recommended that a safety audit or risk assessment is carried out. This documentation should be kept with the structure file for the structure in question. Where unacceptable risks or hazards are identified, the Bridge Manager should look for alternative mitigation measures. It is important that the implications for future maintenance are a prime consideration in the design and implementation of all maintenance schemes.
- C.4.1.2. [The Design Manual for Roads and Bridges \(DMRB\) and the Manual of Contract Documents for Highway Works \(MCHW\)](#) are maintained by Highways England on behalf of all Overseeing Organisations (the national highway / roads authorities in England, Scotland, Wales and Northern Ireland).
- C.4.1.3. The DMRB provides detailed guidance in the form of standards (BDs) and advice notes (BAs) for most aspects of highway structure design and assessment. The guidance includes criteria for structural loading, analysis, material properties, element design or assessment, in addition to geometrical requirements and best practice for design for durability. The MCHW provides model contract documents, specifications, notes for guidance and standard details. Care is required to remain fully aware of changes and additions to the DMRB and the MCHW.
- C.4.1.4. The Overseeing Organisations also issue Interim Advice Notes (IAN), as interim guidance until full standards are available. Interim Advice Notes are available on the relevant national authority website. DfT publishes a [Network Maintenance Manual \(NMM\) and Routine and Winter Service Code \(RWSC\)](#) for the strategic road network in England.

Technical Approval

- C.4.1.5. All structural design and assessment should be subject to a formal Technical Approval procedure such as those used by the Overseeing Organisations [[BD 2: Technical Approval of Highway Structure](#)] or Network Rail [[GC/RT5101 Technical Approval Requirements for Changes to the Infrastructure](#)]. Authorities should have such a procedure in place and have formally appointed an appropriate organisation or individual to act as Technical Approval Authority (TAA).
- C.4.1.6. Both Highways England and Network Rail have a range of documents applicable to maintenance and that refer to the relevant British Standards and Eurocodes. Departures from these standards should be carefully recorded to enable an audit trail for certification.

National Variations

- C.4.1.7. The DMRB is used by authorities in Scotland with some specific variations appropriate for use in Scotland. Transport Scotland issues interim amendments (TSIA) as necessary.
- C.4.1.8. Similarly, the DMRB is implemented by the Welsh Government with some specific variations appropriate for use in Wales.
- C.4.1.9. The DMRB is used in Northern Ireland by Transport NI (TNI), an Executive Agency within the Department for Infrastructure (Dfi), with some specific variations appropriate for use in Northern Ireland. TNI issues interim amendments as DEMs (Director of Engineering Memoranda) as necessary and Northern Ireland specific policy as RSPPGs (Roads Service Policy & Procedure Guide).

Implementation of the Eurocodes

- C.4.1.10. The [Eurocodes](#) are a series of European Standards developed by the [European Committee for Standardisation](#), to provide a common approach for the design of buildings and other civil engineering works and construction products. The Eurocodes are not to be used for assessment.
- C.4.1.11. Ten Eurocodes have been developed and published. They are organised in 58 parts and each part is supplemented by a National Annex.
- EN 1990 Eurocode: Basis of structural design;
 - EN 1991 Eurocode 1: Actions on structures;
 - EN 1992 Eurocode 2: Design of concrete structures;
 - EN 1993 Eurocode 3: Design of steel structures;
 - EN 1994 Eurocode 4: Design of composite structures;
 - EN 1995 Eurocode 5: Design of timber structures;
 - EN 1996 Eurocode 6: Design of masonry structures;
 - EN 1997 Eurocode 7: Geotechnical design;

- EN 1998 Eurocode 8: Design for earthquake resistance; and
- EN 1999 Eurocode 9: Design of aluminium structures.

C.4.1.12. On 31 March 2010, all British Standards that conflicted with the Eurocodes were withdrawn. The [Eurocodes](#) have therefore replaced national codes that were previously published by national standard bodies and have become mandatory for European publicly funded works. As with other European standards, the Eurocodes will be used in public procurement.

C.4.1.13. The Association of Directors of Environment, Economy, Planning and Transport (ADEPT) published the [Guidance Document on the Implementation of Structural Eurocodes](#) in December 2010. This guidance was produced to encourage a common understanding of the changes to policies and procedures that are necessary to implement the Eurocodes within Local Highway Authorities. The document sets out recommended approaches and provides assistance to successfully manage the transition to fully adopting Eurocodes for structural design. It also describes the potential impacts of Eurocode implementation on Local Authority organisations, processes and staff training needs.

Predict Future Demand

C.4.1.14. Changes in demand in the future may alter how a structure should be managed, e.g. if a planned route widening will necessitate a bridge replacement in 10 years' time then the maintenance strategy for the existing bridge should reflect this. The most cost effective solution for the bridge may be to adopt a managed deterioration approach that provides the minimum required performance for the next 10 years but does not necessarily keep the bridge in a visibly good condition.

C.4.1.15. The prediction of future demand on highway structures should align with the network demands and are likely to include changes in vehicle weight, height and width, and traffic volume. Future demands should be predicted using available data, historical trends, and local factors. The following should be considered when developing rules for predicting future demand on highway structures:

- **vehicle weight** – current highway bridge design and assessment standards [BS EN 1991-2, BD21] use a conservative loading model that may be able to cater for some future increases in Gross Vehicle Weights (GVW). However, increases in GVW may require associated changes to the Authorised Weight (AW) regulations, i.e. limits on axle weights, numbers and spacing. If the AW regulations change, the effect on bridges would be examined nationally and appropriate guidance provided by the DfT to Highway Authorities;
- **height and width** – it is unlikely that any change in specified vehicle dimension would force a national programme of bridge 'raising', road 'lowering' or road widening. It should be sufficient to assess the vertical and horizontal clearance requirements on specific structures or structures on a route, e.g. routes/structures that currently have height/width restrictions, routes that may be reclassified as a high load route. Height is not controlled by UK legislation, unlike width, length and weight; and
- **traffic volume** – increases in traffic volume may require highway structures to be widened or replaced as part of a larger highway widening/upgrade scheme. Also, increases in HGV movements (for example, due to a quarry or

distribution centre opening) may have a significant impact on future management and maintenance. The Bridge Manager should seek to obtain advance warning of such schemes and use this in asset management planning.

C.4.2. RISK MANAGEMENT PRINCIPLES FOR HIGHWAY STRUCTURES

- C.4.2.1. The principles of a risk based approach for highway infrastructure are dealt with in Section A.6 of this Code, and risk management is dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Part C](#). This section contains information on risk specifically related to highway structures.
- C.4.2.2. Risk management principles can be used by practitioners to help the decision making process for the management of highways structures. With limited budgets bridge owners can use principles of risk management to identify and prioritise the allocation of resources in the most appropriate location.
- C.4.2.3. An integrated management approach is required. The assessment of a structure's performance (or lack of) needs to be assessed with a strong reference to the criticality of the structure's location on a network.
- C.4.2.4. A small structure/culvert on a critical network link may warrant more attention than a much larger structure on a remote unclassified road. Alternatively, a small structure on an unclassified road (with no local diversion routes possible) that provides the only local link between adjacent villages could be assessed as being more important than a much larger structure on a more significant road (where simple diversions are possible). Hence bridge owners should consider the hierarchy of their structures relative to the hierarchy of the road network, coupled with local factors and constraints to ensure that by applying an integrated asset approach, more efficient management strategies with a reduced impact for users can be realised.
- C.4.2.5. Undertaking risk assessment and developing management strategies from these assessments, should allow for funding to be prioritised in areas where the need is greatest. This can support practitioners in managing the deterioration of their bridge stock in a more proactive integrated manner. It should be noted that the risk assessment approach should be undertaken with caution. This process should not be used to justify a 'Do Nothing' approach, unless it can be shown that 'Do Nothing' is not adversely affecting the condition of the structure. Care should also be given to ensure that bridge owners do not place themselves at an excessive/unacceptable level of risk. Authorities should develop risk based policies to manage and coordinate decision making from risk management/assessment.

C.4.3. RESILIENCE REQUIREMENTS

- C.4.3.1. The principles of resilience for highway infrastructure are dealt with in Part A of this Code. This section contains information on resilience requirements specifically related to highway structures.

- C.4.3.2. Structural failures can result in network disruption with significant repair costs, damage to third party property, and more importantly the potential loss of human life. Bridges and other highway structures rarely experience complete collapse during non-extreme events, however when such collapses do occur, the results can be catastrophic. The review of past bridge failures allows bridge designers to apply lessons learned to new design projects and to the preservation of existing structures which will help prevent future failures.
- C.4.3.3. Failure is defined as the inability of a structure, or one of its primary load-carrying components, to perform its intended function of being safe for use and fit for purpose. Failures can be caused by one, or a combination of the following (not exhaustive):
- errors in design, detailing and construction;
 - effects of unanticipated stress concentrations;
 - inadequate maintenance;
 - use of improper materials or foundation types;
 - unplanned extreme event;
 - unknown deterioration and defects;
 - hidden deterioration and defects;
 - lack of appreciation of the significance of observed defects or of appropriate action;
 - lack of inspection and monitoring;
 - lack of funding for essential maintenance;
 - pressure to keep structures in service; and
 - effects of unanticipated or unforeseen change of use.
- C.4.3.4. It has been shown through various studies that a bridge collapse is most likely to be caused by an extreme event, with the most prevalent type being flooding and scour. Recent extreme weather events have demonstrated this and in 2009 a large number of bridge failures were observed in Cumbria as a result of scour damage from flood events. The extreme flooding observed in 2009 resulted in significant infrastructure damage with an estimated value in excess of £250m. The estimated cost of the damage to the county's roads and bridges alone was circa £34m.
- C.4.3.5. The frequency of occurrence of these events has been increasing. This rise in occurrences is considered to be due to the effects of climate change. Hence further events are possible which need to be planned for by the asset owners during the development of management strategies for the relevant assets. An assessment of high risk structures should be undertaken to understand the adequacy of such structures highlighting any potential for accelerated deterioration as a result of extreme events.

- C.4.3.6. A risk assessed process should be followed to identify critical assets that have the potential to be affected by extreme events and the like, as described in Section A.6 of this Code. Subsequent actions could be monitoring post event and/or remediation work.
- C.4.3.7. Extreme events should not solely be thought of as 'Flood' and 'Scour' events. Fire, vandalism and terrorism may also be significant factors that need to be considered in developing management strategies. Hence any resilience review on existing highway structures should consider all local factors in developing any management strategies. For new structures, building redundancy into the design should be considered; however, the economical balance of resilience v sustainability/lean construction needs to be understood in terms of whole life performance and best value. This assists with unforeseeable future change in use.

Bridge Inspection and Maintenance

- C.4.3.8. Regularly scheduled inspections enable bridge owners to record the general conditions of the bridge to help detect any potential problems that could lead to a failure. Regular inspections give the asset owner a data set to base their decision on. Consequently the inspection process is invaluable and the quality of this information will impact the effectiveness of any agreed maintenance strategies.
- C.4.3.9. When developing maintenance strategies for bridges and highway structures a good maintenance programme will help to reduce the potential for deterioration that leads to a bridge failure. If bridge inspections are not routinely performed, deteriorated areas in need of repair will increase, resulting in the increased potential for a bridge failure. Thus, the use of increased inspection intervals should be undertaken with care and due consideration given to the resilience of the structure and the potential for bridge failure as indicated above.

C.4.4. INTERACTION WITH OTHER OWNERS AND THIRD PARTIES

- C.4.4.1. The Bridge Manager must be prepared to work with other owners and third parties in order to maintain the safe operation of the public highway and to carry out maintenance work.

Access

- C.4.4.2. Maintenance work, including inspections, frequently requires access onto land in other ownership, either at the structure or gaining entry to it. The Highway Authority or other owner does not necessarily own the land adjacent to a structure or under a bridge or have a right to access covered by a legal agreement. Records should be consulted and any landowners contacted to agree arrangements. If agreement cannot be reached it may be necessary for the Highway Authority to use the powers in the Highways Act 1980 (Sections 289 to 292) or equivalent legislation in Scotland and Northern Ireland.
- C.4.4.3. Access to the structure should be arranged so as to minimise damage to the environment. On agricultural land, for example, the timing of the inspection can be significant due to possible damage to growing crops or interference with other farming activities. There may also be a need for special precautions to avoid the spread of animal or plant diseases. Vehicles and equipment can cause rutting or ground compaction as well as direct damage to the vegetation.

Border Agreements

- C.4.4.4. Section 3 of the Highways Act 1980 states that when a bridge straddles a boundary between authority areas an agreement has to be entered into between the two authorities whereby one of the authorities becomes the Highway Authority for the whole bridge and its approaches. Normally all the structures crossing a particular boundary are considered and a fair distribution of individual structures is agreed between the authorities.
- C.4.4.5. These agreements should be adequately documented and recorded to enable effective future management and adjustments that may be required to accommodate changes to authority boundaries and any further local government reorganisation.
- C.4.4.6. Maintenance on structures that straddle authority boundaries necessitates an especially high level of consultation, communication and joint planning of operations between the authorities. Work on strategic routes can also have a significant impact on the whole highway network of adjoining authorities and significant costs may result. Particular attention should be given to emergency planning for these types of structure as any major incident can have a significant effect on both authorities.

Structures Owned by Other Bodies

- C.4.4.7. Highways are frequently supported by or go under structures owned by parties other than the Highway Authority for that highway. Typically, local highways go under and over trunk roads, trunk motorways, live and disused railways, canals, and private accesses. The bridges may be owned by Highways England, Scottish Ministers, Welsh Ministers, Network Rail, London Underground Limited, Canal & River Trust, Scottish Canals, Environment Agency, Internal Drainage Boards, other public authorities or private owners.
- C.4.4.8. A clear definition of responsibilities in respect of the structure and related elements should be prepared for all such situations. Responsibilities are based generally on the reasons the bridge was built and on the need to ensure the integrity of safety and protection systems.
- C.4.4.9. There is also a residual responsibility on the authority, in respect of the public using its roads, relating to bridges owned by other bodies. The authority has a responsibility to seek to ensure that other owners are exercising adequate stewardship over their structures. The Highways Act 1980 Section 56 allows proceedings for an order to enforce repair. Whilst it is reasonable to assume that major infrastructure owners such as Network Rail, Highways England and the Canal & River Trust will be competent in this regard, this level of confidence cannot be taken for granted elsewhere.
- C.4.4.10. Section 130 of the Highways Act 1980 allows proceedings for the protection of public rights and can be used by authorities to enforce another owner to undertake maintenance. This was used in the particular case Railtrack Plc v London Borough of Wandsworth EWCA, where droppings from pigeons roosting in an overbridge were causing a public nuisance.

Structures Over or Adjacent to Operational Rail Lines

- C.4.4.11. When required to undertake inspections or maintenance work on structures over or adjacent to operational railways, the Bridge Manager of the authority is required to adhere to Network Rail, procedures for outside parties. Early notice is necessary to enable the Outside Parties Manager of Network Rail to book track possessions and attendance to facilitate safe access to undertake the work. Similar procedures are required for operational underground and metro systems. Heritage railways often follow similar systems to their previous operators.

Structures Over or Adjacent to Canals or Navigable Waterways

- C.4.4.12. Inspections or maintenance work on structures over or adjacent to canals or navigable waterways should be carried out in such a way as to ensure the safety of waterway users and the integrity of the waterway. The Canal & River Trust, Scottish Canals or the relevant navigation authority may require the Bridge Manager of the Highway Authority to adhere to their procedures. These procedures may be covered in the agreement for the construction of the structure, but in the absence of an agreement or if the agreement is silent, Highway Authorities can use their powers under Sections 289 and 291 of the Highways Act 1980 to gain entry with compensation being determined in accordance with Section 292. As the work being undertaken is primarily for the benefit of highway users and not canal users, Section 118 of the Transport Act 1968 does not apply. Documents, such as the [Canal & River Trust Code of Practice](#) and [Scottish Canals Code of Practice](#) are not mandatory, although certain sections need to be adhered to in order to ensure the safety of canal users.
- C.4.4.13. Early consultation is necessary to enable the bodies concerned to programme the work so as to minimise the effect on users of the waterway. The Canal & River Trust require all work which may cause a restriction or closure of the waterway, to be agreed before the 31 March of the current financial year for work to take place in the following financial year.

Developer Promoted Structures

- C.4.4.14. All proposals for new structures within or over an existing or proposed highway or works which affect existing highway structures should be subject to a formal Technical Approval (TA) process.
- C.4.4.15. Highway managers and District Planning Authorities should inform developers at the outset of development proposals that they must obtain TA for their designs and inform Highway Authorities of the proposals immediately when they become known. This action will encourage liaison between the developer and the TAA at the beginning of the process and avoid potentially abortive work by the developer.
- C.4.4.16. Structures being built as part of any development, irrespective of whether or not they will be maintainable by the Highway Authority, are included in the TA process if they:
- are adjacent to the highway and interfere with the support of the highway or access to it for inspection and maintenance;
 - form part of any road that is to be adopted into the highway under a Section 38, Highways Act 1980, agreement; and

- form part of any road that is being built under a Section 278, Highways Act 1980, agreement.

C.4.4.17. Transport NI has published guidance for [Technical Approval of Highway Structures: Information for Developers and their Designers](#).

Utility Companies and NRSWA

C.4.4.18. Utility companies operate under statutory powers provided and obligations imposed by enabling legislation which is specific to each industry. They are empowered by statute to undertake street works.

C.4.4.19. The New Roads and Street Works Act 1991 (NRSWA) as amended by the TMA controls and co-ordinates work carried out in the street by utility companies (undertakers). The Act also requires the Highway Authority to take due regard of undertaker's apparatus when planning and carrying out highway and bridge works. It is essential that, before any work in the ground occurs, all statutory undertakers are consulted regarding the presence of apparatus and appropriate notice given. Reliance should not be placed on information on a highway structures' database regarding apparatus as it could be out of date.

C.4.4.20. Detailed interpretation of and guidance on the use of the Act has been published in the DfT New Roads and Street Works Act 1991 and Traffic Management Act 2004; Code of Practice on Co-ordination; Volume 2: Operations and Guidance; Section 5: Street Works near Highway Structures.

C.4.4.21. The [Highway Authorities and Utilities Committee](#) (HAUC(UK)), a national group representing local authority associations and the [National Joint Utilities Group](#), have produced a number of codes of practice dealing with the Act. Measures necessary where apparatus is affected by major works (Diversionary works), sets out the procedures involved from the early stages of a highway or bridge scheme including requirements for budget estimates, to the construction stage and early payments.

C.4.4.22. The [JAG\(UK\) website](#) also contains a range of guidance, information and assistance.

C.4.4.23. Section 50 of the Act contains provisions for issuing licences for apparatus to be installed in the highway by persons other than statutory undertakers, e.g. a private sewer. Advance notice to the undertakers is required to be given by the street authority when such a licence is to be issued and details of the installation are to be recorded by the street authority.

Obligations of Undertakers

C.4.4.24. Before carrying out any work, undertakers are required to give notice to the authority (not always the Highway Authority). Designated notice periods are given in the Act or associated Code of Practice. These notification periods are intended to give the street authority an opportunity to consider and comment on the implication of works proposals for the highway infrastructure.

C.4.4.25. Section 88 of the Act imposes an additional obligation on an undertaker proposing works affecting the structure of a bridge. The undertaker is required to consult the bridge authority before giving the usual notice. The undertaker is required to comply with reasonable requirements for safeguarding the structure.

- C.4.4.26. Section 63 of the Act permits a street authority to designate certain streets as “streets with special engineering difficulties”. Under this section, an undertaker must submit plans and sections for approval by the authority before street works can be undertaken. This is the only time that drawing details are required. The authority has the power to require modifications if considered necessary.
- C.4.4.27. Section 63 of the Act suggests that the designation of streets with special engineering difficulties may be appropriate at bridges where strength, stability, waterproofing and access for maintenance may be affected. The designation need only apply to the structure and the street directly adjacent and includes areas adjacent to retaining walls where stability may be an issue. Designating all structures under this section is recommended because it gives the greatest control over statutory undertakers working in the proximity of a highway structure, although some sub-sections of Section 88 would not apply in this case.

Obligations of the Street Authority and the Structure Owner

- C.4.4.28. The authority is required to keep a street works register under Section 53 of the Act and to include the streets with special engineering difficulties. All structures that are likely to be sensitive to undertaker’s work should be recorded in the register. The resulting register provides the Bridge Manager with the earliest opportunity to advise undertakers on works likely to affect highway structures.
- C.4.4.29. The Act defines the requirements when undertaking major highway and bridge works. The authority is required to serve notice of the proposed works under Section 58.
- C.4.4.30. Where apparatus is to be diverted for major bridge works (i.e. replacement, reconstruction or substantial alteration of a bridge), the cost of any alterations to the apparatus will be shared providing advanced notice has been served under Section 85 of the Act and the authority pays in advance to the undertaker 75% of the estimated charge to the authority. The Act and codes of practice make provision for the authority’s costs to be reduced to allow for betterment. Also, where the length of apparatus diverted exceeds 100 metres and that apparatus is more than 7 years old a cost adjustment should be made for financial benefit conferred on undertakers by reason of the deferment of the time for renewal of the apparatus. Guidance on the calculation of these sums is also provided in the Act. No costs of diversionary works to apparatus should be borne by the authority when apparatus is placed in the bridge after advance notice has been given. Advance notice may be served up to 10 years in advance of works for the replacement of a bridge and 5 years in advance for all other works. In view of the cost of diverting apparatus, it is recommended that this procedure is followed.
- C.4.4.31. In all cases, there is no obligation on the part of the authority to provide space for additional apparatus in the future. Such an approach may be prudent when reconstructing a structure or carrying out major works in order to minimise problems in the future with inappropriately placed apparatus. Any costs incurred in making provision for additional apparatus requested by undertakers may be charged to them although it is advisable not to allocate spare ducts to undertakers until they need to lay apparatus across the structure.

Regional Variations

- C.4.4.32. The NRSWA 1991 provides for road works in Scotland in Sections 107-165. England and Wales are covered in the earlier sections of the Act and refer to the relevant sections of the Highways Act 1980.
- C.4.4.33. In Northern Ireland the equivalent legislation is contained in The Street Works (Northern Ireland) Order 1995].

SECTION C.5. INSPECTION, ASSESSMENT AND RECORDING – STRUCTURES

C.5.1. INTRODUCTION

- C.5.1.1. The general principles to be applied to inspections, assessment and recording are outlined in Section A.5 of this Code. This section covers guidance for each category of inspection relating to structures.
- C.5.1.2. Inspection, testing and monitoring should be used to:
- provide data on the current condition, performance and environment of a structure, e.g. severity and extent of defects, material strength and loading. The data enables the Bridge Manager to assess if a highway structure is currently safe for use and fit for purpose, and provides sufficient data for actions to be planned where structures do not meet these requirements;
 - inform analyses, assessments and processes, e.g. change in condition, cause of deterioration, rate of deterioration, maintenance requirements, effectiveness of maintenance and structural capacity. The outputs inform asset management planning and enable cost effective plans, which deliver the agreed levels of service, to be developed; and
 - compile, verify and maintain inventory data, e.g. structure type, dimensions and location, for all the highway structures the authority is responsible for.
- C.5.1.3. The above points illustrate that the data provided by inspection, testing and monitoring is fundamental to highway structures management and hence to Good Management Practice. It is essential that authorities recognise the importance of inspection, testing and monitoring and seek to plan, perform, resource, and use them accordingly.
- C.5.1.4. The extent of inspection, testing and monitoring of structures should be determined using a risk based approach, as defined in Section A.5 of this Code. This should consider the position of the structure on the highway network hierarchy and hence, its importance to the overall transport infrastructure, and also the characteristics of the structure itself in terms of its type, material, condition, vulnerability to closure or restriction due to component failure, flooding, impact etc.
- C.5.1.5. Reducing the level of inspection, or increasing the interval between inspections increases the level of risk to the manager/owner of the asset. This should only be carried out using good practice and asset management techniques, such as deterioration modelling. Asset owners should not be put under unacceptable pressure to reduce inspection periods for any reason that may put public safety at risk.

- C.5.1.6. [The Inspection Manual for Highway Structures](#) (Volumes 1 and 2) was commissioned by Highways England and published in May 2007. A Technical Project Board, representing UK highway bridge owners, oversaw the development; the manual is supported, endorsed and recommended by the UK Bridges Board.
- C.5.1.7. The manual contains detailed guidance which covers the following areas:
- The inspection process;
 - scheduling inspections;
 - planning and preparing for inspections;
 - performing inspections;
 - recording inspection findings; and
 - input to maintenance planning process.
 - Defects, descriptions and causes;
 - Principal causes of defects;
 - Concrete defects;
 - Steel defects;
 - Masonry defects; and
 - Defects in miscellaneous materials.
 - Investigation and testing;
 - The testing process;
 - Summary of testing techniques;
 - General testing techniques;
 - Tests on concrete;
 - Tests on metal;
 - Tests on masonry;
 - Tests on timber; and
 - Tests on advanced composites.

C.5.2. INSPECTION REGIME

- C.5.2.1. An inspection, testing and monitoring regime should minimise risks to public safety, provide sufficient data for management and make effective use of resources. The mix of techniques used in the regime, and frequencies at which they are applied, should be determined by considering appropriate criteria in an objective manner, e.g. through a formal risk assessment. The criteria should include, but not be restricted to, public safety, the characteristics of the assets, the consequence of failure, the environment the assets operate in, the services provided, typical rates of deterioration and susceptibility to damage.
- C.5.2.2. The inspection, testing and monitoring techniques should be sufficient to:
- identify condition, defects and signs of deterioration that are significant to highway structure safety and management;
 - identify any significant changes in condition, loading or environment that have occurred since the last observation;
 - assess or provide information for the assessment of stability and serviceability;
 - determine or assist the determination of the cause, extent and rate of deterioration; and
 - provide information that can be used to support highway structures management, i.e. the identification of needs and associated maintenance works.
- C.5.2.3. The inspection regime should enable any defects which may cause an unacceptable safety or serviceability risk or a serious maintenance requirement to be detected in good time in order to safeguard the public and the structure and implement remedial actions. The regime should consist of a combination of Acceptance, Routine Surveillance, General and Principal Inspections of the whole structure and more detailed Safety and Special Inspections (including Inspections for Assessment), as necessary, concentrating on known or suspected areas of deterioration or inadequacy. Guidance on inspections for highway structures is included in [BD 63 Inspection of Highway Structures](#).
- C.5.2.4. All inspections should result in a report, in a format commensurate with the inspection type, which gives a clear and accurate description of the structure's condition.
- C.5.2.5. A procedure should be implemented whereby the inspector has a clearly defined duty to inform the Bridge Manager, at the earliest possible opportunity, of any defects that may represent an immediate risk to public safety.

Routine Surveillance

- C.5.2.6. All structures should be subjected to Routine Surveillance as part of regular Highway Safety Inspections carried out by highway maintenance staff. Routine Surveillance is normally undertaken from a slow moving vehicle. Inspectors should immediately report to the Bridge Manager any obvious defects that are apparent from the vehicle which need urgent attention, such as damage to the superstructure and bridge supports of overbridges, damage to parapets, flood damage, insecure expansion joint plates, etc. The Bridge Manager should be satisfied that the frequency of Highway Safety Inspections is suitable for the Routine Surveillance of highway structures and, if unsuitable, decide how to deal with the need for additional surveillance.
- C.5.2.7. All highway structure management and maintenance staff should be encouraged to be vigilant at all times when moving around the network and to report anything that might need urgent attention. The general public should also be informed of the need to report any highway structure defects they feel may pose a risk to public safety. This is normally best achieved by providing appropriate contact details (e-mail and/or telephone) on the authority's website.
- C.5.2.8. The Bridge Manager should make formal contact with the highway maintenance staff and, if necessary, explain the important features to observe or defects to report on highway structures during Routine Surveillance and the information that should be recorded if a defect is observed, e.g. structure location and defect description. The Bridge Manager's contact details, or the contact details of an appropriate member of their team, should be provided to the highway maintenance staff.

General Inspection

- C.5.2.9. General Inspections comprise a visual inspection of all parts of the structure (that can be inspected without the need for special access or traffic management arrangements) and, where relevant to the behaviour or stability of the structure will include an inspection of the adjacent earthworks or waterways. Riverbanks, for example, in the vicinity of a bridge should be examined for evidence of scour or flooding or for conditions, such as the deposition of debris or blockages to the waterway, which could lead to scour of bridge supports or flooding. Guidance on General Inspections for highway structures is include in [CSS Bridge Condition Indicators Volume 2: Guidance Note on Bridge Inspection Reporting](#) and Addendum to CSS Bridge Condition Indicator Volume 2.

Principal Inspection

- C.5.2.10. Principal Inspections comprise a close examination, within touching distance, of all accessible parts of a structure, including, where relevant, underwater parts and adjacent earthworks and waterways, utilising suitable access and/or traffic management works as necessary. Closed circuit television, high resolution digital photography/video or drones may be used for areas of difficult or dangerous access, e.g. obscured parts of a structure, confined spaces and underwater inspections.
- C.5.2.11. A Principal Inspection may include a modest programme of tests, when considered necessary, e.g. hammer tapping to detect loose concrete cover or half-cell and chloride measurements to enable risk of reinforcement corrosion to be assessed, tests for cement content and measurements of concrete cover and electrical resistivity of concrete (see Section 7.3 of [BA 35](#)).

- C.5.2.12. A Principal Inspection should be of sufficient scope and quality to determine:
- the condition of all parts of the structure;
 - the extent of any significant change or deterioration since the last Principal Inspection; and
 - any information relevant to the stability of the structure and/or continued use in service and safety.
- C.5.2.13. A Principal Inspection should establish:
- the scope and urgency of any remedial or other actions required before the next inspection;
 - the need for a Special Inspection and/or additional investigations; and
 - the accuracy of the main information on the structure held in the inventory.

Special Inspection

- C.5.2.14. There are occasions when a more specific inspection, concentrating on the condition of particular parts of the structure, is required. This is known as a Special Inspection. The need for a Special Inspection normally arises due to specific circumstances or following certain events, for example:
- when a particular problem is detected during an earlier inspection of the structure or of similar structures;
 - on particular structural forms or types, e.g. cast iron structures, post tensioned structures, structures strengthened with bonded plates;
 - on structures that have loading or other forms of restrictions on use, e.g., restriction of traffic on bridges;
 - when the necessary frequency or access arrangements for a particular part of the structure are beyond those available for General or Principal Inspections;
 - on bridges that have to carry an abnormally heavy load - inspections may be done before, during and after the passage of the load;
 - following a bridge strike;
 - following a flood or high river flow to check for scour or other damage;
 - to check specific concerns, possibly based on new information, e.g. concerns over the quality of previously used batches of rebar or concrete; and
 - where a post tensioned bridge has a regime of Special Inspections implemented as a result of an earlier investigation or a Special Inspection is required in accordance with BA 50 Management of Post-Tension Concrete Bridges, organisation and methods for carrying out Special Inspections.

- C.5.2.15. A policy should be developed clarifying when it is appropriate to carry out a Special Inspection. Further guidance on Special Inspections is provided in [BD 63 Inspection of Highway Structures](#).

Inspection for Assessment

- C.5.2.16. This is another type of inspection, which is carried out before a structural assessment. [BD 21](#) provides guidance on undertaking an Inspection for Assessment.

Safety Inspection

- C.5.2.17. A Safety Inspection may be undertaken following Routine Surveillance or after information has been received which indicates the structure is damaged and may be unsafe. The Safety Inspection should determine the extent of the damage and whether immediate safety precautions or other action should be taken. A Special Inspection may then follow to monitor the condition and effectiveness of interim measures and to determine what repair or other actions should be undertaken in the longer-term.
- C.5.2.18. Extreme unplanned events such as storms, high winds and flooding have a significant impact on infrastructure. Bridges are highly susceptible to damage from extreme events. The susceptibility of the asset owner's bridge stock should be reviewed to highlight potential structures at risk. These structures should be inspected following extreme events such as flooding to check on their integrity. Inspecting certain 'at-risk' structures during extreme events should also be considered to allow early closure if the particular risk level warrants closure.

Acceptance Inspection

- C.5.2.19. The need for an Acceptance Inspection should be considered when there is a changeover of responsibility for the operation, maintenance and safety of a structure from one party to another. The purpose of an Acceptance Inspection is to provide the party taking over responsibility for the structure with a formal mechanism for documenting and agreeing the current status of, and outstanding work on, a structure prior to handover. The scope of an Acceptance Inspection depends on the circumstances, e.g. handover of a new structure, transfer of an existing structure, handback of a structure after a concession period. Acceptance responsibilities and activities depend upon the form of contract, but the Acceptance Inspection is normally carried out by the party taking over responsibility but who may be accompanied by the other party to facilitate agreement. The Acceptance Inspection should include:
- the identification of any permanent access provisions and features affecting the safety and security of the structure. These should be discussed in detail and agreement reached before handover;
 - the identification and handover of all the necessary records, maintenance and operating manuals which have an impact on the future management of the structure; and
 - agreement of the date on which the authority takes over responsibility for the structure. The agreement should be recorded in the Structure File.
- C.5.2.20. Acceptance Inspections on new, existing and concession structures should also include the following, as appropriate.

- Handover of a new structure:
 - An Acceptance Inspection should be undertaken for new structures about one month before the issue of the completion documentation or opening to traffic. A Principal Inspection should be used for this purpose. The inspection should identify and record any defects, developing problems and work outstanding under the contract and secure agreement on any works to be completed before handover. This should act as the benchmark for the inspection carried out at the end of the Defects Correction Period and for subsequent inspections.
 - A construction contract normally includes a Defects Correction Period (also referred to as the Period of Maintenance or Defects Liability Period) during which the contractor is responsible for making good defects that appear. The length of the Defects Correction Period should be specified in the contract.
 - An inspection should be undertaken prior to the end of the Defects Correction Period to identify all defects before the expiry of the contractual obligations. The timing of the inspection should be sufficient to allow agreement of the work to be undertaken by the contractor and, if necessary, enforcement of contractual obligations. The inspection may be a General or Principal Inspection depending upon the type and form of the structure and the length of time since handover or the last inspection.
 - Prior to adoption of a new structure, asset information should be obtained, in the appropriate format, and at the appropriate BIM level, for the authority taking over responsibility for a new structure.
 - The ADEPT Bridges Group has published guidance for the [calculation of commuted maintenance sums for structures to be adopted or transferred](#).
 - Authorities may also wish to use the above, or a similar, procedure for accepting major maintenance work.
- Transfer of an existing structure:
 - An Acceptance Inspection should be undertaken prior to an authority taking over responsibility of an existing structure. A Principal Inspection should be carried out as part of the Acceptance Inspection unless the results of a recent Principal Inspection are deemed to be relevant and sufficient. Should there be areas of concern highlighted in the PI such as defects that could impact on the long term durability of the structure then a Special Inspection should be carried out to ascertain the extent and implications of the defect(s) with respect to the structures future lifecycle costs and commuted maintenance sums.
- Handback after a concession period:
 - An Acceptance Inspection should be undertaken before handback at the end of a concession period, e.g. a PFI or PPP type contract. The inspection should compare the current condition and performance of the structure against the measures specified in the contract. This should include a Principal Inspection unless the results of a recent Principal

Inspection are deemed to be relevant and sufficient. This information should be used to identify and agree items of outstanding work to be completed, in order to satisfy the contract measures, before handback. The timing of the Acceptance Inspection should be sufficient to allow agreement of the outstanding work to be undertaken by the contractor and, if necessary, enforcement of contractual obligations.

Inspection Requirements of Other Owners

C.5.2.21. Where other owners have structures within the footprint of the highway, they are responsible for ensuring the safety, integrity and adequacy of those structures for use by the public. The inspection of other owner structures normally falls into two categories:

- **Newer structures** – an appropriate inspection regime is likely to have been recorded in the licence/maintenance agreement; and
- **Older Structures** – there is unlikely to be a statement of inspection requirements in a formal agreement. The Highway Authority only has the power to act to ensure safety in default of action by the other owner when the structure becomes dangerous. A Highway Authority cannot insist retrospectively on a regime of inspection and maintenance to be undertaken by the other owner where there is no clear statement of requirements in a formal agreement.

C.5.2.22. In certain cases an authority can be reasonably confident on the basis of available information that an owner is acting responsibly and has an adequate regime of inspections in place, e.g. Network Rail, Canal & River Trust, Scottish Canals, London Underground Limited. In some cases, however, this conclusion cannot be justified and the Highway Authority should carry out General Inspections of such structures in the wider interests of public safety. This in no way negates the primary responsibility of the actual owner toward public safety and structural integrity.

Frequency of Inspections

C.5.2.23. When a structure is known or suspected to be subject to a rapid change in condition, consideration shall be given into reducing the interval between inspections (for General or Principal Inspection), alternatively the programming of additional Safety Inspections as noted above should be consider to manage the risk of change.

C.5.2.24. The reduced interval should be such that any significant change in condition or circumstances can be identified and assessed in time for appropriate action to be implemented. The revised inspection regime and reasons for more frequent inspections should be recorded in the Structure File. The more frequent inspection regime may be limited to a specific element or feature.

C.5.2.25. When a structure is deteriorating slowly towards the point where it is no longer serviceable, but before it reaches that state, a management plan should be prepared for the structure, with frequencies of inspection, and intervention levels, established by risk assessment, and this should be recorded in the Structure File.

- C.5.2.26. Highway structures are long life assets and their constituent components deteriorate at different rates due to a wide range of factors, e.g. material type, construction form, usage, exposure and maintenance. The suitability of increased inspection intervals should be assessed and justified using a risk assessment, giving due consideration to the following:
- type, quality, extent and results of previous inspections, testing, monitoring, structural assessment, etc;
 - accessibility of all parts of a structure, for example:
 - if the inspector can get close to all parts of a structure during a General Inspection, there may be little difference between the General and Principal Inspection. A Principal (or Special) Inspection may only be required when the need has been identified by a General Inspection; and
 - if the inspector cannot get close to all parts of the structure during a General Inspection and there is a likelihood of significant defects not being detected, there is a need for regular Principal (or Special) inspections.
 - providing suitably current data for calculating the Condition Performance Indicator (Bridge Condition Indicator) and determining the extent and priority of all defects; and
 - the ease of producing practical and workable inspection budgets and schedules, i.e. scheduling may become unduly complicated if different inspection intervals (especially for General Inspections) are used across the highway structures stock.

Risk Assessment

- C.5.2.27. A risk assessment should be specific to a structure or group of similar structures. An assessment method should be developed that seeks to quantify:
- the likelihood of rapid deterioration or other incidents; and
 - the consequence of unchecked deterioration/incidents.
- C.5.2.28. Assessment of the likelihood of rapid deterioration or other incidents should include, but not be limited to, the following criteria where relevant:
- exposure severity, e.g. mild, moderate or severe, and external influences which may cause rapid deterioration or failure, e.g. significant change in use (above, adjacent or beneath), loading that exceeds existing restrictions, stray current/electrical corrosion;
 - current condition and level of contamination, e.g. chlorides or carbonation, and how these conditions may influence the rate of deterioration. The age of the structure may also be considered;
 - material type and the typical rate of deterioration for the observed deterioration mechanism. Many defects are known to take many years to develop to the point where they require maintenance or present a risk to structural integrity or public safety. The maintenance/repair history of the

structure should be taken into consideration and structure specific characteristics such as fatigue-prone details and susceptibility to scour damage, should be considered;

- severity and extent of damage due to incidents, such as vehicle impact, scour and vandalism, and whether this is likely to lead to further deterioration before it is repaired;
- potential mode of failure, e.g. brittle or ductile failure;
- extent of failure, e.g. local or global failure;
- structural form and age; and
- visibility / access to critical elements.

C.5.2.29. Assessment of the consequence of unchecked deterioration and other incidents should include, but not be limited to, the following criteria where relevant:

- consequence of failure of the structure or its elements, e.g.
 - the likely number of fatalities and casualties based on the size of the structure and traffic volume on the route crossed and obstacle crossed;
 - traffic delay costs incurred through diversions/congestion based on the route type and availability of diversion routes;
 - socio-economic impact based on the location of the structure and the community served, e.g. industrial, business or residential;
- increased costs due to unchecked deterioration/incidents resulting in more expensive maintenance work at a later date; and
- to determine in so far as is reasonably practicable based upon the available information and interpretation, when to intervene to close the structure or the road to ensure public safety.

C.5.2.30. The risk assessment should be recorded in the Structure File and agreed by the Bridge Manager before the frequency of inspections is changed. The validity of the risk assessment should be re-confirmed and recorded by the Bridge Manager after each Principal Inspection or when any other significant change in the condition of the structure becomes apparent.

Scheduling Inspections

- C.5.2.31. Inspection scheduling should seek to make the most efficient use of the resources available and minimise disturbance to the public, e.g. plan inspections to take advantage of traffic management planned for other reasons.

Tunnels

- C.5.2.32. The authority should follow the requirements for the inspection of road tunnels given in [BD 53 Inspection and records for road tunnels](#). The inspection categories are the same as for other highway structures but special attention should be given to the requirements for the inspection of the mechanical and electrical equipment (M&E) of the tunnel. This equipment should receive a General Inspection every year and a Principal Inspection every three years.
- C.5.2.33. [BA 72 Maintenance of Road Tunnels](#) and [BD 78 Design of Road Tunnels](#) also provide guidance on aspects of inspections/maintenance.
- C.5.2.34. The Principal Inspection may require removal of cladding, casings and mountings to fans, etc. in order to gain access. In many cases special testing and access equipment may be required and it may be necessary to employ specialist firms. An emergency exercise involving relevant emergency services should be undertaken as part of the M&E inspection.
- C.5.2.35. Acceptance Inspections (of the Principal type) are required at handover of a new or existing road tunnel. There are two classes of Acceptance Inspection: for new road tunnels (including refurbishment of existing tunnels) and for existing road tunnels. These inspections are described in BD 53.
- C.5.2.36. The Tunnel Operating Authority (TOA) is required to keep and update records for all road tunnels for which it is responsible. A comprehensive list of the required records, with their distribution, is given in BD 53.

Inspection of Mechanical and Electrical Equipment

- C.5.2.37. Mechanical and Electrical (M&E) equipment associated with highway structures includes, but is not limited to, lighting and ventilation in road tunnels, lighting in pedestrian underpasses and hydraulic rams on moveable bridges. The stewardship of this equipment may be the responsibility of the Bridge Manager.
- C.5.2.38. An appropriate regime of inspection (and testing) of M&E equipment should be established. The inspection regime should be commensurate with the manufacturer's recommendations.
- C.5.2.39. Useful guidance on the inspection and testing of M&E equipment associated with highway structures is provided in Series 7000 Mechanical and Electrical Installations in Road Tunnels, Moveable Bridges and Bridge Access Gantries MCHW.

C.5.3. MONITORING

- C.5.3.1. Monitoring is the periodic, or continuous, measurement of structural behaviour by visual / electronic means, or other means to record data on deterioration and performance, e.g. deflections, strains and crack sizes. There are many instances where measurements can usefully be repeated periodically, or in rare circumstances taken continuously, so that condition and performance can be monitored over time.

Need for Monitoring

C.5.3.2. Key reasons for undertaking monitoring include:

- during construction to check behaviour;
- after construction as an aid to the future maintenance management;
- where deterioration or damage has occurred and it is necessary to check for further loss of strength, condition or performance;
- on structures that, when assessed to modern codes, have a load-carrying capacity that is below current standards but do not appear to be suffering distress; and
- to determine safety to remain in use.

Selection of Monitoring Techniques/Design of Monitoring Systems

C.5.3.3. Monitoring covers a wide range of applications, from determining the ingress of chlorides into concrete over a period of years to the transient behaviour of a structure as a heavy vehicle passes over it. Typically, monitoring systems may be put in place to determine long-term movements, crack growth, changes in strain (either long-term or short-term) or the corrosivity of the environment.

C.5.3.4. The techniques used depend on the reasons for monitoring, which should be clearly defined at the outset. The aim should be to install the simplest monitoring system that meets the objectives, providing it is sufficiently robust for the specific location. The following issues should be considered when selecting a monitoring system.

- External factors
 - When devising a monitoring system consideration should be given to monitoring the external factors that may influence the property being measured. Temperature, for example, has a major influence on both structural behaviour and the various deterioration mechanisms that occur in highway structures.
- Data collection frequency
 - Where access is difficult or more frequent measurements are required, e.g. to monitor changes due to temperature, it may be necessary to install sensors that can be connected to a data logging system. This is particularly advantageous in those cases where access causes traffic disruption. It is important to consider how the data will be collected, e.g., it could be downloaded locally by visiting the site, or remotely through telephone lines.
 - The interval between readings depends on what is being monitored and the rate at which it is likely to change, e.g., it might be appropriate to repeat certain types of measurement, such as the determination of chloride concentration, every time a Principal Inspection is carried out. Other types of measurement might need to be repeated more frequently, e.g. monitoring crack widths might require weekly or monthly measurements. Monitoring temperatures or strains might require

measurements every hour and recording transient strains might require measurements to be taken several times a second.

- Most monitoring systems can collect data at regular intervals for the period of the monitoring but in other cases data is collected only when an event triggers the monitoring system. An example is the detection of wire fractures in post-tensioned structures using acoustic monitoring. The structure is monitored continuously but data is recorded only after an acoustic event is detected that has the characteristics of a wire break. Another example is the measurement of stresses under traffic loading where the monitoring system is triggered by heavy vehicles and data is collected only during their passage over the structure.
- Monitoring systems can also be designed to process data as it is being collected from the instrumentation. With this setup, if the system is connected by telephone or other transmission system, it can be designed to act as an early warning device, automatically issuing an alarm when pre-defined limits of the parameters are reached. This type of system can be used effectively as part of a risk management strategy.
- Scour
 - [BD97 outlines requirements for the assessment of scour](#) and other hydraulic actions at highway structures crossing or adjacent to waterways. It provides processes to determine the level of risk associated with scour effects. It also includes processes to assess the robustness of structures in a flood, and references to measures for reducing risk.
 - Advice on the monitoring of highway structures for scour is given in [Manual on scour at bridges and other hydraulic structures](#).
 - Scour monitoring and inspection is not straightforward because scour is not normally visible during a flood and scour holes often fill in during the falling stages of a flood. As a result it can be difficult to assess in flood conditions the magnitude of scour holes and determine whether the structure is safe.
- Retaining walls
 - Monitoring the performance of retaining walls can be carried out by measuring movements directly, but sometimes it is more appropriate to use inclinometers, or electro-levels. Loads and moments in walls can be measured using pressure cells and strain gauges. Associated behaviour of the nearby ground can be monitored using inclinometers, pressure cells and piezometers. Installation and monitoring of these devices is a skilled operation and recourse should be made to a specialist.
- Installation
 - Key issues that need to be addressed when considering the installation of a monitoring system include:
 - Environment of installation;

- Maintenance and power supply;
- Data logging capacity; and
- Protection against vandalism.

C.5.3.5. Details of the monitoring system should be included in the Structure File and Health and Safety File, if appropriate, so that others working on the structure are aware of its presence.

Monitoring of Sub-standard Structures

C.5.3.6. Advice on the monitoring of structures that fail a strength assessment is given in BD 79 Management of sub-standard structures. Monitoring interim measures can avoid the disruptive effect of applying load mitigation interim measures.

Evaluation of Monitoring Results

C.5.3.7. Monitoring a highway structure should not be an end in itself but part of a wider strategy for management. Monitoring shall also include the establishment of critical trigger levels to highlight when and where remedial action is required.

C.5.3.8. Monitoring may generate large volumes of data and consideration needs to be given at the outset to its storage, analysis and eventual presentation, to support a focus on what is needed and avoid becoming immersed in data.

Recording and Reporting of Monitoring Results

C.5.3.9. A detailed record should be kept of the monitoring system. The record should include objectives of the monitoring, the equipment used, the location and position of sensors and data logging system (where appropriate), procedures for maintaining the system and collection of data, where the data is stored and how it is analysed.

C.5.3.10. Where necessary, sensors should be calibrated before use and the calibration records maintained in the Structure File for future reference.

C.5.3.11. Action plans shall be developed as part of a proactive management approach to highlight the required interventions when trigger levels are breached.

C.5.4. COMPETENCE AND TRAINING

C.5.4.1. A basic premise of this Code is that highway structures management (including maintenance planning management and structural review and assessment) is carried out by suitably qualified and experienced civil or structural engineers and on-site work (including inspections, testing and maintenance) is carried out by appropriately qualified, trained and experienced personnel.

C.5.4.2. To assist progress towards the good management practice described in the Code, a programme of Continuing Professional Development (CPD) and training for Bridge Managers, engineers, inspectors and other staff should be provided to enable them to understand and implement the processes described in the Code. It is recommended that agents and contractors are required to demonstrate that their personnel are adequately trained and competent for the work they undertake in relation to highway structures.

Bridge Inspection Competence

- C.5.4.3. The capture of condition information on structures is of prime importance in developing effective maintenance strategies. Studies by the ADEPT Bridges Group have identified a lack of consistency in inspection reporting, while the use of asset management plans and decision support tools have created a greater need for better quality inspection data, both in terms of consistency and accuracy. International, high-profile bridge collapses in the United States, Canada and China have increased the importance of rigorous inspection routines.
- C.5.4.4. Competences that a bridge inspector should have include the following:
- structures types and elements / behaviour of structures;
 - inspection process;
 - defects descriptions and causes;
 - investigation and testing; and
 - repair techniques.
- C.5.4.5. A competence framework for Bridge Inspectors, entitled [Bridge Inspector Certification Scheme](#), has been jointly developed by the UK Bridges Board and the Irish National Roads Authority and has been overseen by ADEPT, Department for Transport, Highways England, London Bridges Engineering Group, London Transport Asset Management Board, National Roads Authority of Ireland, Transport for London, Transport Scotland and Welsh Government. The scheme is being run as one of the widely used National Highway Sector Schemes.
- C.5.4.6. The benefits of the scheme are anticipated to include:
- an increase in the profile of Bridge Inspectors via the introduction of a recognised certification scheme across the UK and Ireland;
 - an increase in the quality of bridge inspections resulting from improved levels of consistency both in the training provided to Bridge Inspectors and the reported results from inspections leading to a greater level of confidence;
 - a reduction in risk for bridge owners due to evidence of competence and best practice;
 - costs savings as a consequence of minimised rework and the ability to better prioritise limited maintenance budgets; and
 - increased flexibility for organisations in moving inspection staff around and sharing them with other sectors.
- C.5.4.7. To link with the Bridge Inspector Competence certification scheme, Highways England have produced [Interim Advice Note 192/16](#) and Transport Scotland have released [Interim Amendment 46/16](#), which provide details on the competencies required for structures inspectors and their certification, which supplements the requirements of [BD63, The Inspection of Highway Structures](#).

C.5.5. ASSESSMENT OF STRUCTURES

- C.5.5.1. The purpose of the assessment of a highway structure is to determine the ability or capacity of the structure to carry the loads which are imposed upon it, and which may reasonably be expected to be imposed upon it in the foreseeable future. The assessment provides valuable information for managing the safety and serviceability of highway structures.
- C.5.5.2. A regime of structural reviews should be implemented whereby the adequacy of structures to carry the specified loads is ascertained when there are significant changes to the usage, loading, condition or the assessment standards. A structural review should identify structures which need a detailed assessment.
- C.5.5.3. A prioritised programme of structural review should be put in place to establish the need to assess, or update the assessment of, all structures which have not been designed or previously assessed to current standards. Where a requirement for assessment is identified, such assessments should be carried out in accordance with national standards which are current at the time.
- C.5.5.4. The results of assessments and structural reviews should be recorded, together with relevant data and assumptions, and kept up-to-date and utilised in the planning and management of future maintenance programmes on the structures.

Structural Review

- C.5.5.5. A review of an individual structure or group of structures, within the structures stock, to establish or confirm the validity of its latest assessment (or its original design if there has been no subsequent assessment) is termed a 'structural review'. A structural review should consider all available current information, taking account of the known condition of the relevant structures, their inherent strengths and weaknesses and anticipated effects of any changes, including changes to assessment standards. A structural review should not normally require detailed analysis of particular structures.
- C.5.5.6. Assessment and structural review are key elements of the management process for highway structures to check their safety and serviceability. All structures should therefore be assessed or reviewed against current national standards.

Assessments

- C.5.5.7. Since detailed assessments require considerable effort, an assessment should only be undertaken when a structural review has identified the need for assessment.
- C.5.5.8. The assessment should take account of all available information about the structure including its service performance. In addition, an 'Inspection for Assessment' should be performed to establish the current condition of key structural elements as accurately as is practicable.

- C.5.5.9. The scope of assessment and method of analysis used should be commensurate with the form of the structure, information available and the consequences of a potential shortfall in the assessed load bearing capacity. Assessment of simple structures not showing signs of distress, particularly if details of the hidden parts of the structure are unknown, may be based solely on inspection as permitted by current standards. This would include mass concrete or masonry retaining walls that did not show signs of bulging, cracking, deformation, tilting etc.
- C.5.5.10. Assessment should generally be carried out initially using simple but conservative analytical methods. Where the adequacy of a structure cannot be confirmed, or falls short of requirements using simple methods, progressively more precise and advanced methods should be employed where it is judged that a desired increase in assessed load bearing capacity might reasonably be achieved.

C.5.6. STRUCTURAL REVIEW AND ASSESSMENT REGIME

- C.5.6.1. [BD101 provides a system for Structural Review and Assessment of structures](#), which links the assessment and inspection processes.
- C.5.6.2. The future management of highway structures should include a regime of ongoing structural reviews to ascertain their adequacy to support imposed loads. Such reviews should be undertaken when significant events occur that could increase the imposed loads above those previously assessed for and/or reduce the load bearing capacity of structures. A structural review should be undertaken, for example, when one or more of the following conditions or events occur:
- the structures are known or suspected to have load bearing capacities below those deemed to be appropriate for the class of highway supported;
 - there is a significant change in the regulations governing the configurations and weight limits of vehicles which may use the relevant highway. The impact of such changes would generally have been assessed by the Department for Transport or Highways England and guidelines issued to authorities on the actions to be taken;
 - the hierarchy of the road carried by the structure has changed or is proposed to be changed. The change may modify the density and type of traffic carried resulting in a change to the 'loading class' defined in [BD21 The Assessment of Highway Bridges and Structures](#);
 - records of the original design or subsequent assessment do not exist or have become discredited;
 - the structure has been modified or is proposed to be modified;
 - the structure is on a route proposed for an abnormal load movement, either a Special Order vehicle or an un-common STGO vehicle, for which the structure has not been previously assessed;
 - significant deterioration or damage has been identified by an inspection. Conditions considered would include those found in structures such as arches which may be susceptible to changing condition factors; and

- structural reviews are recommended to follow alternate Principal Inspections when these are done at the frequency included in the Inspection Manual for Highway Structures. Where Principal Inspection intervals have been changed, the interval for structural review should also be determined and noted on the Structure Files.

C.5.6.3. Many highway structures have already been assessed. A prioritised programme of structural review should be put in place to establish the validity of existing assessments, the appropriate periods of review and the need for new assessments for structures that have not been assessed to current standards. The following priorities are suggested in the absence of any other information:

- structures with suspected load bearing capacities below those deemed to be appropriate for the class of highway supported;
- structures built prior to and including 1975, unless known to have been designed to Technical Memorandum (Bridges) BE 1/73 Reinforced Concrete for Highway Structures where appropriate. 1975 broadly corresponds to the cut off for Stage 2 of the Overseeing Organisations' assessment programme in the 1990's, which picked up bridges not designed to the reinforced concrete shear design rules in BE 1/73;
- reassessment of structures that have passed the 40 tonne Assessment Live Load requirement, to determine their capacity to carry abnormal loads. [BD 86/11 The Assessment of Highway Bridges and Structures for the Effects of Special Types General Order \(STGO\) and Special Order \(SO\) Vehicles](#) is a relevant consideration when assessing bridges for abnormal loads;
- structures built between 1975 and 1985. This period saw significant increases in the HA (normal traffic) loading associated with HB (abnormal) loading and the implementation of BS 5400; Steel, concrete and composite bridges; and
- structures built after 1985, if deterioration or other factors indicate the structure may not meet the required operational load bearing capacity and structural integrity may be compromised. Current highway design loading has remained effectively unchanged since BD 37 Loads for Highway Bridges was first published in 1988. However, during the previous two to three years various interim design standards were in place such that 1985 is believed to represent a reasonable date to assume for the introduction of the current design loading criteria.

C.5.6.4. The ADEPT Guidance Document on the [Implementation of Structural Eurocodes](#) was published in December 2010. This document is a relevant consideration when undertaking structural assessments and/or strengthening.

C.5.7. ASSESSMENT PROCESS

Initial Appraisal

C.5.7.1. Most assessments require an initial appraisal to establish what level of assessment is required and whether any additional information in the form of further inspections or testing is needed. The form of this appraisal may vary, but may include a Level 1 analysis.

- C.5.7.2. When sufficient information has been obtained, the appropriate scope of the assessment should be formally agreed between the overseeing manager and the assessor and be subject to a Technical Approval process. The appropriate scope of assessment may range from a judgement based simply on the Inspection for Assessment for a small retaining wall, as allowed by BD 21 The Assessment of Highway Bridges and Structures, to a detailed structural analysis of all parts of a structure based on information from records, inspections and investigations.
- C.5.7.3. Structures that have not previously been assessed generally require an assessment of all load bearing elements. Assessments arising out of identified local damage and/or deterioration may only require assessment of a limited number of elements that lead towards the design of a suitable repair. Depending on the circumstances, there may be variations in traffic loads that may need to be considered.

Inspection and Testing for Assessment

- C.5.7.4. The report on the Inspection for Assessment should include the observations made and comment on the condition of the structure, giving the condition factors required by BD 21 The Assessment of Highway Bridges and Structures. If the condition has deteriorated since the previous inspection, a statement should be included on its importance and, if appropriate, how the deterioration should be taken into account in the assessment calculations. For example, a condition factor might be used or the assessment might be based on a deteriorated (smaller) section of structural elements.

Technical Approval

- C.5.7.5. Technical Approval is the formal arrangement by which the Technical Approval Authority (TAA) agrees the basis on which a structural design or assessment is to be carried out. It confirms the scope and level of the assessment together with the standards to be used and the forms of analysis models that are to be used. Technical Approval extends to formal acknowledgement of completion by the acceptance of appropriate certification. Guidance on the Technical Approval process is given in [BD 2 Technical Approval of Highway Structures](#).
- C.5.7.6. An appropriate system of Technical Approval should be established and an appropriate organisation or individual should be formally appointed to act as the TAA.
- C.5.7.7. The authority and the TAA should jointly maintain an up-to-date list of current design and assessment standards similar to those listed in Annex B of BD 2.

Formal Assessment Analysis

- C.5.7.8. The analysis of a structure to determine its load bearing capacity should employ an approach that is appropriate for the structural form and materials as recommended by national standards.
- C.5.7.9. The three Levels of Assessment as defined in [BD79 The Management of Sub-standard Highway Structures](#) should be considered, and are summarised in Table 8 below.

Table 8 – Levels of Assessment

Level	Requirement
1	Use of simple analysis methods and full partial safety factors from appropriate assessment standards to produce a conservative assessment.
2	Use of a more refined analysis model such as grillage or finite element models. Also allows the determination of actual characteristic strengths based on existing test data deemed to be relevant to the particular structure.
3	Allows the use of Bridge Specific Assessment Live Loading (BSALL). Also allows the use of characteristic strengths or worst credible strengths based on testing of samples of materials from the structure.

- C.5.7.10. The level of analysis should be appropriate to the circumstances. Where initial assessment does not provide the required confidence in the structure, progressively more advanced methods should be employed, taking into account the cost of more advanced analysis and the benefits that might reasonably be gained.
- C.5.7.11. Level 1 may be used for initial assessments, leading to subsequent Level 2 or 3 assessments. Level 1 should only be relied upon as a definitive assessment if it clearly demonstrates the required load bearing capacity of the structure.
- C.5.7.12. Levels 2 or 3 generally provide the degree of confidence required to establish the load bearing capacities of most structures. The additional testing associated with Level 3 should be dependent on whether or not such evidence might reasonably increase the assessed load bearing capacity to a level which is considered appropriate or desirable for the particular structure.
- C.5.7.13. Where practicable, assessment should include an estimate of any reserve load bearing capacity of the structure. Where there is likely to be ongoing deterioration of a structure, assessment should include the determination of critical condition factors.
- C.5.7.14. Where the assessment indicates that a structure is substandard in relation to the requirements of current standards, remedial options should be considered, appraised and a final action recommended. Interim measures (including those necessary to protect the structure and the public) to be taken prior to the implementation of the recommended remedial action, including restriction of use or monitoring if appropriate, should be recommended. All decisions taken need to be appropriately documented.

C.5.8. ASSESSMENTS FOR ABNORMAL LOADS

- C.5.8.1. The principles of managing abnormal loads are dealt with in Section A.4 of this Code. This section contains information on specifically related to structural assessments.
- C.5.8.2. Assessment for the effects of abnormal loads on bridges and other highway structures should be carried out in accordance with [BD 86](#). This standard is based upon a series of “SV” loading models which more closely model the behaviour of real heavy vehicles than the old HB model, and defines how a Reserve Factor should be calculated for each acceptable vehicle.

- C.5.8.3. BD 86 also provides guidance for converting existing HB ratings to equivalent SV ratings to aid correlation of such ratings with the effects of real vehicles. However, this is necessarily conservative and reassessment to BD 86 should be considered for critical bridges.
- C.5.8.4. For Special Order movements (greater than 150 tonne) and, in some special cases, for General Order movements, detailed assessments may be required for particular structures where no alternative route is readily available.
- C.5.8.5. In such cases, for bridges, consideration may be given to limiting Dynamic Amplification Factors and the effects of normal traffic, which might be on a bridge at the same time as the abnormal load. Guidance for such assessments is provided in Annex D of BD 86.
- C.5.8.6. Where an initial assessment shows that the load effects induced by an abnormal load marginally exceed the capacity of a bridge on the route, it may be possible for the abnormal load to safely cross the bridge provided the speed of the vehicle is restricted and other normal traffic is kept clear of the bridge when the abnormal load crosses it. Checks for such situations can be made in accordance with the procedures given in Annex D of BD 86.
- C.5.8.7. An engineer with good experience of Highway Structure Assessments shall undertake the role of Structures Advisor, to whom the Abnormal Loads Officer should refer decisions relating to vehicle movements which fall outside the agreed guidelines which otherwise determine whether or not particular vehicle movements should be accepted.

C.5.9. RECORDING OF ASSESSMENT RESULTS

Assessment Report

- C.5.9.1. Structural assessment results should be fully detailed in a formal report which should consider providing the following information:
- the name, location and any formal identification number of the structure;
 - for bridges, details of obstacles crossed and roads carried;
 - the date and reason for the assessment;
 - an overview of the method of analysis including a description and diagram of any computer model used;
 - any appropriate geological assumptions and parameters;
 - loading details;
 - level of assessment;
 - overall assessed load bearing capacity;
 - identification of any critical elements of the structure;
 - all condition factors used and if relevant, the pavement condition or other variable factors which formed part of the assessment;

- recommendations in respect of any elements having an assessed load bearing capacity below that required or considered desirable;
- guidance on timescale for which the assessment results are expected to be valid and the date or specific circumstances for undertaking a subsequent structural review; and
- the signed AIP and accepted certification should be included in an appendix together with the assessment calculations or reference to other documents containing the calculations.

Basic Records for the Bridge Management System

- C.5.9.2. The basic results of an assessment should be recorded in a standard format common to all of the structures for which the authority is responsible. Ideally the record would take the form of an electronic database.
- C.5.9.3. The level of detail transcribed from the assessment report into the database should be defined by the Bridge Management System adopted by the authority. This could include basic details of each structure including location, form of structure, details of road(s) carried, span arrangements, and designed or assessed load bearing capacity.
- C.5.9.4. Where the results of the assessment are dependent on variable factors such as pavement condition, as allowed by BD 21, there should be a clear feedback to the Highway Authority to ensure that the ongoing requirements form part of the planning process for periodic maintenance. In such cases, committing to a protocol that ensures good stewardship of the surface quality can lead to the benefit of an increased load bearing capacity rating for the bridge. However, poor condition should generally be assumed if that commitment cannot be assured.
- C.5.9.5. Information on reserves in load bearing capacity with respect to both normal and abnormal traffic loading, where available, and critical condition factors for elements susceptible to deterioration should be used in the planning and management of future maintenance programmes on structures.

Additional Records for Critical Structures

- C.5.9.6. A structure that has a load bearing capacity below those of others on a particular section of road is termed a 'critical structure'. This is a technical term unrelated to the [HIAMG](#) definition of 'critical infrastructure'. If the load bearing capacity of a critical structure is below that required for unrestricted normal traffic (typically the 40 tonne Assessment Loading defined in BD 21), it will effectively restrict the whole section of the road to this weight limit. Alternatively, a structure may be critical with respect to the movement of abnormal loads. In either case, it is useful to record additional information from the assessment to aid consideration of what vehicles should or should not be allowed to use the road.
- C.5.9.7. The additional information recorded for critical structures (particularly bridges) could include:
- details and load bearing capacities of all potentially critical elements with live load capacities up to 15% higher than the governing element/capacity;

- load ratings in terms of HB units and all relevant Reserve Factors against SV vehicles as defined in BD 86 The Assessment of Highway Bridges for the Effects of Special Types General Order (STGO) and Special Order (SO) Vehicles;
- if practicable, lane influence lines for critical effects together with the associated limiting load bearing capacities; and
- for arches, details of the bogie configurations considered and their associated maximum axle loads.

C.5.10. INTERIM MEASURES AND MANAGEMENT OF SUBSTANDARD STRUCTURES

- C.5.10.1. A structure which does not meet the requirements of standards used in its assessment is termed a 'substandard structure'. The assessment of a substandard structure should identify the appropriate remedial action required to maintain its safety.
- C.5.10.2. Prior to strengthening or replacement, all substandard structures should be considered as representing a risk to the public. Where such works have to be deferred, detailed risk assessments should be undertaken and where appropriate interim measures should be implemented as soon as possible.
- C.5.10.3. If there is deemed to be an immediate risk to public safety, [BD 21](#) and [BD 79](#) require that formal interim measures which would effectively mitigate the risk, be put in place until the identified remedial action is implemented. These measures may include:
- weight or width restrictions plus monitoring;
 - propping or temporary bridge plus monitoring;
 - closure and diversion of traffic; and
 - deterring vehicles over-running substandard areas of structures.
- C.5.10.4. BD 79 also provides guidance on the short to medium term management of structures where the immediate application of any of the above measures may not be practicable.
- C.5.10.5. In particular BD 79 provides guidance on the use of weight restrictions and/or the application of monitoring to appropriate structures, and provides a Technical Approval framework for agreeing such measures.
- C.5.10.6. BD 79 indicates that structures that satisfy **all** the criteria in 1, 2 and 3 below and additionally small span bridges as described in 4, may be considered to be appropriate for monitoring subject to Technical Approval.
1. Structures with no significant signs of distress, or structures where distress is observed which does not appear to be recent or significant and detrimental to the safety of the structure.
 2. Structures where failure is likely to be gradual over time, progressing from local signs of distress to more extensive failure before reaching the point

where total collapse is precipitated. It must also be possible to predict the mode(s) of failure under traffic load with reasonable certainty.

3. Structures and situations where monitoring would be meaningful and effective.
4. Bridges of spans less than 5 metres where the consequences of failure are low.

SECTION C.6. PROGRAMMING AND PRIORITIES – STRUCTURES

C.6.1. INTRODUCTION

- C.6.1.1. Programming and priorities are dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Part B](#). This document should be referred to and the advice below considered supplementary.
- C.6.1.2. The general principles to be applied to programming and priorities are outlined in Section 8 of Part A of this Code, with this section covering guidance relating to structures.
- C.6.1.3. Highway structures are exposed to a wide range of naturally-occurring and man-made factors that lead to, or directly cause, deterioration. In addition, the highway network is a dynamic system with changing user demands, some of which may be reflected in changes to codes and standards. The purpose of maintenance is to repair damage caused by deterioration, vehicle impact or vandalism, slow down or prevent the deterioration process and, where appropriate, meet the changing demands of users.
- C.6.1.4. The purpose of maintenance planning and management is to enable the Bridge Manager to develop and implement cost effective and sustainable maintenance plans for highway structures that support the safe operation of the network while delivering the required asset performance and levels of service. The maintenance planning and management process enables the Bridge Manager to deliver the authority's long term goals and objectives by developing maintenance plans that align with and provide detail to the work volumes and phasing identified in the Asset Management Framework.
- C.6.1.5. Maintenance planning should adequately support the safe operation of highway structures. Performance levels should be identified at which a structure or component is considered to be sub-standard and which, if left unmanaged, may result in the structure becoming unsafe. Identifying minimum safety and performance levels assists the prioritisation of needs and development of maintenance plans.
- C.6.1.6. Authorities should be suitably prepared for urgent safety and stability concerns and emergencies and deal with them effectively when they occur. An emergency response procedure should be developed for this purpose and documented, and an associated emergency budget determined.

C.6.2. CLASSIFICATION OF WORK TYPES

C.6.2.1. An important feature of maintenance planning is the appropriate classification of all items of maintenance work. Classification provides a beneficial tool for analysing the workbank and removing appropriate work types from the Value Management and Value Engineering phases, i.e. regular and reactive maintenance. Eleven work type definitions grouped under three headings are given below that cover the majority of operational activities. These work types and the terminology should be used to provide clarity to work volumes identified in plans, i.e. Asset Management Framework, Forward Work Plan and Annual Work Plan.

1. Regular Maintenance

- a. Inspections – covers all inspection types, i.e. Safety, General, Principal and Special. Inspections include confined space inspections, boat inspections, underwater inspections and special follow-up investigations identified from the inspections;
- b. Structural Reviews and Assessments – structural reviews should ascertain the adequacy of structures to carry the specified loads when there are significant changes to usage, loading, condition or the assessment standards. A review should identify structures which need a structural assessment. An assessment quantifies the load bearing capacity of the structure in accordance with the appropriate current standards;
- c. Routine Maintenance – minor work carried out on a regular or cyclic basis that helps to maintain the condition and functionality of the structure and reduce the need for other, normally more expensive, maintenance works. Examples of routine maintenance common to highway structures include cleaning out expansion joints and drainage systems, greasing of metal bearings, removal of vegetation, removal of blockages in watercourses including removal of silt; and
- d. Management of Substandard Structures – normally constitutes implementing interim measures to protect users of substandard structures and may include monitoring. Guidance is given in [BD79 The Management of Sub-Standard Highway Structures](#).

2. Programmed Maintenance

- a. Preventative Maintenance – work carried out to maintain the condition of the structure by protecting it from deterioration or slowing down the rate of deterioration. Preventative maintenance is justified on economic grounds because it provides minimum whole life cost maintenance. By timely intervention preventative maintenance reduces the need for essential work and/or the likelihood of essential work arising prematurely in the future. Examples of preventative maintenance include re-pointing, repainting, minor defect repairs, silane impregnation, cathodic protection and re-waterproofing. Re-surfacing is not included because it is considered to be a road maintenance activity;

- b. Component Renewal – renewal of components that have a finite service life, e.g. bearings and expansion joints;
 - c. Upgrading - work that brings an existing structure up to the appropriate current standard, e.g. strengthening, upgrading parapets, waterproofing. The work may have resulted from a change to standards or a change in requirements for the structure, e.g. enhanced network levels of service;
 - d. Widening and Headroom Improvements – increasing the width or headroom of the existing structure. These improvements are generally considered to be network issues unless arising due to structural maintenance requirements; and
 - e. Replacement – a structure/component is replaced when it reaches the end of its useable life, excluding cyclic Component Renewal item (2b) above. The replacement structure/component restores the full design performance of the structure/component it replaces (if the performance is enhanced it is classified as an upgrade – item (2c) above).
3. Reactive Maintenance
- a. Emergency – work that must be dealt with immediately due to the high risk the situation poses to public safety, e.g. caused by accidents such as bridge strikes; and
 - b. Essential Maintenance – major structural repair work and especially that undertaken when part or all of a structure is considered to be, or about to become, structurally inadequate or unsafe, or unpredictable in its deterioration. Examples of essential maintenance include major concrete, masonry and steelwork repairs, and scour repairs.

C.6.3. INPUTS TO THE PLANNING PROCESS

C.6.3.1. Maintenance planning and management is an on-going activity and as such, requires up-to-date and relevant information on structural condition and performance, to ensure the correct work is being planned and to assess the effectiveness of previous work. Relevant condition and performance inputs to the maintenance planning and management process include, but are not restricted to:

- **Inspection, testing and monitoring** – inspections, primarily General and Principal Inspections, generally provide the most up-to-date and comprehensive data on the condition of highway structures, and as such are a key input for maintenance planning. Inspections are sometimes supplemented by testing and monitoring;
- **Assessment of structures** – structural reviews identify structures that require a structural assessment, while structural assessments identify sub-standard structures. Resources are required for the structural reviews and assessments and for dealing with sub-standard structures. These should be taken into account in the planning process; and

- **Other** – may include incidents, emergencies and reports from the police or public, e.g. bridge strikes, scour damage from a flood, loose bricks.

C.6.3.2. The above data enables a response to any urgent needs or emergencies and to plan work based on the actual current condition and performance. It also allows the maintenance planning process to provide the essential detail to the generic work volumes and phasing produced by the long term asset management planning process.

C.6.4. DETERMINE CURRENT PERFORMANCE

C.6.4.1. The asset inventory, condition and performance data should be used to determine the current performance of the highway structures in a way that supports the identification of needs and Value Management. Much of the information should be in a format that can be readily used for identifying needs, for example element condition data and assessed capacity. Some data may require manipulation in order to provide information that assists identification and Value Management, for example, structure specific Performance Indicator values.

C.6.4.2. The current performance should be determined for individual elements and/or structures using absolute measures, e.g. severity and extent of a defect or assessed capacity of a structure. The description of current performance should be commensurate with the level of detail required for short term maintenance planning. This implies a greater reliance on absolute measures that describe current condition and performance in detail rather than performance measures. Performance measures are more suited to determining performance in the long term asset management planning process.

C.6.5. IDENTIFICATION OF NEEDS

C.6.5.1. The purpose of this task is to identify and document all maintenance required on highway structures and the associated cost estimates. The documented maintenance needs and costs are referred to as the structures workbank. The structures workbank forms the basis of the subsequent Value Management and Value Engineering processes.

C.6.5.2. A formal approach to the identification of needs should be developed but the Bridge Manager should be aware that maintenance needs can arise due to a wide range of factors, some of which may not be covered by a formal approach. Common criteria that should inform the identification of needs are:

- assessment of condition and performance data by a suitably qualified and experienced engineer to identify needs;
- development of lifecycle plans to identify maintenance cycles and intervention thresholds; and
- identification of regular maintenance needs (e.g. inspections, structural reviews and assessments and routine maintenance) and planned improvement/development schemes.

- C.6.5.3. The following sections describe the above criteria in more detail. Some modern structures also have Maintenance Manuals as required by Appendix A of [BD 62 As Built, Operational and Maintenance Records for Highway Structures](#). These should also be used to inform the identification of needs.

C.6.6. CONDITION AND PERFORMANCE DATA

- C.6.6.1. The condition and performance data should be reviewed periodically by a suitably qualified and experienced engineer to identify maintenance needs. It is recommended that General Inspection pro forma are reviewed and signed off no longer than two months after the inspection, but preferably within one month. Thereby the signing off and identification of needs are combined. Some authorities may also wish to combine data entry with these tasks.
- C.6.6.2. This exercise is heavily dependent on the engineer's knowledge of the elements/structures and the appropriate methods for dealing with the needs. As a minimum, the engineer should have knowledge of a range of appropriate maintenance techniques and in which circumstances the techniques should be applied.
- C.6.6.3. The Bridge Manager may wish to define some generic rules/guidelines, which define when a particular maintenance method should be used. These rules/guidelines are normally defined in the lifecycle plans (see below), but may need to be defined separately for situations that the lifecycle plans do not cover, e.g. when elements deteriorate below the intervention thresholds defined in the lifecycle plans and may require alternative maintenance techniques.

C.6.7. LIFECYCLE PLANS

- C.6.7.1. Lifecycle plans should be used to identify needs on specific structures and elements. The cyclic/intervention rules established in the lifecycle plans are compared against the current condition and performance of a structure/element and the specific characteristics of the structure are assessed to determine if the lifecycle plan activity is appropriate, i.e. the lifecycle plans should be used as general guidance when identifying specific maintenance needs.
- C.6.7.2. Where appropriate, lifecycle plans should be amended through the maintenance planning process because the bridge engineer is undertaking a more detailed review of needs compared to asset management planning. Such amendments should then be passed back to asset management planning to improve long term work predictions.
- C.6.7.3. A lifecycle plan should be developed for each structure group/sub-group. Refinement of the groups and sub-groups may prove beneficial as it allows greater management planning control through more targeted lifecycle plans, but more knowledge of deterioration rates and mechanisms is required.
- C.6.7.4. Lifecycle plans should be developed using whole life costing, if appropriate, in order to establish the most cost-effective approach. Whole life costs should not be the sole consideration and other issues such as asset performance and network safety should also be considered where relevant.

- C.6.7.5. [A Good Practice Guide on Lifecycle Planning for Highway Structures](#) has been published by the London Bridges Engineering Group (LoBEG). This is a useful reference document providing a step-by-step approach on structure specific lifecycle planning and whole life costing. The Good Practice Guide is accompanied by a computerised Lifecycle Planning Model and associated User Guide.
- C.6.7.6. [The Structures Asset Management Planning Toolkit](#) was developed by the Highways Asset Management Finance Information Group (HAMFIG), with ownership taken by the UK Bridges Board. It was developed to provide a tool to undertake lifecycle planning and asset valuation of structures in accordance with the CIPFA Code of Practice on Transport Infrastructure Assets (since August 2016 this has been renamed the [Code of Practice on the Highways Network Asset](#)).
- C.6.7.7. In Scotland and Wales, guidance and lifecycle planning tools are available to members of the SCOTS/CSSW Roads Asset Management Project group via the RAM Knowledge Hub. Cost projection tools are available for structures and other asset types.

Routine Maintenance Regime

- C.6.7.8. Highways England has a well-developed routine maintenance regime which is described in the [Routine and Winter Service Code](#). This comprises tasks such as removing graffiti, removing vegetation, clearing debris and bird droppings from components, clearing drainage systems, repairing gap sealant, cleaning sliding and roller surfaces of bearings and re-greasing, checking and, if necessary, tightening fixings on deck movement joints and removing debris and silt from culverts.
- C.6.7.9. Highways England considers that, whilst many of these tasks are fairly minor in themselves, failure to carry them out may lead to deterioration of the structure and the need for more costly repair operations in the future. Highways England considers that generally a routine maintenance regime is cost effective in whole life terms.
- C.6.7.10. Authorities are recommended to follow the guidance provided in the Routine and Winter Service Code and establish an appropriate routine maintenance regime for highway structures. In doing so particular consideration should be given to the following points:
- Removal of graffiti – whilst the removal of all graffiti is commendable in improving the local environment, it can be an expensive operation if the graffiti is persistent. Some authorities have therefore decided only to remove racist or obscene graffiti (generally as soon as it is reported), unless there is little likelihood of more appearing in the medium term or there is an area-wide clean-up campaign organised by the local council or community body with the intention of keeping the area clean. Some urban authorities remove all graffiti in order to meet council objectives and tourist expectations; they accept this is a significant and essential expense; and
 - Repair of gap sealant – sealant has often been specified by designers for gaps/joints where it is not essential and as a result some authorities have decided only to repair sealant where it is required. Examples include open joints that are visually unacceptable (but are not prone to vandalism) or where

replacement will help prevent ingress of water which could lead to frost damage, corrosion of metalwork or reinforcement or unacceptable staining.

Structures Workbank

C.6.7.11. The structures workbank is a database of all work that is currently outstanding on the network, including estimated costs for doing the work. It is recognised that certain work types by their very nature, e.g. re-active maintenance, cannot be planned in detail in advance but the workbank should still include a volume of work for these, albeit on unknown structures, based on past experience and engineering judgement. A workbank format should be established that is appropriate to local, and if appropriate, national needs. Figure 3 highlights three possible approaches.

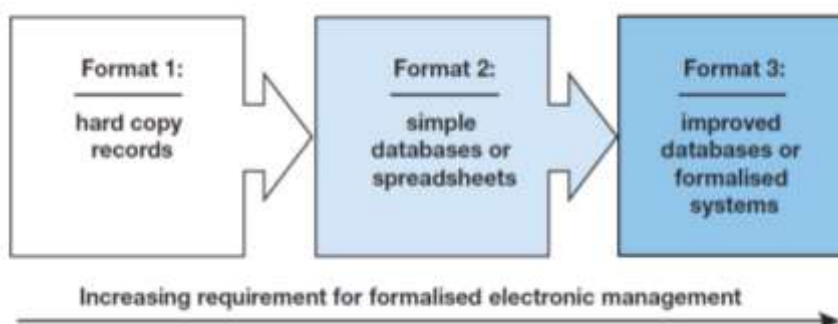


Figure 3 – Possible formats for the structures workbank

C.6.7.12. The workbank should include a full list of all maintenance required on the structures stock. The workbank should provide the following information for each item of work:

- name and number/reference of the structure;
- element where work is required;
- defect, including severity and extent (if appropriate);
- required work;
- work type;
- recommendation for when the work should be undertaken, i.e. which year; and
- estimated cost.

C.6.7.13. The full list of information is taken forward to the Value Management and Value Engineering phases. Once work has been undertaken it should be identified as completed and removed from the workbank.

C.6.8. VALUE MANAGEMENT

- C.6.8.1. Value Management is used to prioritise the identified needs compiled in the structures workbank. This process is the planning (including value engineering if appropriate), scheduling and implementation of non-value managed work. The workbank identifies all work, not only value-managed work, and all the work needs to be appropriately managed.
- C.6.8.2. Value Management should be used because it provides a formalised approach for assessing the benefits of undertaking maintenance and the associated risks of not undertaking maintenance. The risks and benefits should cover hard issues, e.g. condition and assessed capacity, that can be assessed objectively and soft issues such as local importance, customer feedback and synergies with other work that may need to be assessed subjectively.
- C.6.8.3. The outcome of the Value Management process should be a prioritised list of actions in the structures workbank that is taken forward to the Value Engineering process. It should also identify where there will need to be an option appraisal in the Value Engineering process.
- C.6.8.4. Value Management should not be a complex and overly involved process. It should cover the appropriate criteria in a manner that enables engineers readily to compare and identify a priority score.
- C.6.8.5. The full Value Management process is only appropriate for major schemes. A simplified process should be used to deal with common types of moderate and minor maintenance.

Value Management Regime

- C.6.8.6. A Value Management regime should be established that identifies the frequency of review and the approach to be taken. The regime should identify:
- **Value Management frequency** – some activities may be performed on a continuous basis, e.g. automated prioritisation of needs based on objective criteria. Other, more subjective criteria, e.g. local importance, are best analysed at regular intervals when one or more appropriate staff can review the latest needs. Value Management reviews or workshops held at least once every year, but preferably every six months, are likely to be appropriate for most authorities;
 - **Prioritisation criteria** – the criteria considered during the Value Management process to prioritise needs. They may be objective or subjective in nature; and
 - **Value Management review/workshops** – the staff to be involved in the Value Management review or workshop and the format this activity should take.
- C.6.8.7. The Value Management regime should be appropriate to the size and characteristics of the highway structures stock.

Prioritisation Criteria

- C.6.8.8. The Value Management process should be developed by suitably qualified and experienced staff who have a sound understanding of maintenance requirements and an awareness of longer term goals and objectives, as identified in the Asset Management Framework. The process should be transparent, encompassing the important prioritisation criteria, but it should also be flexible enough to assess a wide range of work and structure types. The sensitivity of the process to each prioritisation criterion should be fully trialled and the output assessed, possibly against predefined expectations.
- C.6.8.9. The Value Management process should include a range of prioritisation criteria that are appropriate to the characteristics of the highway structures stock and network. As a minimum, prioritisation criteria should be considered that relate to the following three categories:
- **Safety and functionality** – criteria in this category should seek to use information from the asset inventory and database to rank the importance of the need. Examples of criteria that could be considered are structure type, structure location, route carried, obstacle crossed, element condition, assessed capacity, height restriction and traffic flow restrictions. The criteria considered should influence the prioritisation score in an appropriate manner, e.g. as condition deteriorates the prioritisation score increases, as route classification increases the prioritisation score increases;
 - **Benefits and dis-benefits** – criteria in this category should seek to quantify in a simplified manner, the benefits and dis-benefits produced by addressing and not addressing a need. It may be more appropriate to use engineering judgement rather than an automated procedure. If the former approach is used it should be guided by a simple classification procedure, e.g. High, Medium or Low benefit/dis-benefit. Examples of benefits/dis-benefits that should be considered include lower or higher whole life costs, reduced or increased journey times, minimisation of network disruption, and integrating work items to achieve cost savings; and
 - **Socio-economic and environmental** – criteria in this category should cover the softer issues that cannot be readily quantified by an automated prioritisation process, e.g. local policies, user/customer perception, impact on local communities and businesses, environmental impact and sustainability considerations. A formalised approach should be developed that allows the reviewer, or workshop attendees, to quantify criteria easily, e.g. High, Medium or Low impact.
- C.6.8.10. Many of the above criteria can be assessed through a formalised risk analysis and risk assessment approach.
- C.6.8.11. During the development of the Value Management process, careful consideration should be given to the weighting of each criterion. While it is recognised that safety will be a motivating factor other issues should be addressed to ensure a balanced work programme, e.g. priorities of the Asset Management Framework. Otherwise the process may focus solely on more apparent maintenance needs and fail to address preventative maintenance requirements. The system should also provide robust and justifiable prioritisation scores.

C.6.8.12. The level of refinement depends upon the complexity of the network and the number of issues that have to be accounted for. The adopted system should allow for future development and have the ability to cope with increasingly complex situations.

Value Management Review/Workshop

C.6.8.13. The prioritisation criteria should be challenged in a formal Value Management review or workshop. In the context of this Code, a review is performed by one person, preferably the Bridge Manager, and a workshop is attended by more than one appropriately qualified and experienced person.

C.6.8.14. The review/workshop should assess each need in turn and give it a final prioritised score. The starting point for the review/workshop may be:

- **Un-prioritised workbank** – in this case the review/workshop must address all the prioritisation criteria. It is advisable to use a small number of important criteria in order to avoid the review becoming overly complex; and
- **Semi-prioritised workbank** – in this case an automated prioritisation would have already been performed based on the asset inventory and database information (primarily using the safety and functionality criteria). The review or workshop should therefore concentrate on the softer prioritisation issues that may not be appropriate for automation, e.g. **socio-economic and environmental**.

C.6.8.15. The cost estimates for the prioritised needs are compared against the 1 to 3 year funding plan. Starting at the top of the prioritised list, i.e. taking the most critical need first, the cost estimates are added together until they equal the 1 to 3 year budget.

C.6.9. VALUE ENGINEERING

C.6.9.1. Value Engineering is the process of developing an optimal solution to a maintenance need and reducing waste and inefficient aspects of design, construction and maintenance [Achieving Excellence in Construction]. Value Engineering takes the prioritised needs from the Value Management exercise and creates cost effective schemes that can be planned, scheduled and implemented.

C.6.9.2. The two key components of Value Engineering are option appraisal and scheme development. Important criteria that feed into these components include maintenance options and standards, Whole Life Costing and synergies with other schemes. Option appraisal, scheme development and Whole Life Costing are described below.

C.6.9.3. The full Value Engineering process is only appropriate for major schemes but a simplified process should be used to deal with moderate and minor works, where minor works should be grouped into those of a similar type to streamline the process.

Option Appraisal

- C.6.9.4. Option appraisal is necessary to identify the appropriate maintenance solution when there is more than one practical alternative for addressing the maintenance need. There may be only one practical maintenance option for many of the identified needs and it may have already been determined from the Identification of Needs and Value Management exercises. When there is only one practical maintenance solution, option appraisal is not required and the work item can be passed through to the scheme development process.
- C.6.9.5. The Value Management phase should have flagged up needs that are suitable for option appraisal. These needs should now be assessed by suitable personnel in order to identify the practical maintenance options. Personnel suitable for assessing options may include:
- Bridge Manager/engineer and other suitably qualified and experienced staff within the authority; and
 - external consultant and contractor staff with suitable experience and preferably a sound knowledge of the structures and network.
- C.6.9.6. It is beneficial to involve the aforementioned personnel as early as possible in the exercise as this may lead to alternative proposals that benefit the network and lead to long-term savings. Early contractor involvement may enable the cost of work to be more robustly informed and effectively assessed. This process increases confidence levels and makes achievement of the planned work regime more likely.
- C.6.9.7. The options should be analysed using Whole Life Costing to identify the most cost effective solution. Larger maintenance or improvement needs may merit the use of more sophisticated analysis techniques that account for a wider range of socio-economic issues, e.g. Multi Criteria Decision analysis. Expert advice should be sought regarding the suitability of applying more sophisticated techniques.
- C.6.9.8. Large upgrade or improvement schemes may require a formal public consultation exercise. In such cases, authorities should identify appropriate parties to include in the consultation, e.g. local residents and businesses, and give them a suitable opportunity to comment on the options proposed.

Scheme Development

- C.6.9.9. Scheme development is the effective combination of individual work items into schemes, in which each item makes best use of available funding and resources.
- C.6.9.10. Procurement routes have a major effect on scheme development and out-turn costs. Senior managers, Bridge Managers and budget holders should be involved in the choice of procurement routes. In choosing a procurement route due consideration should be given to obtaining value for money, monitoring quality and rewarding or penalising good/poor quality respectively. The adoption of supply chain partners helps in the effective choice of maintenance solutions because advice can be sought at an earlier stage. Early contractor involvement is one method available.

- C.6.9.11. The scheme development process should focus on the minimisation of network disruption and minimisation of whole life costs without compromising other important aspects such as appearance, access arrangements, environmental and sustainability issues, etc. It should be recognised that it may not be possible to minimise both network disruption and whole life costs and a compromise may have to be accepted. When developing schemes a number of alternative techniques are available for combining work items, each having different outcomes. Commonly used techniques include:
1. **Combine different work items on one structure** - addresses all actions on one structure thereby creating one period of longer network disruption compared to several interventions of shorter individual disruption but possibly longer total disruption. This technique may have relatively high scheme costs because the contractor has to mobilise for a range of activities and possibly more than one contractor is required;
 2. **Combine similar work types** – a scheme of works that concentrate on one specific work type or similar work types. This technique should achieve cost savings by procuring the work in bulk because mobilisation fees are reduced and the contractor is provided with a steady work stream. A disadvantage is increased network disruptions at a particular location because different contractors may visit one structure in order to carry out their specific activities; and
 3. **Combine schemes based on route or area** – this technique is similar to technique 1 above except that it is extended to cover a series of schemes on a route. It should achieve cost savings by procuring the work in bulk because contractor mobilisation fees are reduced and they are provided with a steady work stream. A disadvantage is that a number of contractors are likely to be required, leading to the possibility of programme extensions, site conflicts and continued network disruption over a short period.
- C.6.9.12. The developed schemes are used to prepare the Forward Work Plan.

C.6.10. PREPARE FORWARD WORK PLAN

- C.6.10.1. The Forward Work Plan is a detailed 1 to 3 year programme of work. This provides details of the schemes to be carried out in the 1 to 3 year period and their approximate annual phasing.
- C.6.10.2. The Forward Work Plan should draw together all the work that has passed through the Value Management and Value Engineering phases, i.e. developed schemes, and non-value managed work, e.g. inspections, structural assessments, routine maintenance and management of substandard structures.

C.6.11. MONITORING, REVIEW AND FEEDBACK

- C.6.11.1. The Annual and Forward Work Plan should be regularly monitored and reviewed to assess work delivery, i.e. planned programme and costs vs actual. Changes may be required to the planned schedule of works if it has deviated significantly from the original plan. Feedback loops should also be implemented to assess and record out-turn costs and the quality of the final solution (this data may also inform improvements).

- C.6.11.2. The workbank should be continually reviewed to check that maintenance needs are being properly addressed and removed from the workbank once acted upon. It is helpful to record the dates when the scheme is included and removed from the workbank so the turnaround can be monitored.

C.6.12. IDENTIFY IMPROVEMENTS

- C.6.12.1. The Bridge Manager should continually seek to improve the efficiency and effectiveness of the maintenance planning and management process. Improvements to the maintenance planning and management process may align with improvements to the long term asset management planning process, and the Bridge Manager should seek to combine the work required on these improvements where appropriate.
- C.6.12.2. Feedback from inspections and maintenance work should be used to improve the accuracy and development of lifecycle plans and maintenance strategies. Out-turn costs should be used to improve workbank cost estimates, whole life costing and asset management planning.

C.6.13. STRENGTHENING PRIORITISATION BASED ON BD 79

- C.6.13.1. *BD 79 The Management of Sub-Standard Highway Structures* lists the factors which should be taken into account in any prioritisation of strengthening work. These include:
- risk of structure collapsing;
 - traffic delay costs caused by interim measures;
 - other social, environmental and economic consequences caused by interim measures;
 - the negotiability of alternative routes;
 - the cost-effectiveness of the strengthening (ratio of costs and benefits); and
 - other benefits from scheme.
- C.6.13.2. A Good Practice Guide on [Maintenance Prioritisation for Highway Structures: Phase 1](#) has been published by London Bridges Engineering Group (LoBEG).

WELL-MANAGED HIGHWAY INFRASTRUCTURE PART D. LIGHTING

SECTION D.1.

INTRODUCTION TO PART D – LIGHTING

D.1.1. INTRODUCTION

D.1.1.1. Part D of Well-managed Highway Infrastructure covers specific issues and themes regarding lighting, and includes the following asset types:

- lighting columns;
- lighting units attached to walls/wooden poles;
- heritage columns;
- illuminated bollards;
- illuminated traffic signs;
- columns and foundations;
- brackets;
- luminaires;
- control equipment, cables; and
- control gear, switching, internal wiring cabling (within ownership).

D.1.1.2. The overarching principles and common themes of maintaining highway infrastructure are covered within Part A. Asset specific guidance for highways and structures are covered in Part B and Part C respectively.

D.1.1.3. The [Management of Electronic Traffic Equipment](#) is covered within a separate Code of Practice.

D.1.1.4. The objectives of this Part of the Code are as follows:

- to encourage delivery of the right quality and amount of light in the right place and at the right time;
- to support a risk based approach for lighting management that is suitably recorded and documented;
- to deliver value for money through the adoption of appropriate technology;
- to encourage the development, adoption and regular review of policies for lighting operation and maintenance, consistent with the wider principles of integrated transport, crime reduction, sustainability and best value;

- to encourage harmonisation of lighting maintenance practice, where this is consistent with user expectations, whilst retaining reasonable diversity to accommodate local requirements; and
- to encourage the adoption of an efficient and robust approach in the collection, processing and recording of lighting asset inventory and condition data for the purpose of local and national needs assessment, including:
 - scenario planning and investment modelling;
 - management;
 - performance monitoring; and
 - electricity purchase.

D.1.2. FURTHER GUIDANCE

D.1.2.1. Guidance on general best practice and recommendations can be found on the following websites:

- [The Institution of Engineering and Technology;](#)
- [The Institution of Lighting Professionals;](#)
- [The London Lighting Engineers Group;](#)
- [The Highway Electrical Association;](#)
- [The Scottish Futures Trust;](#)
- [TRL;](#)
- [ADEPT; and](#)
- [Transport Advice Portal.](#)

Reduced Lighting

- D.1.2.2. Increases in electrical energy charges have placed additional burdens on Local Authority budgets. As a result some Authorities have responded by reducing the period of operation of their highway lighting installations (for example instead of from dusk until dawn to perhaps dusk until midnight and then from 05:00hrs to dawn) or in some cases by switching off parts of the installation completely. The alternatives to the reduction or removal of street lighting should be considered such as the “[invest to save](#)” approach.
- D.1.2.3. Work funded by the ADEPT, Transport Scotland, SCOTS and TfL has resulted in detailed case studies which have been published as free downloads from the [TRL website](#).
- D.1.2.4. [The LANTERNS report](#) considered the risks of reduced lighting. The full report is available free from the Journal of Epidemiology and Community.

SECTION D.2. LEGAL FRAMEWORK – LIGHTING

D.2.1. INTRODUCTION

D.2.1.1. General duties and powers are dealt with in Part A of this Code. This section contains information on duties and powers specifically related to lighting.

D.2.2. LIGHTING SPECIFIC LEGAL CONSIDERATIONS

D.2.2.1. There is no statutory requirement on local authorities in the United Kingdom to provide public lighting. The following statutes empower local authorities to light roads but do not impose a duty.

D.2.2.2. In England and Wales, the [Highways Act 1980](#) empowers a Highway Authority to provide lighting for any highway or proposed highway for which they are, or will be, the Highway Authority. District Councils and many Parish or Town Councils also have the power to provide lighting as local lighting authorities; these powers being conferred by the Public Health Act 1985, or the Parish Councils Act 1957. Where such Councils wish to provide lighting on a highway, the consent of the Highway Authority is required.

D.2.2.3. In Northern Ireland, the Roads (Northern Ireland) Order 1993, Article 44 grants the Department for Infrastructure the power to provide road lighting, where the Department considers that any road should be illuminated.

D.2.2.4. In Scotland, the Roads (Scotland) Act 1984, Section 35, empowers a local roads authority to provide lighting for roads, or proposed roads, which are, or will be, maintainable by them and which in their opinion ought to be lit.

D.2.2.5. Highway Authorities have a duty of care to the road user. Any loss to an individual as a consequence of the inappropriate use of these powers may result in action being taken to recover the loss. Such action could be taken on several grounds:

- negligent exercise of power (including failure to use that power). There is no blanket immunity;
- action for misfeasance of public office; and
- breach of the common law duty of care (if it can be established).

D.2.2.6. NOTE: This duty of care does not imply any duty on the Highway Authority to keep the public lighting lit. However, an authority responsible for the maintenance of public lighting should be able to demonstrate that they have systems in place to maintain the public lighting equipment in a safe condition, including the detection of dangerous equipment.

New Roads and Street Works

- D.2.2.7. [The New Roads and Street Works Act 1991 \(NRSWA\)](#) is an enabling act setting out the duties of Street Authorities to coordinate and regulate works carried out in the highway. All underground cables should be recorded in accordance with the Electricity Safety, Quality and Continuity Regulations 2002 (as amended) and the Code of Practice for Recording of Underground Apparatus in Streets.
- D.2.2.8. The [JAG\(UK\) website](#) contains a range of guidance, information and assistance.

Statutory Nuisance: Lighting

- D.2.2.9. In England and Wales street lighting is not specifically exempt from the legislation, but it is unlikely to qualify as a statutory nuisance as generally speaking it is not considered to be within the definition of 'premises'.
- D.2.2.10. In England and Wales the [Clean Neighbourhoods and Environment Act 2005](#) applies and Section 102 of the legislation makes artificial light a potential statutory nuisance.
- D.2.2.11. In Scotland the [Public Health etc \(Scotland\) Act 2008](#) applies.
- D.2.2.12. In Scotland street lighting is more exposed to complaint of statutory nuisance, as in addition to defining 'premises' as a source of potential statutory nuisance the Scottish Act also includes artificial light from 'any stationary object'. [Guidance documents](#) have been published by the Scottish Government,

Natural Habitats

- D.2.2.13. Local Authorities should be aware that under the [Conservation \(Natural Habitats, &c\) Regulations 1994](#) and as amended in 2007 European Protected Species of plants and animals receive protection.
- D.2.2.14. One such protected species on which artificial light can have adverse effects is bats and so care needs to be taken not to disturb the animals themselves or their roosts and habitats. Guidance is available from the [Bat Conservation Trust](#) and the [Institution of Lighting Professionals](#).

Traffic Management

- D.2.2.15. Guidance for Local Authorities regarding their general duties relating to network management including enforcement of network management duties the maintenance of records and information (e.g. including records and locations of apparatus) and the duty to inspect records etc. can be found in the [Traffic Management Act 2004](#) document.

Climate Change

- D.2.2.16. [The Climate Change Act 2008](#) empowered the government to set national targets for the year 2050 for the reduction of greenhouse gas emissions and to encourage energy users to meet the objectives of the Act, such as reducing such emissions or removing greenhouse gas from the atmosphere.
- D.2.2.17. The Act also introduces legally binding carbon budgets, which set a ceiling on the levels of greenhouse gases that can be emitted into the atmosphere. The ensuing Carbon Reduction Commitment was renamed to [CRC Energy Efficiency Scheme](#).

D.2.2.18. In summary, if the organisation is within the scope of CRC, then all unmetered electricity with the exception of lighting for domestic use, should be reported.

Crime and Disorder

D.2.2.19. Section 17 of the [Crime and Disorder Act 1998](#) states the duty to consider crime and disorder implications. The Crime and Disorder Act does not apply to Scotland or Northern Ireland.

Traffic Signs

D.2.2.20. [The Traffic Signs Regulations and General Directions 2016](#) prescribes the design and conditions of use of traffic signs on or near roads in England, Scotland and Wales. Further guidance is available in the form of [DfT Circular 01/2016](#).

D.2.3. CONSERVATION AREAS

D.2.3.1. The introduction of the Civic Amenities Act 1967 gave legislative control to the protection of conservation areas which are defined as - 'an area of special architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance.'

D.2.3.2. Conservation Areas are designated more on local criteria than on national criteria and their designation is derived by a local authority with support and advice from [Historic England](#), the English Government's lead advisory body for the historic environment, and [Cadw](#), the Welsh Government's historic environment service. Consideration is given to the history, building style, important views and different activities performed in the area as well as other factors of which the exterior lighting may be one.

D.2.3.3. After a Conservation Area has been designated it undergoes a dynamic process of assessment to preserve and enhance the character and appearance of the Area. A conservation area appraisal document should be developed and the maintenance and appearance of exterior lighting should be considered when an appraisal is put together.

D.2.3.4. The maintenance and/or replacement of heritage equipment can be a costly process and financial constraints may have an effect on the decision as to which equipment may or may not be used. Alternatives to exact physical replacements of existing equipment which give the same 'feel' to the conservation area may be considered by the authority and proposals for alternative equipment should be investigated.

D.2.3.5. A grant scheme may be available for preventative maintenance and repair of historic places, some examples of which can be seen below:

- [Historic England](#);
- [The Architectural Heritage Fund](#);
- [Funds for Historic Buildings](#);
- [Heritage Lottery Fund](#); and
- [War Memorials Trust](#).

SECTION D.3. ASSET MANAGEMENT INFORMATION – LIGHTING

D.3.1. INTRODUCTION

- D.3.1.1. Asset data management is dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Part B](#). This document should be referred to and the advice below considered supplementary.
- D.3.1.2. Asset management systems are dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Part C](#). This document should be referred to and the advice below considered supplementary.

D.3.2. PRINCIPLES AND CONSIDERATIONS

- D.3.2.1. Lighting asset management systems should provide and support the following list of functions:
- collection, storage and retrieval of inventory data and condition data;
 - works management and prioritisation;
 - production and reporting of national and local performance data;
 - deterioration modelling and life cycle planning;
 - management and storage, in electronic format, of drawings, photographs and reports;
 - identify different cleaning intervals for installations with different conditions, lamp types, environmental zones and luminaire IP ratings; and
 - identify different routine maintenance intervals for installations with different conditions, including for example: lamp types, LED configuration, Driver type, environmental zones and luminaire and gear compartment IP ratings.
- D.3.2.2. The asset management system should be kept up to date to ensure the currency of the data held, and responsibility for updates should be confirmed.
- D.3.2.3. Accurate recording of asset data, inspection records and maintenance activities is essential. A suitable monitoring regime should be in place to ensure good quality information is in use.
- D.3.2.4. Asset data will also support the calculation of Gross Replacement Cost and Depreciated Replacement Cost for lighting associated with highway infrastructure, as required for Whole of Government Accounts. Guidance on this is available from [CIPFA](#).
- D.3.2.5. Guidance has been developed on [Managing Unmetered Energy Street Lighting Inventories \(MUESLI\)](#), which covers the following:

- the proper establishment and maintenance of unmetered supply inventories for unmetered supply customers;
- appropriate practices for Distribution Network Operators when checking that inventories are accurate and being properly maintained; and
- procedures for remedial actions if material irregularities or discrepancies are identified.

D.3.3. CENTRAL MANAGEMENT SYSTEMS (CMS)

D.3.3.1. Central Management Systems (CMS), also known as telemanagement, is a system that provides remote dynamic street lighting control. Using a CMS, the operator can choose exactly when to switch each individual street light on or off and/or by how much to reduce the lamp power. This allows any number of switching events and/or dimming levels. CMS can use web based technology to control lighting times based on official lighting up time and traffic conditions as well as fault reporting and warning of imminent lamp failure

D.3.3.2. To ensure consistent records it is essential that there is an effective interaction between the inventory and CMS databases. CMS is best characterised as a communication system for providing 'Monitoring', 'Reporting' and 'Control' of street lighting.

D.3.3.3. CMS allows detail monitoring and reporting of key aspects of the asset including:

- whether the light is operating as expected or not – i.e. faults or outages;
- circuit characteristics - current, voltage, power factor;
- switch on and off times;
- adapting levels; and
- total energy consumed (see Section D.7, trading arrangements).

D.3.3.4. In addition, it is possible to include the following:

- predictive faults based on history to date and component characteristics;
- breach of base compartment / door off; and
- light output.

SECTION D.4.

ASSET CONDITION AND INVESTIGATORY LEVELS – LIGHTING

D.4.1. INTRODUCTION

- D.4.1.1. To maintain the service to the public there is a need to identify lighting units and illuminated traffic signs which have failed or have mechanical defects, and then to repair them within timescales based upon a risk based approach to managing the public lighting and illuminated stock. The time period from initial failure through identification and assessment to rectification should follow that in the authority's street lighting strategy, in line with the risk management principles set out in this document.
- D.4.1.2. Provision must be made to deal with emergency situations and to protect the public from danger, by dealing appropriately with events such as vandalism and vehicle impact within the authorities risk based response times.
- D.4.1.3. Failures such as twisted luminaires or rotated brackets do affect light distribution and, consequently, optical performance. All non-emergency faults should be subject to the same risk based response criteria as failed units.
- D.4.1.4. The efficient organisation of work schedules and routing, coupled with adequate materials and competent staff, will help keep the installation safe and maintained. The quantity and application of these resources should be set at levels which will meet the risk based response times for repairs.

D.4.2. MONITORING FOR INOPERATIVE LIGHTING

- D.4.2.1. Procedures should be implemented which identify failed lighting so that faults and urgency of response can be risk assessed. Methods of identifying lighting not working include:
- periodic patrols at night at an appropriate frequency. Faults shall be recorded for subsequent transfer to the asset management system;
 - central management system (CMS), which remotely monitors the equipment with an electronic device at each luminaire which is capable of recording and reporting the status and/or failure (or imminent failure) of the equipment; and
 - the public can be encouraged to participate in monitoring by reporting lights out. Encouragement can include advertisements, notices on vehicles and lighting columns, and items in authority publications.
- D.4.2.2. Call handling staff should receive sufficient training to enable them to identify emergencies, and to assure appropriate coordination between them and emergency teams.
- D.4.2.3. CMS will report certain faults including outages and day-burners, and public reporting may also generate reports about mechanical defects including:

- wilful damage;
- overhanging trees and vegetation;
- vehicle damage;
- misaligned brackets;
- missing doors;
- unsecured or missing lantern bowls;
- missing identification numbers; and
- partial faults in LED lanterns.

D.4.2.4. A system of assessment to evaluate the appropriate actions and responses on receipt of such information must be set up and operated.

D.4.2.5. When using a Central Management consideration should be given as to how this information can be obtained proactively. The provision of a dedicated day or night scout at regular intervals may be needed to supplement these other methods.

D.4.3. RESPONSE TIMES

D.4.3.1. Examples of typical reactive maintenance activities are given below:

- non-emergency faults involving the replacement of components of apparatus;
- non-emergency faults involving the replacement of a complete unit of apparatus, including those made safe as emergency faults;
- non-emergency faults requiring the replacement of mandatory traffic signs and illuminated traffic bollards, including those made safe as emergency faults;
- non-emergency faults involving the repair or replacement of any of the DNO's / IDNO's equipment;
- non-emergency faults requiring the removal from apparatus of any offensive and/or racist graffiti;
- non-emergency faults requiring the removal of all other graffiti and/or any unauthorised attachments from apparatus;
- non-emergency faults involving rectification of non-operating Belisha beacons and flashing school warning signs;
- emergency faults, including the removal of unauthorised attachments that pose a safety hazard;
- installation of a complete unit of apparatus; and
- following completion of task, return of completed paperwork.

D.4.4. EMERGENCY SERVICE

- D.4.4.1. Parts of the installation may become a danger to the public as a result of incidents such as vehicle impact, cable damage, vandalism, storm damage and deterioration of components. Such incidents can result in potential danger and require emergency response.
- D.4.4.2. Arrangements should be in place to provide an emergency response at any time. Both the asset owner and service provider may be involved in processing and undertaking this work. The action to be taken will depend on a technical assessment at the time a report of damage or fault is received. Where situations arise which present a potential danger to health and safety, there is a need for an immediate attendance and a risk based practical maximum response time should be imposed.
- D.4.4.3. Staff involved in providing the emergency service must be competent and exercise their risk based judgement as to the action required, and those directly involved on-site must also have appropriate tools and plant to deal with the incident. There should be provision to mobilise additional resources to assist or to attend other emergency calls.
- D.4.4.4. The principal task must be to make the installation safe but in doing so there is a possibility that street lighting or illuminated traffic signs or bollards will be taken out of service. An assessment of the consequent road safety risk should be made and, if necessary, steps taken to carry out temporary repairs providing it can be done without endangering personal safety or that of the public. Traffic bollards are intended to guard obstructions in the carriageway and when damaged or removed a process to protect the road user from a potential impact with the island must be in place. In the absence of temporary repairs adequate signage and temporary warning lights should be provided.
- D.4.4.5. Due to the nature of emergency work, oral instructions are the most likely way of instigating an attendance. As soon as possible a Work Instruction should be raised to ensure the incident is properly tracked and recorded. Records should be kept of all relevant information, including:
- the time and source of the call-out;
 - time arrived and extent of work undertaken;
 - further work required; and
 - time left site.
- D.4.4.6. If the incident was a result of vehicle impact then details of the vehicle(s) should be recorded to institute procedures for the recovery of costs.

SECTION D.5. INSPECTION, ASSESSMENT AND RECORDING – LIGHTING

D.5.1. INTRODUCTION

- D.5.1.1. The general principles to be applied to inspections, assessment and recording are outlined in Section 5 of Part A of this Code. This section covers guidance for each category of inspection relating to lighting assets.

D.5.2. DEFECT RISK ASSESSMENT

- D.5.2.1. Risk management is dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Part C](#), and Section 5 of Part A of this Code.

D.5.3. ELECTRICAL INSPECTION AND TESTING

Introduction

- D.5.3.1. In terms of possible dangers from electricity, the Electricity at Work Regulations 1989 require all systems to be constructed, maintained and operated, so far as is reasonably practicable to prevent danger. In any action for contravention of these duties it is a defence to prove that all-reasonable steps and due diligence to avoid an offence had been exercised. To illustrate due diligence it follows that periodic inspections should be undertaken to understand whether or not an electrical installation may present a danger and prove that on the day of inspection the installation was in a safe condition.
- D.5.3.2. BS 7671 Requirements for Electrical Installations (formerly known as the IEE Wiring Regulations) do not themselves impose statutory requirements but state: “Installations which conform to the standards laid down in BS 7671:2008 are regarded by HSE as likely to achieve conformity with the relevant parts of the Electricity at Work Regulations 1989”.
- D.5.3.3. The IET Guidance Note 3 [Inspection and Testing](#) supports a risk based approach for inspection of electrical installations, stating: “The person carrying out subsequent inspections may recommend that the interval between future inspections be increased or decreased as a result of the findings of their inspection.”
- D.5.3.4. The co-ordination of electrical inspection and testing with other cyclic maintenance activities should be considered to help reduce disruption to the public; however this may not be the most cost effective means of carrying out this operation and separate personnel may be needed for this purpose.

Visual inspection of electrical equipment

- D.5.3.5. The nature and location of public lighting installations is such that visual inspection of the electrical equipment and wiring is of paramount importance. The condition of the electrical equipment and wiring should be visually checked at each cyclic maintenance or repair visit and its condition reported back to the asset owner. So far as reasonably practicable, the visual inspection should verify that the health and safety of persons, animals and property is not endangered.
- D.5.3.6. The general visual conditions of the electrical installation should be noted on the inspection report. However, if any particular item causes concern, it is recommended that the problem be detailed on an appropriate supporting schedule.
- D.5.3.7. During the visual inspection, any dangers should be identified that may arise during the testing procedure. The street lighting operative should take any necessary action and implement safety precautions to avoid danger. Where a problem is considered as dangerous, the item of equipment should be repaired immediately or taken out of service by removing the fuse from the supply termination until the fault has been rectified. Problems related to the Distributors cable or cut-out (cracked, broken fuse carrier, loose connection, exposed live conductors, etc.) should be reported to the relevant Distributor. See section 7. Under no circumstances should an electrically dangerous item of equipment be left in operation.
- D.5.3.8. Failure to carry out an electrical inspection must be recorded in the street lighting operative's report. A record should be made of any departure from the regulations.
- D.5.3.9. For further details on electrical inspections see refer to BS7671 and associated guidance including in particular Guidance Note 3.

Electrical Testing

- D.5.3.10. Testing should only be carried out by a competent person. All test equipment should be suitable for the test intended, correctly calibrated and regularly certified. For further details on electrical testing refer to BS7671 and associated guidance including in particular Guidance Note 3.

Electrical testing records

- D.5.3.11. The results of periodic electrical inspection and testing must be recorded.
- D.5.3.12. Records of maintenance, including electrical test results, should be kept in accordance with the agreed retention period of the organisation, enabling the condition of the equipment and the effectiveness of maintenance policies to be monitored. A computerised asset management system should allow electrical test certificates to be linked to the specific individual item of equipment, thus providing an efficient maintenance system.
- D.5.3.13. It should be noted that the scope of testing for highway lighting circuits and columns extends to 5th core distributor cabling in relation to the measurement of external earth fault loop impedance.

Capacitor replacement

- D.5.3.14. Capacitors should be replaced on failure. As the power factor of the circuit should be maintained at 0.85 lagging or above, it should be measured at each electrical test. It is possible that the most economical way of ensuring the power factor of the circuit is maintained, is by group replacement of the capacitors during the electrical test.

Surge Protection

- D.5.3.15. The operation of electronic equipment in street lighting can be severely affected by lightning or electrical switching events. These increases in voltages (surges or transient overvoltages) could possibly cause irreparable damage to equipment.
- D.5.3.16. A Surge Protective Device (SPD) is specifically designed to protect equipment from such events by redirecting the harmful voltage away from the equipment.
- D.5.3.17. SPDs should be checked, where practicable, during the periodic electrical inspection and test that it is still in a serviceable condition (Many SPDs have fault indicators that will show when the device has operated or has been damaged or destroyed by a surge).
- D.5.3.18. It is important prior to applying any insulation resistance tests, to establish if the installation has any SPDs installed. SPDs should be isolated during insulation resistance testing, as the SPD could operate, by treating the test voltage applied to the system as a transient overvoltage. (see [BS 7671](#))
- D.5.3.19. The type and use of SPDs varies between manufacturers and all maintenance should be carried out in accordance with the manufacturer's instructions. Further guidance can be found at the [BEAMA website](#).

Structural inspections and testing

- D.5.3.20. Structural failures of corroded lighting columns and illuminated traffic sign posts, together with under-investment in replacement, have raised awareness of the increasing age of the stock and its deteriorating condition.
- D.5.3.21. A visual inspection of each lighting column and illuminated traffic sign post should be carried out at every cyclic maintenance or repair visit and a report made, stating the equipment's condition and any remedial works required. Lighting operatives should have the competence to recognise specific defects in different types, materials and constructions of lighting columns and illuminated traffic sign posts and to assess the severity of the problem.
- D.5.3.22. Consideration should be given to inspecting and analysing lighting columns or illuminated traffic sign posts when removed from service, due to accident damage or replacement. The general condition of the unit, particularly the root section, will give an overall guide as to the condition of other similar units in similar locations and of similar age.
- D.5.3.23. Whilst visual inspections can provide a cost-effective means of assessing the general condition of the stock, they cannot identify internal or underground corrosion. The information determined from visual inspections should be recorded and used to develop further inspection and testing programmes as part of an overall assessment procedure for determining the condition of the stock.

Risk Assessment

- D.5.3.24. A strategy for the management of the structural safety of lighting columns and illuminated traffic sign posts should be developed and implemented. This strategy should include risk management procedures for prioritising the inspection and testing of lighting columns and illuminated traffic sign posts and the development of non-destructive testing programmes to determine the structural integrity of these items.

Structural Testing

- D.5.3.25. An assessment of the structural condition of lighting columns and illuminated traffic sign posts can be made by a number of methods. These methods vary from “indicative tests”, such as ultrasonic testing at critical points on the unit, to “strength tests”, such as a full dynamic test, where a unit is subjected to a load equivalent of the maximum design load and its deflection at ground level recorded. Indicative tests do not give a direct measure of the structural strength of the unit tested; the data has to be analysed to provide an indication of structural strength. Strength tests should provide an actual measurement of the residual structural strength of the lighting column at the time of testing.
- D.5.3.26. Most of the tests and in particular the strength tests need to be carried out by specialist contractors with the correct equipment and procedures.
- D.5.3.27. Structural testing should be carried out using a risk based approach. The risk based approach to structural testing should include the following factors for the testing of lighting columns and traffic sign posts:
- locations where the poor condition of the lighting columns has been established as a result of routine visual inspections or other reports;
 - environmental conditions;
 - lighting columns of greater than 8 m mounting height;
 - other steel lighting columns on classified roads;
 - steel lighting columns on other roads including residential streets;
 - results of previous inspections and tests;
 - age profile;
 - homogeneous asset groups;
 - known asset types with problems;
 - luminaire conversions;
 - unusual column foundations/footings;
 - types of lighting column posing a significant risk (e.g. those fitted with unauthorised attachments; steel columns with right-angled door openings; steel columns with hot swaged joints and brackets with missing bolts or sealing gaskets; and pre-stressed concrete columns with poorly fitted or missing spacing plugs);

- non-galvanized steel columns may be more prone to failure than older steel lighting columns or newer galvanized lighting columns;
- areas of high and frequent wind exposure;
- lighting columns mounted on over-bridges; and
- volume of traffic.

D.5.3.28. The above criteria should provide sufficient detail on which the testing of steel lighting columns and illuminated traffic sign posts can be prioritised. However, each authority should establish its own priorities based on the types, ages and condition of their stock. The results obtained from the testing programme should be iteratively reapplied to update and refine the process and to ensure that the most appropriate priorities are being addressed.

D.5.4. LIGHTING COLUMNS AND ILLUMINATED TRAFFIC SIGN POSTS

Inspection and assessment of protective coatings

- D.5.4.1. Lighting columns and illuminated traffic sign posts can be protected from the effects of the weather, pollution and other environmental elements. Steel lighting columns and illuminated traffic sign posts in particular will quickly deteriorate if they are not provided with a protective system such as hot dipped galvanizing. Further protection may also be given by the application of an additional protective system such as paint or powder coating.
- D.5.4.2. The condition of lighting columns' and illuminated traffic sign posts' protective systems, including the finish to aluminium, stainless steel or composite materials, should be inspected at each maintenance visit and a report on its condition submitted by the service provider to the asset owner. Maintenance street lighting operatives should have the competence to recognise the different types of materials used in manufacture of lighting columns and illuminated traffic sign posts and the different types of protective systems applied, together with the potential defects and severity of the defects applicable to each.

Protective coatings and their application

- D.5.4.3. The frequency for the reapplication of protective systems to lighting columns and illuminated traffic sign posts should be determined on a risk based approach taking account of the following matters:
- condition and age of equipment;
 - condition of existing coating;
 - level of atmospheric pollution;
 - location of equipment;
 - type of protective system used; and
 - other environmental factors.

D.5.4.4. Further guidance on the application and maintenance of protective coatings can be found in [National Highway Sector Scheme 19A](#) and the [lighting column technical forum](#).

D.5.4.5. Lighting columns are particularly vulnerable to corrosion underground and consideration should be given to extra protection to the root section and proportion of column directly above the ground.

D.5.5. LIGHT MEASUREMENT

D.5.5.1. The process for measuring lighting performance is set out in [BS EN 13201-2:2015](#).

D.5.5.2. Lighting measurements can also be used to verify the failure point of LED luminaires, where this is due to parametric failure (the most common failure mode), and also for non-LED lighting systems, to verify that a lamp change has taken place as part of a bulk lamp change cycle.

D.5.6. TREES

D.5.6.1. The effect of trees on the performance of the lighting installation should be considered at the design stage and care taken to minimise the need for unnecessary pruning and damage to the tree throughout the expected life of the lighting installation. Account should be taken of the inevitable growth in height and spread of the tree, and help and advice sought from an arboriculturist at the design stage.

D.5.6.2. Care should be taken to avoid unnecessary damage to roots and branches when erecting or removing lighting columns or excavating cable trenches. See [NJUG Guidelines for the Planning, Installation and Maintenance of Utility Services in Proximity to Trees](#) for further details.

D.5.6.3. More details can be found in Section B.4 of this Code regarding siting of trees, and clearance for vehicles.

D.5.7. RELIABILITY OF DATA

D.5.7.1. Asset data management is dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Part B](#). This document should be referred to and the advice below considered supplementary.

D.5.7.2. Opportunities to ensure quality and reliability of data occur at a number of levels including:

- survey instructions and documentation;
- selection and appointment of staff;
- training;
- specification and procurement of surveys;
- audit procedures;
- survey procedures;

- data capture software;
- processing software;
- maintenance and calibration of equipment; and
- record keeping.

D.5.7.3. Considerable care should be taken in the derivation of locally enhanced versions of surveys to ensure that data can be extracted, without bias from the survey.

D.5.8. COMPETENCE

D.5.8.1. Competence of staff is dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Part C](#). This document should be referred to and the advice below considered supplementary.

D.5.8.2. Employers of persons working on lighting installations, including client and contractor's personnel, must have a system in place to authorise and certify the level of competency of those employed and be able to demonstrate the necessary training and supervision to achieve and maintain the certified level of competency.

D.5.8.3. Regulation 16 of the Electricity at Work Regulations states that: "No person shall be engaged in any work activity where technical knowledge or experience is necessary to prevent danger or where appropriate, injury, unless he possesses such knowledge or experience, or is under such degree of supervision as may be appropriate having regard to the nature of the work".

D.5.8.4. Regulation 16 applies to any work relating to electrical equipment whether or not a risk of injury is actually present at that time.

D.5.8.5. Some work, such as testing, may need to be carried out on live equipment and must only be carried out by an appropriately trained, skilled and experienced person competent in these activities.

D.5.8.6. Competence requires training, technical knowledge and experience sufficient to provide:

- adequate knowledge of electricity
- adequate knowledge of the system to be worked on
- adequate knowledge of the hazards which might arise and the precautions to be taken
- adequate experience of electrical work
- adequate experience of working on the appropriate system; and
- ability to recognise at all times when it is safe for work to continue.

D.5.8.7. Operatives should be trained and instructed to ensure that they understand the safety procedures which are relevant to their work and should only work in accordance with any instructions or rules.

- D.5.8.8. When operating or working on the DNO / IDNO cut-out the operative should be appropriately trained and, where necessary, approved by the DNO / IDNO.
- D.5.8.9. In some circumstances, operatives will need to be supervised where their technical knowledge or experience is insufficient to ensure that they can carry out the work safely. Supervisors must have their responsibilities clearly explained to them by the duty holder, as defined in the Regulations, who must decide on the degree of supervision required.
- D.5.8.10. Options for demonstrating on-site competence are National Highway Sector Scheme 8 (NHSS 8) and the associated Highway Electrical Registration Scheme (HERS) that sets out a reasonably practicable approach to the identification, achievement, recording and maintenance of competence. Some DNOs / IDNOs may require evidence of training and assessment to Electricity Association Engineering Recommendation G39/2 (which includes a reference to HERS). However reliance solely on G39/2 without additional training and assessment of competence would leave the employing organisation open to failures to meet the requirements of the Health & Safety at Work etc. Act, the Management of Health and Safety at Work Regulations, the Electricity at Work Regulations and the Construction Design and Management Regulations amongst others.
- D.5.8.11. By law all gas engineers in the UK must be on the [Gas Safe Register](#). Maintenance of gas equipment in lighting units should only be carried out by gas engineers registered with Gas Safe.

D.5.9. RECORDING OF INFORMATION

- D.5.9.1. Information from all inspections and surveys, together with any immediate or programmed action, including nil returns, should be accurately and promptly recorded, monitored, and utilised with other relevant information in regular reviews of maintenance strategy and practice. This is particularly relevant in the case of safety inspections.

D.5.10. DEVELOPMENTS IN SURVEY TECHNOLOGY

- D.5.10.1. Regular reviews of survey strategy should take account of new technologies and methods. This could include the use of in-vehicle location and communications technology to record the position of defects and to ensure that they are instantaneously recorded with the works gang. These defects should then be reviewed and prioritised for correction.

SECTION D.6. PROGRAMMING AND PRIORITIES – LIGHTING

D.6.1. INTRODUCTION

- D.6.1.1. Programming and priorities are dealt with in the [UKRLG Highway Infrastructure Asset Management Guidance \(HIAMG\), Part B](#). This document should be referred to and the advice below considered supplementary.
- D.6.1.2. The general principles to be applied to programming and priorities are outlined in Section A.8 of this Code, with this section covering guidance relating to lighting assets.

D.6.2. PRINCIPLES

- D.6.2.1. A well-designed risk based cyclic maintenance programme will help to prevent the performance of the installation falling below the designed level; will identify any mechanical, structural, electrical or optical work necessary to maintain or increase the life of the installation; may reduce the incidence of faults; and check that the installation is safe.
- D.6.2.2. Cyclical maintenance programmes should be determined taking account of all variables including lighting system, light source, luminaire sealing, age and type of equipment and other requirements such as electrical testing. Whilst it is desirable to carry out as many of these tasks as possible on a single visit, the tasks required and the competency of the workforce may limit the range of work that can be completed at one time.
- D.6.2.3. The principles of maintenance are equally applicable to high-mast lighting. However, due to the added complexities of maintaining high-mast lighting, in particular the need typically to lower head frames for access for works, consideration should be given to carrying out a complete maintenance of the equipment, including group replacement of the lamps at appropriate intervals.
- D.6.2.4. Luminaire maintenance intervals may be set to correspond with group lamp replacement. The luminaire maintenance intervals should be calculated taking account of the maintenance factor and suggested luminaire maintenance factors are given in BS 5489.

D.6.3. MANAGEMENT OF MAINTENANCE

Strategy

- D.6.3.1. A lighting system requires inspection and maintenance to ensure that it is safe, operates correctly, continues to provide the designed performance and in order to maximise its useful life. Maintenance can be divided into two aspects:
- Routine or cyclical, a process of preventative maintenance carried out on a cyclical basis to help reduce or eliminate failures and to ensure the system is operating at its intended design outputs.

- Reactive, where failures of equipment are recorded and the equipment repaired or replaced.

D.6.3.2. An asset management strategy covering the details of the service provision and the targets it is intended to achieve, should be implemented. The targets should be related to the defined policies of the authority. Performance management is covered in Section A.7 of this Code, and also the [HIAMG](#) document.

D.6.4. DESIGN FOR MAINTENANCE

D.6.4.1. Equipment used in lighting systems should be selected, installed, maintained and operated to give a durable and efficient performance. Each item should be assessed for its potential life, availability, cost of spares and replacements, ease of maintenance, recycling/disposal and, when used in combination, compatibility with other components.

D.6.4.2. Initial cost is important but it is whole life costs that should guide the final selection of equipment, including;

- ongoing maintenance;
- energy;
- traffic management;
- carbon;
- disposal costs;
- performance of existing equipment; and
- initial capital procurement costs.

D.6.4.3. LED lighting is increasingly being deployed and there are often energy efficiencies from its use. However LED lighting systems are complex and appropriate guidance should be consulted before considering procurement.

D.6.4.4. The Institution of Engineering and Technology (IET) have published the [Code of Practice for the Application of LED Lighting Systems](#) and [Recommendations for Energy Efficient Exterior Lighting Systems](#).

D.6.5. RECYCLING AND WASTE DISPOSAL

D.6.5.1. Lamps and luminaires have to be recycled where possible and disposed of appropriately. Most lamps are considered hazardous waste. Lamp and Luminaire Producer Schemes, funded by a levy on new products, exist to ensure the disposal of such equipment in line with the WEEE Regulations and Environment Agency requirements. Examples of these can be found via the links below (other compliant schemes are available):

- [Lumicom](#); and
- [Recolight](#).

D.6.6. COMMUTED SUMS

- D.6.6.1. ADEPT has published [guidance on the commuted sums mechanism](#), through which developers may be required to contribute to future maintenance of areas adopted by local authorities.

D.6.7. TRAFFIC SIGN AND BOLLARD MAINTENANCE

- D.6.7.1. Cleaning of sign faces should be carried out in accordance with the asset owners risk assessment and policy. Optical inspection and cleaning of illuminated traffic sign luminaires should be carried out in conjunction with the group replacement of lamps, or more frequently if necessary, to ensure the conspicuity of the sign.
- D.6.7.2. External cleaning of traffic bollards should be carried out in accordance with the asset owners risk assessment and policy. In areas of heavy traffic, and especially in winter, additional cleaning may be required. Such additional cleaning should be built in to the cyclic maintenance schedules. Optical inspection and internal cleaning of illuminated traffic bollards should be carried out in conjunction with the group replacement of lamps.
- D.6.7.3. Solar powered bollards utilising battery storage will need maintenance in accordance with manufacturers guidance to ensure effective operation throughout the night
- D.6.7.4. Further information regarding the maintenance of traffic signs can be found in Part B of this Code.

D.6.8. LAMP REPLACEMENT

Introduction

- D.6.8.1. There are two options for the replacement of discharge lamps and the asset owner needs undertake a risk based approach to determining which of these strategies it uses:
- group lamp replacement; under which all lamps of a similar type and burning hours in a particular area or street are replaced at the same pre-defined time; and
 - burn to extinction, under which lamps are replaced on failure.
- D.6.8.2. The legal requirements for the illumination of certain mandatory traffic signs may influence whether a group lamp replacement strategy may be adopted.

Burn to extinction

- D.6.8.3. A burn to extinction lamp replacement strategy will run all lamps until they eventually fail. The performance of discharge lamps depreciates over time and more significantly towards the point of ultimate failure, so just before failure the lamps will be emitting significantly lower levels of light than required by design. Best value will not be obtained from the electrical energy consumed, as at end of life lamps are performing well below optimal performance.

- D.6.8.4. With a burn to extinction policy each individual lamp will fail at a different time to its neighbours, this may lead to a peak of replacements being required in the winter months when lamps are burning longer and the risk of failure is higher, this places peaks and troughs in the workload. Eventually each street will contain a mixture of new and old lamps, some giving more light than others and leading to patchy lighting levels. While this may not be acutely obvious, frequent changes in light levels will fatigue the driver's eye, resulting in a road safety hazard.
- D.6.8.5. If a burn to extinction policy is adopted, then consideration should be given to introducing 'find and fix' night scouting. The alternative is that the authority will incur the financial and environmental cost of attending to widely dispersed and sporadic faults, which can be significant, both in urban and rural areas.
- D.6.8.6. Burn to extinction has also not been seen as good practice in the past because lamp lumen depreciation would normally be included within any designed lighting solution and this would then advise when an installation would start to drop beyond compliant design standards. Extending the lamp life until the lamp actually fails will run the risk of the lighting solution failing to deliver the illumination required for the task in hand.
- D.6.8.7. However, with the take up of LED, it is likely that Lighting Authorities will potentially operate these assets until failure which may be many years, while this may be the case, an authority should continue to understand that the lighting levels maintain their compliant design expectation.

Group lamp replacement

- D.6.8.8. Bulk lamp replacement is intended to replace all lamps in a series well before they reach the point of failure and before they begin to perform sub optimally in terms of energy consumed for the light generated. Advantages of a well-planned bulk replacement programme are that it will ensure isolated lamp failures are minimised and that the lighting system performance is maintained at an appropriate level throughout the life of the installation. It will also help to ensure that there is a reasonably uniform workload and expenditure profile within and across the years.
- D.6.8.9. The lamp replacement frequency should be determined by;
- the type of lamp;
 - the manufacturer;
 - the lamp wattage; and
 - its annual hours of operation.
- D.6.8.10. To take advantage of improved products, bulk replacement and cleaning intervals should be continually reviewed in line with the specific lamp manufacturers' performance predictions. In order to maintain their thermal characteristics LED lantern canopies may need more frequent cleaning of their external heat sink areas.

- D.6.8.11. Authorities that adopt a policy of bulk lamp change but then do not replace isolated lamp failures as they occur, should be aware that this may actually increase energy consumption and the likelihood of premature failure of the control gear, when it continuously tries to ignite a failed lamp.
- D.6.8.12. Group lamp replacement is generally seen as good practice reducing the risk of lighting solutions running below design standards.
- D.6.8.13. The proactive lamp change model generally provides owners with improved Value for Money and lowering cost through planned lamp change regimes. This maintenance approach enables service planning and accurate forecasting which supports good asset management.
- D.6.8.14. An assessment should be undertaken to determine whether a group replacement or a burn to extinction regime is most appropriate for the authority.

D.6.9. COMPATIBILITY OF COMPONENTS

- D.6.9.1. Compatibility of appropriate replacement components or assemblies may be an issue. Generic substitutes may not have the same visual appearance or give the same lighting performance as the original equipment. The main issues to be considered are:
- Lighting Performance. The original design for lighting any given road, footpath or area usually depends on optimising a number of factors, environmental, optical and functional (relating to anticipated use). From this process the optimum choice of luminaire performance and their spacing and mounting heights will be determined to achieve a specific performance in accordance with the requirements of the following:
 - [BS 5489-1:2013 Code of practice for the design of road lighting – Lighting of roads and public amenity areas](#);
 - [BS 5489-2:2016 Code of practice for the design of road lighting – Lighting of tunnels](#);
 - [BS EN 13201-2:2015. Road lighting. Performance requirements](#);
 - [BS EN 13201-3:2015. Road lighting. Calculation of performance](#);
 - [BS EN 13201-4:2015. Road lighting. Methods of measuring lighting performance](#); and
 - [BS EN 13201-5:2015. Road lighting. Energy performance indicators](#).
 - It is important that maintenance repairs do not introduce components (e.g. luminaires) or carry out adjustments (reflector positions, lamp positions, LED modules, surge protection, drivers) that affect the designed performance. Changes in luminaire type and / or LED modules will require assessment, prior to installation, to establish that the distribution and light control are at least equivalent either to that of the original installed or to the current requirements of the asset owner as set out in their policy;
 - Many high-speed roads are often subject to restrictions on the times that access can be made available for maintenance activities and therefore every

effort must be made to ensure that lights not working are repaired and put back into full operation in the shortest time on-site. Maintenance activities on restricted access roads have to be planned in advance and this should allow the purchase of the correct luminaires to replace those that need replacement. Care should be taken when ordering replacement luminaires to ensure that to the performance matches those in situ on the road. Good records and knowledge of the lighting system will provide good guidance as to the quantity of units needed for maintenance purposes;

- Mechanical performance will also be affected by changes in mounting height, bracket out-reach, spigot angle and through the incorrect alignment of bracket and luminaire relative to the lit area;
- Lighting column replacement has to be considered on an individual basis as movement to a different location may affect light distribution and potentially reduce performance;
- Replacement control gear must be capable of operating the lamp no less efficiently than the original control gear. New or revised circuit wattages must be recorded in the inventory particularly as electronic ballasts have a lower consumption than wire wound ballasts;
- Operating hours. Photocells have standardised switching levels relating to a total number of operating hours per annum. The cells also have specific characteristics relating to power consumption, reliability and stability that effect the operating hours and the charging arrangements. Changes in photocell types and/or operating hours must be recorded in the inventory particularly as electronic cells have lower consumption than thermal cells and new cells typically have lower lux levels (e.g. 35/18) than those they replace;
- Increased weight, the replacement product should be checked for suitability with the structure that it is proposed to be fitted;
- Energy consumption of CMS nodes compared to that of any photocells being replaced; and
- CE Marking applies to lighting and associated equipment. Guidance on this is available in the [HEA / HEA-HEMSA Guide to the Construction Products Regulations \(CPR\) and CE Marking](#).

SECTION D.7. SERVICE AGREEMENTS

D.7.1. INTRODUCTION

- D.7.1.1. To obtain or continue to have an unmetered supply an authority must comply with:
- the criteria identified in [The Electricity \(Unmetered Supply\) Regulations 2001](#);
 - the [NMRO](#) have issued guidance about compliance;
 - a Connection agreement with the respective Distribution Network Operator(s) (DNO). This agreement will follow the [national terms of connection](#); and
 - the obligations described in the Balancing and Settlement Code (BSC) for unmetered supplies captured in [BSCP520 and its associated documents](#).

D.7.2. SERVICE AGREEMENT

- D.7.2.1. The provision of public lighting is dependent on the supply of electricity through the network of the DNO or an Independent DNO (IDNO). An IDNO is an embedded network within a DNO area increasingly used for new domestic or commercial developments. The obligations on IDNOs and DNO are the same.
- D.7.2.2. [Ofgem](#) have set out a minimum level of service for new connections. This is currently covered under the Guaranteed Standards of Performance (GSoPs) set out by Ofgem. Departures from the GSoPs should mean that rebates for non-performance are made by the DNO / IDNO and if necessary, after exhausting the DNO / IDNO complaints procedure, recourse to Ofgem in terms of non-performance.
- D.7.2.3. It should be borne in mind that following a decision in the High Court (PN Daly Ltd and United Utilities Electricity PLC v Wigan MBC, 2003), it has been established that the works involved in the connection and disconnection of street lighting and other items of street furniture to the electricity distribution system are not “street works”, but are “works for road purposes”.
- D.7.2.4. Competitive arrangements are also now in place for connections, disconnections and transfers through the use of authorised Independent Connection Providers (ICP). DNOs / IDNOs are obliged to facilitate competition and also not to discriminate between their own business activities and that of competitors. Reference should be made in particular to the [Competition in Connections Code of Practice](#).

D.7.3. PROCEDURES FOR NEW INSTALLATIONS

- D.7.3.1. New installations include the following:
- new capital lighting schemes;
 - road improvement schemes;

- provision of connections and/or disconnections;
 - transfers; and
 - new services.
- D.7.3.2. The agreement or contact should detail the procedures to be followed by both parties when:
- placing orders;
 - notifying that equipment is installed and ready for connection; and
 - notifying that equipment has been connected.
- D.7.3.3. In order for the ICP or DNO / IDNO to comply with the required response time for a new installation the authority will need to supply relevant information:
- an accurate location of the equipment involved including:
 - postcode;
 - asset number;
 - location, road name and, for example, side of, rear of, outside house number, etc;
 - a map of the area (minimum size 1:1250 with the apparatus highlighted); and
 - Ordnance Survey co-ordinates or GIS co-ordinates.
 - a description of the work involved and the number of points involved.
- D.7.3.4. The estimate from the ICP / DNO / IDNO should include the following information:
- a plan showing the extent of the works together with any civil engineering works (for instance ducts) required from the authority;
 - a schedule detailing the estimated costs based on the standard schedule of rates where applicable; and
 - a breakdown of contestable and non-contestable works
- D.7.3.5. The authority may also request one or more ICPs to provide an estimate for the contestable elements. The authority, on accepting the estimate, shall provide an order for the works together with a programme of works.
- D.7.3.6. On installation of the new equipment, or when existing equipment is ready to be disconnected/transferred, the authority shall advise the ICP / DNO / IDNO advising that the site is now ready for their works.

- D.7.3.7. The authority should amend the Asset Management System accordingly as soon as practicable with all connections, disconnection and alterations. The relevant DNO / IDNO should also be recorded.

D.7.4. PROCEDURES FOR REPAIRS

- D.7.4.1. The agreement or contract should detail the procedures to be followed by both parties when placing orders.
- D.7.4.2. When the authority has identified a fault on a DNO / IDNO electricity service it shall notify the DNO / IDNO as soon as possible.
- D.7.4.3. The DNO / IDNO shall respond to faults within or better than the timescales set out in the [Electricity \(Connection Standards of Performance\) Regulations 2015](#) and the [Quality of Service Guaranteed Standards](#).
- D.7.4.4. The authority is responsible for providing a safe enclosure for the DNO service termination equipment and reporting any concerns or faults with the cut-out or service termination equipment.
- D.7.4.5. The authority should monitor the DNO / IDNO performance in order to validate or, if required, claim rebates. It should be noted that the DNO / IDNO is required to pay rebates for non-performance, there is no requirement for these to be claimed by the customer. Authorities should appreciate the necessity to ensure that DNO / IDNOs are provided with accurate and reliable information in a timely manner when they are requested to carry out work. Failure to do so may lead to a failure to enforce any remedial action or rebates.

D.7.5. CUT-OUTS

- D.7.5.1. Most authorities have the ability to operate the cut-out for the purpose of connecting internal wiring, withdrawing fuse carriers during maintenance of equipment and replacing failed fuse cartridges. This is included within ENA EREC G39/2 and the [Competition in Connections Code of Practice](#).

D.7.6. ELECTRICITY SETTLEMENT INVENTORY

- D.7.6.1. The Connection Agreement and the Balancing and Settlement Code (BSC) obligations require the authority to maintain an accurate inventory of all unmetered equipment. This inventory should be submitted to each of the DNOs who have connections on a frequency agreed with the DNO. If there are frequent changes to the inventory then this may be monthly but where few changes this may extend to annually.
- D.7.6.2. The content and file structure of the inventory submission is defined in the BSC Operational Information Document. The parties may agree an alternative format.
- D.7.6.3. The key data items are the Charge Code which is a 13 digit code defining the type of unmetered equipment and the Switch Regime defines the type of operation of the equipment (i.e. continuous, electronic photocell 35/18lux, or part night).
- D.7.6.4. [Generic LED Charge Codes and variable power switch regimes](#) have been produced by Elexon.

- D.7.6.5. The BSC website includes lists of approved Charge Codes and Switch Regimes and their associated information, such as chargeable watts. Equipment manufacturers apply for Charge Codes when they first place equipment on the [market](#).
- D.7.6.6. The asset management system should identify the relevant DNO / IDNO to which the equipment is connected and whether the connection is metered or unmetered.
- D.7.6.7. Unmetered supplies are based on an assumption that the authority maintains an accurate and up to date inventory. Under the Connection agreement the DNO can audit the identified street furniture and the inventory records to identify material discrepancies. The [Managing Unmetered Energy Street Lighting Inventories \(MUESLI\)](#) covers the audit methodology.

D.7.7. TRADING ARRANGEMENTS

- D.7.7.1. Unmetered supplies can be traded on a Half Hourly (HH) or Non-Half Hourly (NHH) basis. Most large unmetered supplies are traded on a HH basis.
- D.7.7.2. NHH trading uses the inventory to determine an Estimated Annual Consumption (EAC) using predefined annual hours which differ across 14 areas of GB.
- D.7.7.3. HH trading can utilise a PECU Array and/or CMS equipment switching information to give more reflective consumption data. The authority should contract with a BSC approved Meter Administrator to use the inventory and switching data to calculate HH data.
- D.7.7.4. Authorities should procure energy through their corporate procurement arrangements who normally employ a specialist utilities procurement organisation.

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Steering Group Members

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UK Roads Board James Bailey

UK Bridges Board Stephen Pottle, Nicola Head

UK Lighting Board Ian Hardy

SCOTS Ewan Wallace, Bill Barker

CSS Wales Darren Thomas

TNI John Irvine, Alan McMurray, Jackie Kelly

ADEPT Liz Kirkham

Atkins Project Team

John Paterson

Lila Tachtsi

Mike Bordiss

Nick Rushall

Chris Capps

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James Henderson

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Disclaimer

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