Roads Liaison Group

LIGHTING
UK LIGHTING BOARD

Well-lit Highways

Code of Practice for Highway Lighting Management

November 2004

UK Lighting Board

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Foreword

When the Road Lighting Maintenance Code of Good Practice was first published in 1999, a strong foundation was created for industry professionals and local authority elected members to develop positive and lasting road lighting maintenance policies. At the time, the Code of Practice proved a great success, being well received by its target audience. However, things move on, we now have to look at our service more from the "outside in" if we are to sustain Best Value and ensure effectiveness and efficiency in all that we do.

This Code of Practice has been developed by street lighting professionals throughout the United Kingdom. Its production has been project managed and is endorsed by the UK Lighting Board. A primary objective of the project team was that the new Code should encourage co-ordination and consistency in the delivery of public lighting maintenance. The Code seeks to harmonise public lighting maintenance practice where this is achievable and consistent with the expectations of users, whilst retaining scope for local discretion and diversity. Consequently, the Code is intended to apply throughout the United Kingdom and should accommodate any key differences that exist in the devolved administrations.

The UK Lighting Board has recognised the importance of achieving Best Value in public lighting maintenance. Lighting is a highly valued and visible service with the potential to make a significant contribution to the wider corporate objectives defined in the Performance Plans prepared by local authorities. The Code of Practice has accordingly been developed to follow closely the principles of Best Value, to facilitate the conduct of Best Value reviews involving public lighting maintenance, and to provide a stimulus to the pursuit of continuous improvement. However, in order to improve our services in line with Comprehensive Performance Assessment, local authorities also have to focus on citizens and community leadership in all that they do. This presents yet another challenge to the lighting professional, making effective performance management essential if our ambitions and targets are to be achieved in delivering an excellent service to our customers.

Well maintained road lighting can change our communities, make the night time environment a safer place to be, encourage regeneration and investment, leading to an improved local economy and at the same time contributing to a more inclusive society. However, these benefits are only achievable if the right decisions are made. This Code comprises a framework of guidance and standards, the application of which will make a significant contribution to the decision making process.

For many years lighting professionals have had to derive maintenance policies that have tended to "react" to a Road Lighting infrastructure in a state of decline, through underfunding and neglect. With adequate investment we will be able to embrace a fundamental move from reactive to planned maintenance and it is hoped that the adoption of the recommendations in this Code of Practice will assist in delivering a better and safer night-time environment on our highway network.

On behalf of the UK Lighting Board, I would like to thank all those individuals and organisations who have contributed to the development of this code.

Roger Elphick OBE
Chairman of the UK Lighting Board

Executive Summary

This code of practice aims to provide local authorities with guidance in an ever-changing environment, creating a strong foundation for a positive and lasting road lighting maintenance policy. Adoption of the recommendations in this code will help achieve the delivery of Best Value services. Whilst the code is specifically intended for road lighting, the principles are equally applicable to other forms of exterior lighting.

SUMMARY OF RECOMMENDATIONS

1. The authority's policy in relation to the provision of its public lighting service should be clearly stated and should cover all the organisation and services involved in delivering the service. (3.2)

2. All personnel engaged in public lighting operations should be trained in accordance with national guidelines such as those produced by the Institution of Lighting Engineers and issued with the appropriate certification. (3.3.3)

3. No operatives should be placed at risk due to lack of skills on the part of themselves or others dealing with electrical equipment. (Appendix C)

4. Each authority should establish and maintain up to date and accurate inventory of all highway electrical equipment (including authority cable networks) as part of its asset management system. (3.3)

5. Authority cable networks should be recorded on Ordnance Survey based plans or alternatively on a Geographic Information System. (3.3)

6. An asset management system should be used to control and record all cyclical and reactive maintenance activities. (3.4, 4 and 5)

7. Cyclical maintenance intervals for lighting installations should be determined to ensure the installation’s correct operation and light output, minimize failures and maximize life. (4.1)

8. Lamp replacement policies should be carefully evaluated taking account of local technical and geographic considerations, to maintain light output whilst limiting the number of lamp failures to an acceptable level. (4.5)

9. Each authority should establish and operate a system for monitoring the operational status of its equipment. (5.2)

10. Each authority should establish and operate a system for the reporting of faults by the public. The system should allow for the reporting of emergencies 24 hours per day each day. (5.2)

11. Each authority should establish and enforce specific response times for each maintenance task. (5.4)

12. Each authority should determine the frequency of electrical inspection and testing and carry out such works at a frequency of not less than once every 6 years.

13. The condition of all enclosures, including the general structural condition of lighting columns, illuminated traffic sign posts, feeder pillars, etc. should be recorded on the operative report at each maintenance visit. (4.6)

14. New steel lighting columns should, as a minimum, be hot dipped galvanised and consideration should be given to the application of further protective coating by the lighting column manufacturer at the time of manufacture. (4.7)

15. A programme for the maintenance and reapplication of protective coatings for *in situ* lighting column or illuminated traffic sign post should be determined and implemented taking account of the location, existing protective system and any other environmental factors including atmospheric conditions. (4.7.1 and 4.7.2)

16. A risk assessment strategy for the management of the structural safety of lighting columns and illuminated traffic sign posts should be developed and implemented and where necessary structural testing of lighting columns and illuminated traffic sign posts should be carried out. The asset management systems should include sufficient data as to the location, type and age of the equipment to allow the risk assessment to be carried out. (3.4 and 4.7.3)

17. Each authority should negotiate a formal service level agreement with the Distribution Network Operator (DNO). (6)

18. Each authority should ensure that their procedures, and those of any contractor, do not prevent the DNO from meeting agreed performance standards. (6.9)

19. Each authority should consider the use of competitive tendering for highway electrical maintenance as part of its Best Value policy. (7.1)

20. Each authority should seek competitively tendered supplies of electricity for its highway electrical equipment. (7.2)

Chapter 1
Introduction

This Code of Practice is intended to apply throughout the United Kingdom and to accommodate any key differences that exist in the devolved administrations. It seeks to harmonise public lighting maintenance practice where this is practicable and consistent with the expectations of users, whilst retaining scope for local discretion and diversity.

The importance of public lighting operation and maintenance to the integrated transport network agenda, to public amenity and safety, and to crime reduction has never been more widely recognised. The inevitable consequences of significant under-investment over many years are an increasingly visible deterioration in the infrastructure and accompanying public concern.

The response of many authorities to funding constraints has been to concentrate on repairs to lights out, deferring works of preventative maintenance and in particular renewal of the infrastructure. In extreme situations this has led to the removal of lighting columns simply to ensure public safety in terms of column collapse, whilst leaving the road inadequately lit. An increased programme of investment in public lighting maintenance, following the recommendations of this Code, will help to address this decline.

This Code of Practice does not give detailed recommendations for the maintenance of gas lighting, for which advice should be sought from suitable specialist organisations. However, some information is given in Appendix I – Gas Lighting.

Chapter 2
Objectives and status of this code

2.1 OBJECTIVES

- To encourage the development, adoption and regular review of policies for public lighting operation and maintenance, consistent with the wider principles of integrated transport, crime reduction, sustainability and best value.

- To encourage harmonisation of public lighting maintenance practice and standards, where this is consistent with user expectations, whilst retaining reasonable diversity consistent with local choice.

- To encourage the adoption of an efficient and consistent approach in the collection, processing and recording of public lighting inventory and condition data for the purpose of local and national needs assessment, management and performance monitoring and electricity purchase.

- To encourage the adoption and regular review of a risk management regime in the determination of local technical and operational standards.

2.2 STATUS OF THE CODE

- The recommendations of this Code are explicitly not mandatory on authorities. The key principle of Best Value, requiring authorities to involve users in the design and delivery of services, implies that authorities should have reasonable discretion to respond to such involvement.

- Authorities have certain legal obligations with which they need to comply, and which could, on occasion, be the subject of legal action. In such circumstances, the contents of this Code may be considered to be a relevant consideration. In these circumstances, where authorities elect to adopt policies, procedures or standards differing from those recommended by this Code, it is essential for these to be identified together with the reasoning for such differences.

- This Code is based on the assumption that available funding for public lighting maintenance will provide some flexibility for authorities to pursue a regime of assessment and rational planning for renewal of the infrastructure. Where this is not the case, considerations of public safety will need to take precedence.

2.3 DEFINITIONS

For the purposes of this Code of Practice the following definitions are used:

Authority means all forms of national and local authority having a responsibility for public lighting maintenance.

Client means the person or organisation responsible for the operation and management of the public lighting system in a defined area.

Contractor means the person or organisation employed by the client to undertake the maintenance of the public lighting system in a defined area.

DNO means the Distribution Network Operator of a public electricity distribution system within a defined licensed area.

Highway power supply means an electrical installation comprising an assembly of associated highway distribution circuits, highway distribution boards and street furniture, supplied from a common origin.

Ingress Protection (IP) rating means the degree of protection against the ingress of solids, dirt or moisture (see BS EN 60529).

Initial lamp flux means the output of the lamp, when new, in lumens.

Lamp flux maintenance factor means the value of the lamp output at the specified lamp replacement interval as a percentage of the initial lamp output.

Luminaire maintenance factor for a specific luminaire means the period determined according to the cleaning interval, the Ingress Protection (IP) rating of the luminaire, and pollution category of the area in which the lighting is installed.

Public lighting means a system of street lighting and any associated illuminated traffic signs and illuminated traffic bollards owned by the authority.

Illuminated traffic bollard means transilluminated bollards lit by internal or base-mounted lighting units, carrying one or more diagrams from the Traffic Signs Regulations & General Directions (TSR&GD), or the same type of unit with all plain aspects.

Illuminated traffic sign means internally or externally illuminated signs, carrying a diagram or legend as required by the TSR&GD, flashing school crossing warning signs, centre island beacons, and pedestrian crossing Belisha beacons.

Street lighting means a system of lighting illuminating streets, footways, footpaths, cycle tracks and pedestrian subways open to public access.

Chapter 3
Provision of the service

3.1 LEGAL POWERS AND DUTIES

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.

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.

In Northern Ireland, the Roads (Northern Ireland) Order 1993, Article 44 [5] grants the Department of the Environment the power to provide road lighting, where the Department considers that any road should be illuminated.

In Scotland, the Roads (Scotland) Act 1984, Section 35 [6], 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.

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.

- Breach of the common law duty of care (if it can be established).

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.

The Health and Safety at Work Act 1974, together with the Management of Health and Safety at Work Regulations 1992 and the Construction (Design and Management) Regulations 1994 provide for a requirement for authorities to carry out work in a safe manner and establish arrangements for the management of construction works. In Northern Ireland the equivalent legislation is the Health and Safety at Work Order (NI) 1978 and the Construction (Design and Management) Regulations (NI) 1995.

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 NRSWA, the Code of Practice for Recording of Underground Apparatus in Streets and the requirements of the Electricity Safety, Quality and Continuity Regulations 2002.

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

- Disability Discrimination Act 1995.
- Criminal Justice and Public Order Act 1994.
- Human Rights Act 1998.
- Freedom of Information Act 2000.
- Local Government Act 2000.

3.2 POLICY

The authority's policy in relation to the provision of its public lighting service should be clearly stated and should cover all the organisation and processes involved in delivering the service. Details of particular importance to the public should be explicit and include:

a) Service performance targets:

   (i) Authority

   (ii) DNO.

b) Frequency of night time monitoring for outages.

c) How to contact the authority:

   (iii) Telephone

   (iv) E-mail

   (v) Mail.

d) Reporting of faults and/or emergencies.

All this information should be available to the public and easily accessible:

- Via the internet.
- Published and displayed in libraries, housing offices and similar public buildings.
- Annually with Council Tax requests.
- Via community newspapers.
- Through interested parties such as Parish, Town and District Councils.

See Clause 5.2 Monitoring for inoperative lighting and Appendix B – Fault Reporting.

Customer care for public lighting activities will normally be integrated into the authority's overall policy for customer care and response to complaints. For this purpose, it is

useful to distinguish between reports of equipment not working, and complaints that, for instance, a previous report has been ignored. The former should be treated as faults and dealt with accordingly, whereas the latter should be classified as a complaint under the authority's customer care procedure.

3.3 MANAGEMENT OF MAINTENANCE

3.3.1 Strategy

All the elements of a public lighting system require inspection and maintenance to ensure that they are safe, operate correctly, continue to provide the designed performance and to maximise their life. Maintenance can be divided into two aspects:

1. 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 (see Section 4).

2. Reactive, where failures of equipment are recorded and the equipment repaired or replaced (see Section 5).

A service management strategy covering the structure of the organisation, 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. Without clearly defined targets, it will be difficult to assess how successfully the service has been delivered.

3.3.2 Computer Systems

The management of the asset, energy and maintenance activities is best organised using dedicated software specifically designed to handle public lighting systems. A comprehensive package will include equipment inventories, work instructions and monitoring, scheduling of cyclical activities, energy calculations and financial control. Digital mapping, with links to the public lighting database, should also be incorporated and should be used to record highway power supplies cable records and feeder pillar locations. Other information, such as new works plans and photographs, can also be incorporated if required.

Without access to computerised data and records of work carried out, the reporting of key information and the production of Performance Indicators will be difficult, if not impossible. Management information and data analysis of failure modes, response times and expenditure provide the opportunity to plan for the future whilst controlling the present.

3.3.3 Competence of staff

All those involved in managing and providing the service should have appropriate experience, skills, training and equipment to perform their tasks. Monitoring and training should be coordinated to ensure high levels of competence. Effective training should support changes in techniques, materials and procedures.

All personnel should have a thorough understanding of personal and task-related risks, together with awareness of the available range of actions and options.

Specific recommendations for competency related to various disciplines and activities are given in Appendix C – Competence.

3.4 ASSET MANAGEMENT

3.4.1 The asset

In terms of public lighting equipment an asset normally involves equipment owned and operated by the authority and includes:

- Street lighting.
- Illuminated traffic signs.
- Illuminated traffic bollards.
- Feeder pillars.
- Highway power supplies, including cables, joints and other components.
- Electrical connections on lighting columns for festive decorations.

This equipment is usually situated on a highway or public area and can include equipment mounted on adjacent structures or buildings. Equipment may also be situated on un-adopted roads and areas.

3.4.2 Asset management systems

Other assets include the databases, inventories, inspection records, test certificates, etc. that hold valuable information about the equipment installed. When setting up an asset management system, links to this data should be considered for ease of operation.

All authorities should develop and operate detailed asset management systems of their public lighting stock, to assist in the effective maintenance management of the assets in accordance with the authority's defined maintenance strategy, to enable appropriate risk assessment strategies to be formulated, and to facilitate the purchase of electricity for unmetered equipment. Fault and repair histories, together with the results of inspections and electrical and structural testing, should be included to allow the monitoring of the condition of the lighting stock and to determine future asset replacement programmes. These details will enable maintenance requirement to be established and provide supporting information for capital and revenue bids for additional finance, particularly through Local Transport Plans in conjunction with the 10-year Plan for Transport expenditure.

A properly maintained asset management system will hold information that can be used effectively and efficiently to report on all aspects of the service. Operations that may, typically, be planned and reported on are:

a) Efficient planning and execution of cyclic maintenance:

   (i) group lamp replacement

   (ii) electrical inspection and testing

   (iii) structural inspection and testing

   (iv) painting.

b) Efficient planning and execution of night-time patrols for the detection of outages.

c) Efficient planning and execution of repairs.

d) Accurate returns to the energy suppliers on energy consumption and the maintenance of accurate data for energy procurement.

e) Production of information and cable records to comply with the New Roads and Street Works Act and the Electricity Safety, Quality and Continuity Regulations.

f) Accurate data for performance indicators KPIs, BVPIs.

g) Accurate data to prioritise asset replacement programme.

h) Financial expenditure analysis and the control of expenditure.

i) Recovery of costs from third parties (e.g. vehicular knockdowns).

3.4.3 Management information

It is important to have information and data about the progress and operation of the service including items such as:

- Analysis of trends.
- Re-occurring faults.
- Specific component failure.
- Response times.
- Geographical trends.

3.4.4 Inventories

The inventory can be split into several subject areas:

Geographic data – a record of the road or area on which the lighting is situated and the standard of lighting provided. Data should be cross referenced to the National Gazetteer where possible.

Apparatus data – a record of equipment location and type, with technical data which will remain the same unless the equipment or components are changed or modified and should be sufficient to identify different types of equipment, light sources, operational hours and electricity connection arrangements. It should also include any additional information necessary to comply with BSCP520 requirements for the purchase of unmetered electricity and details of metered supplies that need to be excluded from the declared load for unmetered supplies (See Appendix G - BSCP 520 file format and flow chart).

Risk assessment data – data required to carry out structural assessment of lighting columns and illuminated traffic sign posts. This may also include details on access restrictions for maintenance and special equipment.

Operational data – a dated record of actions carried out to equipment, including cyclic and reactive maintenance, with a history of previous actions.

Recommendations for the minimum data to be held in the inventory are given in Appendix A – Inventory Data Sets.

3.4.5 Response times

The client should ensure that the asset management system is updated regularly to ensure the currency of the data held. Such updates may be carried out by either the client itself, a managing organisation or by the contractor. Failure by a managing organisation or a contractor to meet the specified standards may be treated as non-compliance and a default payment made as compensation to the client for loss of service. Where the client carries out these tasks directly, it should adhere to the specified standards.

Recommended maximum response times are given in Table 3.1 below.

Table 3.1 – Maximum response times for updating of Asset Management System

Nature of activity	Response time following return of completed work sheet
Cyclic maintenance activities	5 working days
Non-emergency faults	5 working days
Emergency faults	1 working day
Commissioning of a single unit of lighting equipment, illuminated traffic sign or illuminated traffic bollard	10 working days
Commissioning of a complete system of lighting	10 working days
Decommissioning and removal of a single unit of lighting equipment, illuminated traffic sign or illuminated traffic bollard	10 working days
Decommissioning and removal of a complete system of lighting	10 working days
Fixing of non-illuminated attachment	20 working days
Fixing and commissioning of illuminated attachment	5 working days

3.5 DESIGN FOR MAINTENANCE

3.5.1 Materials

All the equipment used in public 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. Initial cost is important but it is whole life costs (manufacturing + procurement + maintenance + energy + recycling/disposal) that should guide the final

selection of equipment. When selecting equipment, the maintenance client organisation should be consulted and their views obtained. Past history and performance of existing equipment may provide useful guidance. In respect of proposals to introduce new equipment, a maintenance overview may reveal anticipated problems and advantages which could influence selection. From a maintenance view, there are advantages in limiting the range of equipment types. Lower stock levels, availability of spares, management of repairs and experience in fault finding/repairs are all benefits that can be expected to accrue.

3.5.2 Design

At the design stage every effort should be made to limit or eradicate risk to the installation, maintenance operatives and the public. The design should ensure that any special requirements or conditions with regard to the installation and maintenance of the system accompany the installation instructions. Where appropriate, a maintenance manual should be prepared and included in the safety file, which should be updated and enhanced / enlarged throughout the maintenance contract and be made available to the maintenance contractor's successor in the event of a change in contractor.

3.5.3 Trees

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.

Care should be taken to avoid unnecessary damage to roots and branches when erecting or removing lighting columns or excavating cable trenches. See *NJUG 10 Guidelines for the Planning, Installation and Maintenance of Utility Services in Proximity to Trees* for further details.

Suitable arrangements for monitoring any interference with the performance of the lighting installation and for pruning should be included within the maintenance manual. Only minor pruning of branches up to 50 mm in diameter should be carried out by maintenance personnel. More extensive pruning should be carried out by qualified operatives under the supervision of an arboriculturist. See BS 3998: 1989 Recommendations for Tree Work for further details.

3.5.4 Maintenance factors

The frequency of luminaire maintenance and the group replacement of lamps have a direct relationship on the performance of the lighting installation. BS 5489–1: 2003 recommends that lighting installations be designed to provide a minimum maintained level of luminance or illuminance throughout the life of the installation. This is realised in the design process by the use of a maintenance factor (MF) which takes account of the lamp flux maintenance factor and luminaire maintenance factor. The use of a maintenance factor provides a logical basis for the design process and helps to achieve the minimum maintained lighting level throughout the life of the installation.

Where lamps are burnt to extinction (see Clause 4.5.2), luminaires may be maintained at the time of lamp replacement. In such circumstances it is impossible to determine an overall maintenance factor for use in design.

3.5.5 Recycling and waste disposal

Maintenance of public lighting systems generates waste products such as failed or group replaced lamps, failed control gear, luminaires and replaced lighting columns and posts in varying quantities. Each of these products has different characteristics and different recycling or disposal requirements.

Figure 3.1: The Boulevard, Kingston upon Hull. A lighting scheme designed to light a heavily treed boulevard without extensive pruning of the trees. The carriageway lighting is provided by centrally mounted catenary suspended luminaires using high pressure sodium lamps. The footway lighting is provided by secondary luminaires mounted on the rear of the lighting columns using ceramic metal halide lamps. Photograph by kind permission of Sugg Lighting Ltd.

Many lamps contain small but significant quantities of heavy metals such as mercury, which should be recovered where possible and viable. Similarly the metal end caps and other metal products used in the construction of lamps should be recovered and recycled. The disposal of lamps should be carried out using purpose designed equipment which restrict the discharge of dangerous gasses and particles and reduce the potential for explosions. Any resultant waste that cannot be recycled should only be disposed of in waste disposal sites registered for that type of waste. See Appendix H – Lamp Disposal Legislation for more detail.

Control gear and old luminaires contain metals such as aluminium, copper and stainless steel and these items should be recovered and recycled. Plastic bodies of luminaires may also be ground down and recovered for other plastic products.

Steel, aluminium and cast iron lighting columns and posts have generally been recovered as scrap metal and reused for other products. Concrete lighting columns have normally been buried in landfill sites, but this is now becoming unacceptable due to the waste of natural resources and the volume to be disposed of. There are a number of companies now offering to crush concrete lighting columns, recovering any reinforcing materials and using the crushed concrete as aggregate or infill material.

Current legislation and good environmental practice regarding the disposal of waste means that it is no longer morally, ethically or legally acceptable to just dispose of waste products and every effort should be made to reduce the volume and to recycle wherever possible.

3.6 BEST VALUE

3.6.1 Improving performance

Knowledge of, and comparison with, other authorities may lead to changes in the way the service is delivered. Regardless of these external influences, there is an inherent expectation that all parties involved in delivering the service will seek ways to improve the service to meet the customer's needs. The introduction of new techniques, new equipment and new management strategies must have identifiable beneficial outcomes. Cost implications must be recognised but savings or increases in expenditure should not be the sole consideration.

Performance indicators (PIs) should be used to measure both client and contractor effectiveness at delivering the complete service and to provide a baseline from which improvement can measured. The items listed in 3.6.2 that are to be reported on annually should be monitored continuously, so that corrective action and improvement can be taken as soon as required.

3.6.2 Performance reporting

Annually, as part of the Best Value procedure, the authority should report actual performance in complying with the service policy statement.

The report should include both national performance indicators and local performance indicators (LPI), and may also include other relevant statistics.

There are two main categories of PIs:

1. To provide internal management information to monitor and control service delivery. It is not expected that this information will be published.

2. To publish in the public domain (including reporting to Government).

In category 1 indicators such as:

a) Average time to identify a fault.

b) Number of actual patrols completed.

c) Average time from identification of fault to issue of instruction for repair

are a measure of the management of works identification and client effectiveness.

d) Time from instruction to completion of fault repair.

e) Percentage return visits

provide a measure of the effectiveness of repairs undertaken by the contractor.

f) Number of call outs to emergencies.

g) DNO's performance, time from instruction to completion.

In category 2 some statistical data is useful to the public in developing an understanding and appreciation of the service provided. Annual reporting of the following items is recommended:

a) Total number of faults identified by:

(i) authority patrol

(ii) public reporting

(iii) other reports.

b) Percentage of lights working as planned.

c) Total number of failed or faulty DNO service connections.

d) Total number and cost of incidents of:

(i) vandalism/wilful damage

(ii) vehicular impact.

Additionally, Government may require other PIs and these should be included in the annual report.

Chapter 4
Cyclical maintenance

4.1 INTRODUCTION

Cyclic maintenance is the main tool in the management of preventative maintenance, forestalling poor performance and failure of the installation. A well-designed 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; reduce the incidence of faults by preventative maintenance; and check that the installation is safe. Good maintenance should be considered as an essential part of managing health and safety risks.

Cyclical maintenance will normally include the following tasks:

- Luminaire inspection, maintenance and cleaning.
- Photocell / timing mechanism inspection, adjustment and cleaning.
- Visual inspection and minor repairs to electrical equipment and wiring.
- Mechanical inspection and maintenance including door security.
- Visual inspection of the structural condition of the lighting column or illuminated traffic sign post, bracket, luminaire and any attachments.
- Programmed electrical inspection and testing.
- Programmed structural testing.
- Programmed group lamp replacement.
- Programmed painting.
- Inventory data verification.

Cyclical maintenance programmes should be determined taking account of all variables including lamp type, luminaire sealing, age and type of equipment and statutory requirements such as electrical testing. Whilst it is desirable to carry out as many of these tasks as possible on a single visit, the task, competency and experience of the workforce may affect the range of work that can be completed at one time.

A careful assessment of the tasks and the qualification and experience of the maintenance operatives should be carried out to ensure maximum efficiency is achieved. If necessary, separate crews should be used for different tasks, to minimise delays and maximise productivity.

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, such as once per annum. This should minimise lamp

outages, however care should be taken to ensure that the high-mast lighting continues to perform the task for which it was designed. Should the number of lamps out of operation at any time exceed 25 per cent of the total number of lamps installed on the mast, then an intermediate maintenance visit should be carried out.

4.2 LUMINAIRE MAINTENANCE

When determining luminaire maintenance intervals, the following issues need to be taken into consideration:

- IP rating of luminaire.
- Pollution category of area.
- Lamp type and group replacement frequency.
- Different intervals for installations with different conditions (e.g. rural or urban).
- Relationship between cost of new scheme and cleaning interval (i.e. lower overall maintenance factor equates to shorter spacing or higher wattage of lamp).
- Effect of cleaning interval on maintained level of lighting.

It is common practice to set luminaire maintenance intervals to correspond with group lamp replacement. The luminaire maintenance intervals should be calculated taking account of the luminaire maintenance factor and the lamp flux factor used in the design (see Clause 3.5.4). The lamp flux maintenance factor can be established from the lamp manufacturer's data, and suggested luminaire maintenance factors are given in Table D1 of Appendix D (informative) Typical luminaire maintenance factors of BS 5489–1: 2003.

Ongoing improvements in lamp technologies such as increased lamp life, reducing lumen depreciation and amendments to initial lumen outputs, together with the reductions in atmospheric pollution, may allow the luminaire maintenance period and group lamp replacement period to be adjusted in the future, whilst still maintaining the overall maintenance factor used in the design to be retained. The effect on the overall maintenance factor can be calculated in accordance with principles of design in BS 5489–1: 2003.

Technical Report No. 19 The Effectiveness of Lantern Cleaning, published by the Institution of Lighting Engineers, provides additional information for Authorities considering luminaire maintenance intervals and demonstrates that cleaning has a significant effect on recovering the depreciation of light output of the luminaires due to dirt. Cleaning the exterior of the luminaire bowl has the most significant effect, followed by cleaning the interior of the bowl. Cleaning of interior reflecting surfaces has the least significance, as these surfaces can be easily damaged, and reflectors distorted or moved during the cleaning process. It is preferable not to clean them.

Figure 4.1: Maintenance of 8 m lighting unit. Photograph reproduced by permission of Parkersell Highway Lighting Ltd.

To maximize cleaning intervals, new luminaires should have an optical compartment sealed to a minimum of IP54; however, luminaires sealed to a higher IP rating may have significant advantages by extending maintenance intervals. The interior of optical compartments in luminaires with an IP6x or greater rating do not require to be cleaned, providing the efficiency of the sealing system is maintained. Dependent upon the design of the luminaire, the optical compartments on many new luminaires are sealed to a higher IP rating than the gear compartment. This is not considered to be detrimental to the operation of the luminaire provided the respective sealing systems are maintained. However, some manufacturers are now recommending that electronic control gear should only be used in IP6x sealed enclosures to protect the control gear from damp and dirt.

The transparent cones of photoelectric control units should be cleaned at each luminaire maintenance visit to help maintain accuracy of switching.

Where lamps are burnt to extinction (see Clause 4.5.2), luminaires may be maintained at the time of lamp replacement. However, due to the wide variation in the life of individual lamps, maintenance only at lamp replacement cannot be considered as cyclic maintenance and a luminaire maintenance interval cannot be defined.

Computerised asset management systems can be used to identify different cleaning intervals for installations with different conditions, lamp types, pollution problems and luminaire IP ratings.

4.3 ILLUMINATED TRAFFIC SIGN AND BOLLARD MAINTENANCE

Cleaning of sign faces should be carried out annually. 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 achieve an overall maintenance factor of not less than 0.8. The maintenance factor should be calculated in accordance with Clauses 3.54 and 4.2.

External cleaning of illuminated traffic bollards should be carried out at least annually. 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.

NOTE: For the optical performance of traffic sign plates refer to the Highway Maintenance Code of Practice.

4.4 OTHER TASKS

Other tasks that should be carried out during each cyclic maintenance visit include:

1. A visual inspection of the luminaire, lighting column, illuminated traffic sign post and bracket, for corrosion, cracking, spalling of concrete, damage, non-verticality, etc. Maintenance operatives should be trained to recognise the structural condition of the lighting column, illuminated traffic sign post and bracket, which can be simply referenced against a known indicator. Appendix J – Lighting Column Structural Condition, contains three typical lighting column conditions depicting moderate to severe structural deterioration. This system can be used to indicate an appropriate level of deterioration against each lighting column or illuminated traffic sign post inspected, as part of the more detailed structural survey described in Clause 4.7.3.

   The recorded results of this visual inspection should be reviewed to assess the need for replacement, painting or for a more in-depth investigation of severe corrosion, cracking or apparent structural failure.

   Structural failure of a particular type of luminaire, lighting column, illuminated traffic sign post or bracket should prompt a thorough inspection of all units of the same or similar type.

   The security, safety and condition of any attachments to the lighting column or illuminated traffic sign post should be checked and reported on at each maintenance visit.

2. Mechanical maintenance consisting of the following items:

   a) Replacement of damaged luminaire bowls, gaskets or bodies.

   b) Luminaire, bracket and sign plate fixings checked for security.

   c) Lighting column and illuminated traffic sign post doors and locks checked for security.

d) Hinges, door locks, raising and lowering gear operated and lubricated.

e) Alignment of luminaires and bracket arms checked and realigned/repaired as necessary.

f) Checking, verification and resetting (if necessary) of luminaire optical distribution.

g) Minor pruning of trees and other foliage obscuring the luminaire.

3. Data verification to check that inventory data is correct.

4. Visual inspection or full electrical inspection and testing as appropriate and minor repairs of electrical equipment and wiring.

5. Inspection of the condition and visibility of the diagrams on the faces of illuminated traffic signs and bollards (see Highway Maintenance Code of Practice).

6. Group lamp replacement as appropriate (see Clause 4.5.3).

4.5 LAMP REPLACEMENT

4.5.1 Introduction

There are two main strategies for the replacement of discharge lamps:

1. Burn to extinction, under which lamps are replaced on failure.

2. Group lamp replacement; under which all lamps of a particular type in a particular area or street are replaced at the same pre-defined time.

Due to the legal requirements for the illumination of certain traffic signs, it is recommended that a group lamp replacement strategy be adopted for illuminated traffic signs and bollards.

Lamp manufacturers are generally unable to provide accurate data of the mortality rate of discharge lamps operated under field conditions, but can often supply limited data obtained under laboratory conditions (see Figure 4.2). Laboratory data on lumen depreciation is also available and can be reasonably applied to site conditions (see Figure 4.3).

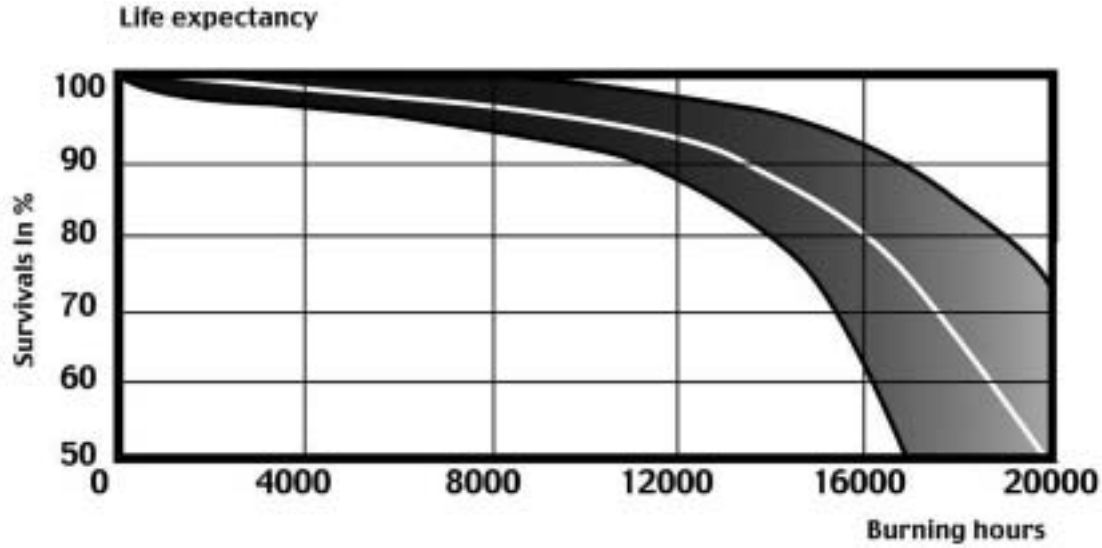


Figure 4.2: Typical example of a discharge lamp's life expectancy curve

NOTE: The figure is not representative of any lamp type or wattage or of any manufacturer's product.

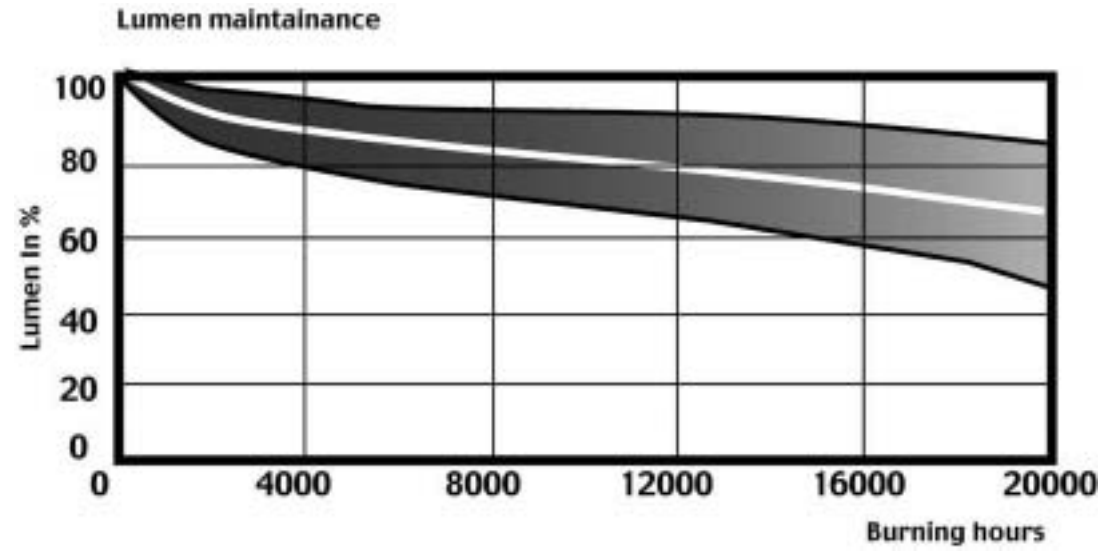


Figure 4.3: Typical example of a discharge lamp's lumen maintenance curve

NOTE: The figure is not representative of any lamp type or wattage or of any manufacturer's product.

4.5.2 Burn to extinction

A burn to extinction lamp replacement policy maximises the life of the lamp. However as individual discharge lamps have a varied life expectancy it is impossible to assess the level of lumen depreciation that will occur throughout the installation and therefore a maintenance factor representative of the lighting system's operating conditions cannot accurately be set. The lumen output of all discharge lamps falls during life (see Figure 4.3). Unless the level of depreciation is taken account of in the design, the installation will be providing lighting levels lower than those recommended in BS 5489–1: 2003 for most of its life.

As electricity is paid for on a predetermined basis, the effective cost per lumen will increase as the lumen output decreases. Thus the cost per lumen will be higher throughout the life of burn to extinction lamps when compared to group replaced lamps.

It is often claimed that burning discharge lamps to extinction can damage or cause premature failure of the control gear. This possibility can be minimised by the use of electronic control gear or timed igniters, which prevent the circuit from continuously trying to ignite a failed lamp.

A burn to extinction lamp replacement policy will increase the average number of faults to be rectified per day. When determining a lamp replacement policy, the cost of attending to sporadic and widely dispersed faults, particularly in remote rural areas, should be taken into account and offset against any potential savings from burning the lamp longer. Whilst it is difficult to cost the loss of amenity to the public due to the reduced level of illumination provided over the life of the installation, consideration of this aspect should also be taken in to account when determining a policy.

Although some Audit Commission findings tend to support a burn to extinction policy for certain lamp types and wattages, the Commission emphasises the need to assess the best policy for each individual authority.

4.5.3 Group lamp replacement

It has traditionally been accepted that group lamp replacement is the most cost effective policy for the majority of discharge lamps used in public lighting installations. Group replacement of discharge lamps helps to ensure that the lighting system performance is maintained throughout the life of the installation. Lamp replacement periods depend on the type of lamp and annual hours of operation, but lamp technology continues to improve, and to maximise the benefits from these improvements, group replacement intervals and cleaning intervals should be regularly reviewed. Records of the design criteria used should be recorded, as this information will allow the effect of extending the replacement and/or cleaning intervals, to take account of improvements in lamp life and lumen depreciation, to be assessed.

Group lamp replacement programmes should be organised so that a reasonably uniform workload is achieved every year.

Lamps in new lighting units installed more than 12 months prior to the group lamp replacement programme of the immediate area should be included in the appropriate group lamp replacement programme. Computerised maintenance management programmes should allow lamps replaced in the last 12 months to be identified so they are not replaced as part of the group lamp replacement programme.

Lamps should be run up after replacement to ensure they are working correctly.

Further details on lamp replacement policies are published in the Institution of Lighting Engineers' *Technical Report No. 17 A Study of Lamp Replacement for Discharge Sources.*

4.5.4 Capacitor replacement

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 economic way of ensuring the power factor of the circuit is maintained, is by group replacement of the capacitors at the time of the test.

4.6 ELECTRICAL INSPECTION AND TESTING

4.6.1 Introduction

The Electricity at Work Regulations state that “As may be necessary to prevent danger, all systems shall be maintained so as to prevent, so far as is reasonably practicable, such danger”.

To demonstrate that an installation meets the necessary safety standards, electrical inspection and testing comparable to any other fixed equipment installation should be carried out. Electrical inspection and testing should be carried out at intervals of up to six years in accordance with the requirements of BS 7671: Requirements of Electrical Installations.

The frequency of the electrical inspection and testing should be determined taking account of the following:

- The type of installation.
- The use and operation it is subject to.
- The frequency of maintenance.
- Any external influences which exist.
- Past history of inspection and repair.

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.

4.6.2 Visual inspection of electrical equipment

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 client. So far as reasonably practicable, the visual inspection should verify that the health and safety of persons, animals and property is not endangered.

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.

During the visual inspection, any dangers should be identified that may arise during the testing procedure. The 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 main fuse from the supply termination until the fault has been rectified. Under no circumstances should an electrically dangerous item of equipment be left in operation.

Lighting columns are often used as highway distribution units for electrical supplies to adjacent illuminated traffic signs/bollards and temporary supplies; therefore, it is important that the inspection takes account of such external installations and any changes in condition affecting electrical safety.

Fuses or other circuit protection devices should be checked for correct type and value and if necessary replaced.

The presence of electronic devices on the system should be identified and recorded as such items may be damaged during testing. Such items may have to be disconnected from the circuit to allow testing of the remaining installation.

Failure to carry out an electrical inspection must be recorded in the operative's report. A record should be made of any departure from the regulations.

Operatives should be trained and competent to carry out visual inspections and recognise any potential dangers

For further details on electrical inspections see Appendix D – Electrical Inspection and Testing.

4.6.3 Testing

Testing should only be carried out by a competent person with sufficient training and experience to interpret the test results and identify any inherent problem within the installation (see Appendix C – Competence). All test equipment should be suitable for the test intended, correctly calibrated and regularly certified. For further details on electrical testing see Appendix D – Electrical Inspection and Testing.

4.6.4 Electrical testing records

The results of periodic electrical inspection and testing must be recorded on an inspection certificate. Suitable test certificates specially designed for highway electrical installations are available from the National Inspection Council for Electrical Installation Contracting (NICEIC).

Records of maintenance, including electrical test results, should be kept throughout the life of the installation, 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 meeting the demands of the regulations and providing an efficient maintenance system.

4.7 LIGHTING COLUMNS AND ILLUMINATED TRAFFIC SIGN POSTS

4.7.1 Inspection and assessment of protective coatings

Lighting columns and illuminated traffic sign posts need to 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, as a minimum, 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.

Lighting columns manufactured from aluminium, stainless steel or composite materials generally require no additional protective coatings to be applied. To maximise the life of the lighting column or illuminated traffic sign post, any protective systems need to be maintained throughout its life.

In environmentally sensitive areas such as conservation areas and town/city centres, the application of additional protective coatings may be carried out to provide a more

decorative and aesthetically pleasing finish to the lighting columns and illuminated traffic sign posts as well as providing protection. The negative impact poorly maintained public lighting equipment can have on an area should not be overlooked and should be taken in to account when determining maintenance and reapplication of protective coating intervals.

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 contractor to the client. Maintenance operatives should be trained 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.

4.7.2 Protective coatings and their application

Site-applied protective coatings vary from the simple oil-based paint system up to high-build multiple coat systems. Many of the high-build protective coatings provide superior protection and life to the simple oil-based paints, but do not have the same overall high quality of finish. Such systems are considered as acceptable in less sensitive areas, particularly alongside high-speed roads with little or no pedestrian movement. New high-build multi-coat systems which have a higher quality of finish are now becoming available and should be acceptable in most areas other than very sensitive locations where high value is given to the aesthetics of the area and the infrastructure.

Lighting columns and illuminated traffic sign posts are subject to high levels of pollution from traffic spray, animals and other environmental factors. All too often lack of preparation before the application of a protective system leads to failure of the new coating. When selecting a suitable paint finish for application to *in situ* lighting columns and illuminated traffic sign posts, care should be taken to ensure that the existing finish is sound, well adhered to the substrate and compatible with the proposed new paint system. Adhesion of the existing paint system can be checked by carrying out a cross-hatch test on a representative selection of units to be painted and compatibility checked by applying a small patch of the proposed new paint system over the existing protective system. When preparing *in situ* lighting columns or illuminated traffic sign posts for the application of a new protective system, the complete surface of the unit should be cleaned, de-greased and any corrosion treated before the new protective system is applied. Failure to carry out these tasks may result in the breakdown, de-lamination or peeling of the new protective coating and the need for further maintenance.

The frequency for the reapplication of protective systems to lighting columns and illuminated traffic sign posts should be determined taking account of the following matters:

- Condition and age of equipment.
- Level of atmospheric pollution.
- Location of equipment.
- Type of protective system used.
- Other environmental factors.

In aesthetically sensitive areas, the frequency of maintenance and reapplication of the protective coatings may need to be reduced from that used for protection only, to maintain the decorative and aesthetic appearance of the lighting columns and illuminated traffic sign posts.

Further guidance on the application and maintenance of protective coatings can be found in the Institution of Lighting Engineers' *Technical Report No. 26 A Practical Guide to the Painting of Steel Lighting Columns and Bracket Arms.*

Figure 4.4: Corrosion damage due to lack of maintenance of protective finish

4.7.3 Structural inspections and testing

4.7.3.1 Introduction

The continuing structural failures of corroded lighting columns and illuminated traffic sign posts, together with the under-investment in replacement, have raised awareness of the increasing age of the stock and its deteriorating condition.

To help assess the structural condition of the stock, 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 written report made by the contractor to the client, stating the equipment's condition and any remedial works required. Maintenance operatives should be trained 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.

Every time a lighting column or illuminated traffic sign post is removed from service, due to accident damage or replacement, its condition should be inspected and analysed and the information recorded. 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. If a removed unit shows severe corrosion or other worrying defects, it should prompt a thorough inspection of all units of the same or similar type.

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.

4.7.3.2 Risk Assessment

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. Detailed advice is given in the Institution of Lighting Engineers' *Technical Report No.22 Lighting Columns and Sign Posts – Planned Inspection Regime* (Second Edition, 2001) based on research undertaken by the Transport Research Laboratory (TRL) for the Highways Agency, County Surveyors Society and the Institution of Lighting Engineers.

4.7.3.3 Structural Testing

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. Whatever tests are used, a detailed analysis of the result will be needed to maximise the value of the information obtained. Structural testing should be carried out to a pre-determined programme. However, as most of the tests and in particular the strength tests need to be carried out by specialist contractors with the correct equipment and procedures it is considered that this work should be programmed separately to other cyclic maintenance activities.

Experience indicates the following order of priorities for the testing of lighting columns may be appropriate:

- Locations where the poor condition of the lighting columns has been established as a result of routine visual inspections or other reports.

- 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.

It is recommended that illuminated traffic sign posts be tested at the same time as the lighting columns in the street, unless it can be shown that they are of a substantially different design or protective system or age.

When determining priorities in each of the above sections, the following additional details should be considered:

- The four types of lighting column identified by TRL as posing a significant risk (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).

- Age of installation (provisional information indicates that non-galvanized steel columns manufactured in the 1960s and 1970s are 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.

- Volume of traffic.

The results of any visual inspections and previous test results obtained from similar lighting columns and illuminated traffic sign posts of similar age and in similar locations should also be considered when determining priorities.

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.

There is no proven method of testing currently available for other types of lighting column, such as concrete, fibreglass and cast iron, although some strength tests are now being tried for concrete lighting columns. Reliance must therefore be placed on visual inspections, the accuracy and usefulness of which can be greatly enhanced by suitable training of operatives to recognise defects in the different types of lighting columns and the material used in their construction.

4.8 SCHEDULES

The client should agree schedules of cyclic maintenance work with the maintenance contractor, based on the information contained in the asset management system. Maintenance schedules should indicate the number, lamp type and wattage, and mounting height for each lighting unit, illuminated traffic sign and bollard to be maintained. Schedules should be listed by road for each agreed period of each year and indicate the need for group lamp replacement where appropriate. Electrical testing,

structural testing and painting should be similarly scheduled and a programme agreed for implementation with the respective contractor.

The contractor should sign and date all completed maintenance schedules showing that all cyclic maintenance works, group lamp replacements, testing and painting have been completed before returning them to the client. The schedule should record all additional work completed or required, the results of the structural inspection and visual inspection of the electrical equipment and wiring and any other relevant information.

The asset management system should be updated with the information provided by the contractor as soon as possible after receipt, but within five working days.

4.9 RESPONSE TIMES

The client should have an agreed schedule of maximum response times for differing situations and categories of work. Failure by the contractor to meet the standard may be treated as non-compliance and a default payment made as compensation to the client in appropriate cases.

Typical items against which a response time is required are for the completion of:

- Cyclical maintenance schedule.
- Group lamp replacement schedule.
- Painting of equipment schedule.
- Electrical testing schedule.
- Structural testing schedule.
- Return of paperwork.

Recommended maximum response times are given in Table 4.1 below.

Table 4.1 – Maximum response times for cyclical maintenance activities

Nature of activity	**Maximum response time following indicated completion date on work sheet**
Cyclical maintenance schedule	20 working days
Group lamp replacement schedule	20 working days
Painting of equipment schedule	20 working days
Electricity testing schedule	20 working days
Structural testing schedule	20 working days
Following completion of task, return of completed paperwork	5 working days

Chapter 5
Reactive maintenance

5.1 INTRODUCTION

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 predefined timescales. The time period from initial failure through identification and assessment to rectification should be kept to a minimum, as this period has the greatest influence on the public perception of the quality of the service delivered.

Provision must be made to deal with emergency situations and protect the public from danger, by dealing promptly with events such as vandalism and vehicle impact.

Although the standard measure of success relates to the percentage of lights working correctly there has to be equal regard to the repair of mechanical faults. 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 response criteria as failed lamps.

The contractor has a responsibility to contribute to the efficiency and quality of service delivery and to work with the client to provide an effective repair service. The efficient organisation of work schedules and routing, coupled with adequate materials and competent staff, will help keep the installation safe and maintained to a high standard. The quantity and application of these resources should be set at levels which will meet response times for repairs and will achieve the required level of lamps working as planned.

5.2 MONITORING FOR INOPERATIVE LIGHTING

In order to ensure that the designed service is delivered as continuously as possible, procedures should be put in place to identify lighting not working as planned, on a regular basis, so that faults can be promptly rectified. Three possible methods of identifying lighting not working as planned are:

1. The client, the maintenance contractor or a separate contractor may undertake periodic patrols by operatives at night at an appropriate frequency. Faults can be recorded on a tape recorder, data recording device or on paper for subsequent transfer to the asset management system. Typical inspection frequencies are 14 calendar days, however these may be extended in summer or in remote rural areas.

2. Remote monitoring of 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. Some systems may provide additional monitoring and control facilities such as remote switching and/or dimming of the lamp and recording of electrical parameters.

   Isolated rural areas or isolated remote footpaths without vehicular access may be areas where there are particular benefits from remote monitoring.

Remote monitoring systems are rapidly developing. Three different approaches based on three communication technologies are currently available:

a) Mains-borne signalling using the existing distribution cable network. The scope of these systems is currently limited to intercommunication between equipment located within the same distribution transformer area. There are potential problems associated with the use of the cable network by other data transmission systems and the requirements imposed by the DNO. Mains-borne signalling is probably best suited to highway distribution networks under the direct control of an authority.

b) Radio / microwave communication between any similarly equipped street furniture. System coverage is generally restricted to line of sight between items of street furniture connected to the system. Signals can be collected at a single position and fed into the telephone network for collection of information from remote areas.

c) Cell phone network using GSM technology to transmit data between individually equipped units and a central collection point.

3. The public can be encouraged to participate in monitoring by reporting lights out, particularly on residential roads. Encouragement can include advertisements, notices on vehicles and lighting columns, and items in authority publications.

Regardless of the monitoring and fault-reporting procedure operated, a facility for reporting emergency situations must be included and be available 24 hours a day every day.

Appendix B – Fault Reporting gives further information on report centre activities and fault reporting.

Whilst not specifically planned to pick up other faults, methods 1 and 3 will also generate reports about mechanical defects, wilful damages, overhanging trees and vehicle damage. A system of assessment to evaluate the appropriate actions and responses on receipt of such information must be set up and operated. When using method 2, consideration should be given as to how this information can be obtained.

5.3 MONITORING BY THE CONTRACTOR

Where night-time inspection patrols are carried out by the contractor there are two options available:

1. A combining of patrols and repair. Such a system will combine the monitoring of lights with the repair of those found not to be working as specified. Monitoring of this style of maintenance strategy is difficult for the client as output measurement of lamps working correctly has to be undertaken. In addition, the client must be satisfied that the patrol is effective at scouting the whole lamp population and identifying failed lamps and mechanical defects. To cover these points the client has to:

a) Organise a regular cycle of client night-time ‘verification’ inspection covering a significant proportion of the lighting population (at least 10 per cent if contractor performance payments are involved).

b) Undertake an analysis of work issued and completed.

In addition, other fault reports, such as those from the public, have to be incorporated into the repair schedules.

All work undertaken should be supported by a work instruction regardless of the method of payment (priced or lump sum). This will allow the activities to be recorded and analysed to provide information for work analysis and inventory updates. Client intervention in determining priority and scope cannot be effectively applied.

To operate this system effectively the contractor has to have active participation in the client's maintenance systems. Consideration has to be given to the extent of access allowed and permissions needed to maintain system integrity and security.

Contractor-led night-time patrol and repair has a major advantage over other systems in that working outside of normal hours potentially gives easier access to roads normally not accessible during the working day. However, this advantage has to be balanced against:

- Noise and visual intrusion to adjacent residential property.
- Progress in night inspection dependant on repair workload.
- Reduced hours of darkness available at certain times of year.
- Continuous car parking at night particularly in areas with terraced properties.
- Use of larger vehicles, which may restrict access to certain streets and areas.
- Personal safety of the operatives.

2. Inspection patrol only. The maintenance contractor or a separate contractor carries out the night-time inspection patrol. Monitoring of the contractor's performance will involve a client night-time "verification" inspection covering a proportion of the lighting population. Work generated by the contractor will be processed through the client and, after assessment, issued as work instructions.

5.4 REPAIRS AND REPLACEMENTS

5.4.1 Fault reporting and management process

All reports should be subject to assessment to ensure there is no duplication of works instructions. A flow chart setting out the fault reporting and management process is shown in Figure 5.1 below.

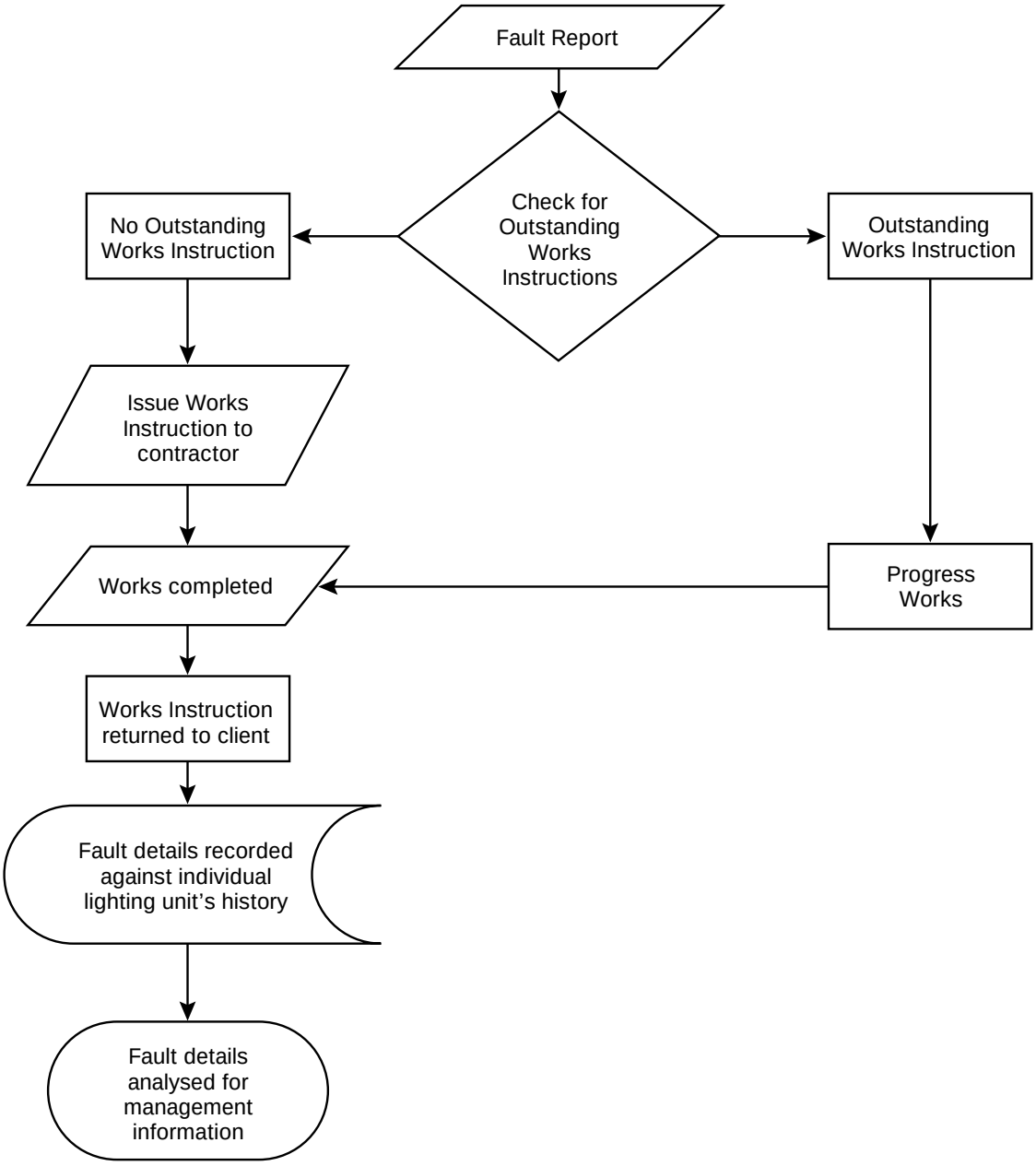


Figure 5.1 Fault reporting and management process

5.4.2 Response times

The client should have an agreed schedule of maximum response times for differing situations and categories of work. Failure by the contractor to meet the standard may be treated as non-compliance and a default payment made as compensation to the client for loss of service.

Recommended maximum response times are given in Table 5.1 below.

Table 5.1 – Maximum response times for reactive maintenance activities

Nature of faults	Response time
Non-emergency faults involving the replacement of components of apparatus	5 working days
Non-emergency faults involving the replacement of a complete unit of apparatus, including those made safe as emergency faults	5 working days
Non-emergency faults requiring the replacement of mandatory traffic signs and illuminated traffic bollards, including those made safe as emergency faults	1 working day
Non-emergency faults involving the repair or replacement of any of the DNO's equipment	15 working days
Non-emergency faults requiring the removal from apparatus of any offensive and/or racist graffiti	1 working day
Non-emergency faults requiring the removal of all other graffiti and/or any unauthorised attachments from apparatus	5 working days
Non-emergency faults involving rectification of non-operating Belisha beacons and flashing school warning signs	1 working day
Emergency faults, including the removal of unauthorised attachments that pose a safety hazard	2 hours
Installation of a complete unit of apparatus	20 working days
Following completion of task, return of completed paperwork	5 working days

5.4.3 Persistent non-performance

The public expect, and are entitled, to receive a specified level of service. Both the client and contractor have duties to manage and deliver an effective service.

Consideration should be given to the action required if elements of the service are persistently not performed, resulting in a reduction in service and/or unreasonable delays. The causes are various and include:

- Quality of workmanship.
- Breaches of safety procedures.
- Failure to meet response times.
- Lack of materials.
- Transport and plant deficiencies.
- Default in patrol cycle.

- Delays in assessment and issue of work.

- Lack of inventory data.

Whenever there is an issue identified, a technical review should establish a remedy (the cause is almost incidental, as it is the corrective action that will restore the service). An agreed improvement plan should be developed detailing the action(s) to be taken, timescales and ways of measuring success. If the situation has contractual consequences then the contractor should be issued with an Improvement Notice that will include the improvement plan.

A procedure should be in place to deal with continued poor performance. Ultimately the termination of the contract may be the only resort available to the authority.

5.4.4 Fault identification and repair

All valid reports should be converted into a Works Instruction, which should contain as a minimum the information shown in Table 5.2 below:

Table 5.2 – Works instruction information

Information required	Examples
Location	Address, unit reference number
Type of fault or repair	Failure to light, bracket mis-aligned, door missing
Priority	Response category
Equipment details	Column, material and height; lamp type and wattage; luminaire type and make
Special requirements	Access details/known risks/specific traffic management plans
Service connection	DNO or authority; location of switching points/isolation; authority cable records
Date	Date issued to contractor
Remarks	Repeat visit; previous repair history

NOTE: Works that can be identified as unsuccessful repairs should be issued for re-working on a shortened response time.

5.4.5 On-site activities

At site it is important that there is effective fault diagnosis with appropriate repairs and replacements to ensure the equipment is restored to full working order, is mechanically safe and is left functioning as intended. Adequate time must be allowed to undertake repairs and testing to ensure that the repair has been effective. Unsuccessful repairs which lead to second or more visits are detrimental to service delivery and wasteful of resources.

Whilst on site, the installation should be visually inspected to identify optical, mechanical and electrical defects, and any additional works required.

Minor repairs and adjustments may best be undertaken before leaving site. The client should establish the extent and scope of works that can be undertaken without reference back to them.

Some works may require authority of the client before proceeding; others may require further assessment and scheduling into a works programme.

Where there are doubts as to the accuracy and completeness of the asset inventory, a check at a maintenance visit should be considered. See Clause 3.4 Asset Management.

5.4.6 On-site checklist

Checks that should be carried out at each reactive maintenance visit include:

- A visual inspection of the luminaire, lighting column, illuminated traffic sign post and bracket for corrosion, cracking, spalling of concrete, damage, non-verticality.
- The security, safety and condition of any attachments to the lighting column or illuminated traffic sign post.
- Luminaire, bracket and sign-plate fixings checked for security.
- Lighting column and illuminated traffic sign post doors and locks checked for security.
- Alignment of luminaires and bracket arms checked and realigned / repaired as necessary.
- Checking, verification and resetting (if necessary) of luminaire optical distribution.
- Checking, verification and resetting (if necessary) of timing devices.
- Data verification.
- Visual inspection of electrical equipment and wiring.
- Inspection of the condition and visibility of the diagrams on the faces of illuminated traffic signs and bollards (see Highway Maintenance Code of Practice).

5.4.7 Completion of work and fault records

All work instructions should be signed and returned detailing the fault condition identified, work involved, date completed and equipment used. This information should be entered into the asset management system as soon as possible after receipt.

The following is a list of the minimum information required on each fault record:

- Unique job reference.
- Location.
- Equipment reference.

- Work issued.
- Date issued.
- Date completed.
- Work undertaken.
- Components installed.
- Response category.

5.4.8 DNO service failures

DNO service failures and faults identified and confirmed by the contractor should be issued to the DNO. The response times will depend on local standards of performance agreements, service-level agreement or similar arrangement. The client must have a system in place to monitor the progress to works. Within this process, it is important to be able to assess the consequences of the continued loss of electrical supply and, if necessary, accelerate repairs. See Chapter 6.

5.4.9 Verification

The contractor should provide supervision and monitor the works to ensure work instructions and inspections are completed satisfactorily in accordance with the specification and internal method statements and procedures.

The client must be assured that repairs are being carried out properly and should institute a system of random and regular inspection and audits to examine completed work on-site and associated data.

5.4.10 Unsuccessful or incomplete work

When repairs are unsuccessful or incomplete, the contractor should be required to return to site and carry out an effective repair within a revised and shortened response time. The contractor, to establish what improvements in the repair process might be beneficial, should investigate the cause of the unsuccessful or incomplete repair.

5.5 EMERGENCY SERVICE

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.

Arrangements should be in place to provide an emergency response at any time, 24 hours per day and 365 days of the year. Both the client and contractor 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 practical maximum response time of “within two hours” should be imposed.

Staff involved in providing the emergency service must have sufficient experience and knowledge to exercise 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.

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.

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.
- Time left site.

If the incident was a result of vehicle impact then details of the vehicle(s) will be required to institute procedures for the recovery of costs.

5.6 COMPATIBILITY OF COMPONENTS

There is a significant issue of compatibility in choosing appropriate replacement components or assemblies. 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:

1. 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 and their spacing and mounting heights will be determined to achieve a specific performance in accordance with the requirements of BS 5489–1: 2003 and BS EN 13201. It is important that maintenance repairs do not introduce components (particularly luminaires) or carry out adjustments (reflector positions, lamp positions) that affect the designed optical performance. Changes in luminaire type will require assessment, prior to installation, to establish that the distribution and light control are at least equivalent to that of the original installed, e.g. full cut-off (flat glass) luminaires, which have been installed to reduce the night-time visual impact of the lighting and sky-glow, should not be replaced with semi-cut-off bowled luminaires during maintenance activities.

2. 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. This often leads to luminaires being replaced rather than repaired on-site. However, this is not

an excuse to use the wrong type, make or model of luminaire. 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 the correct body type, reflector type and bowl type are specified to match those *in situ* on the road. In this way the aesthetics and the performance of the lighting system will be maintained. Good records and knowledge of the lighting system will provide good guidance as to the quantity of units needed for maintenance purposes.

3. It is becoming increasingly common to see low pressure sodium luminaires replaced by high pressure sodium luminaires on failure. This not only causes an ad hoc appearance to the street but on traffic routes can also introduce a potential danger to motorist or pedestrian due to the change in the distribution of the light. This practice should only be used where a complete conversion of the street is to be carried out in the near future. Similarly, care should be taken when replacing luminaires fixed to bracket arms with post-mounted luminaires to ensure that optical performance is maintained.

4. 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.

5. 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.

6. Electrical 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.

7. 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 regime. Changes in photocell types and/or operating hours must be recorded in the inventory. The replacement of older photocells can bring improved accuracy in switching, reducing operating hours and energy consumption.

Chapter 6
Service agreements with the distribution network operator

6.1 INTRODUCTION

In order to obtain unmetered electricity supplies an authority must enter into an Unmetered Connection Agreement with the local DNO and have and maintain an accurate detailed inventory of all its unmetered equipment in accordance with the requirements of the Balancing and Settlement Code Procedure BSCP520 (See appendix G-BSCP520 file format and flowchart).

6.2 SERVICE LEVEL AGREEMENT

As the provision of public lighting is ultimately dependent on the supply of electricity from an electricity supplier through the network of the local DNO, an agreement on service levels for connections to, and repairs of, the DNO's distribution network is essential. This may be best done in consultation with other authorities served by the same DNO.

The service level agreement will normally include:

- Timescale for service works (connections, disconnections and transfers).
- Timescale to attend emergencies.
- Timescale to repair faulty/damaged electricity service connections.
- Specifications for equipment.
- Procedures for processing work.
- Procedures for access to equipment.
- Procedures for monitoring DNO and authority performance.
- Procedures for permanent reinstatement of excavation.
- A mechanism for agreeing prices.
- Penalties for failure to perform.

6.3 ALTERNATIVE CONTRACT

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".

In the view of this decision, it has been suggested that instead of a service level agreement for public lighting works, a contract should be entered into with the DNO, so that the performance levels become an obligation on the DNO, rather than a target.

However, as competition is not at this stage possible for the actual connection and disconnection to the live main, described as the non-contestable element of the works, any contract for these elements will have to be negotiated with the local DNO.

In addition, it is possible that the repair of faulty DNO connections to public lighting will continue to be regarded as “street works”, as the connection is the property and responsibility of the DNO and the maintenance of the supply is the statutory duty on the DNO. In this case, repairs will continue to be subject to a Service Level agreement.

6.4 COMPETITION IN CONNECTIONS

As indicated in 6.3 above, competition is not yet possible for connection and disconnection of services to the live main, although discussions continue within the industry and with the Office of Gas and Electricity Management (OFGEM).

It is possible to have competition for the contestable elements, such as excavation, laying of service cable and reinstatement, which can be integrated with contracts for the installation of public lighting. However, the practical difficulty remains of co-ordinating these contractual works with works carried out under an agreement with the DNO, which may be difficult to programme and control. Once the implications of the High Court decision are clear, given that the relationship with the DNO for connections will become contractual, it might be possible for such works to be carried out by the DNO as a formal sub-contract to a public lighting installation contract.

However, it is unlikely that emergency attendance to damaged public lighting service connections will become contestable and thus not subject to competition.

6.5 PROCEDURES FOR NEW INSTALLATIONS

New installations shall be deemed to include the following:

- New capital lighting schemes.
- Road improvement schemes.
- Provision of connections and/or disconnections.
- Transfers.
- New services.

The agreement or contact should detail the procedures to be followed by both parties when:

- Seeking estimates.
- Placing orders.
- Notifying that equipment is installed and ready for connection.
- Notifying that equipment has been connected.

In order for the DNO to comply with the response times for new installations (see Table 6.3) the authority will need to supply the following information to the DNO:

1. 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).
- Ordnance Survey co-ordinates or GIS co-ordinates.

2. A description of the work involved and the number of points involved.

3. The priority of the work (see Table 6.3).

This data should be supplied to the DNO, seeking an estimated cost of the works as early as possible before the works are required but as a minimum within the following timescales.

Table 6.1 – Suggested minimum times for seeking DNO service estimates to completion

Activity	**Minimum notice period**
New installations (1–10 columns)[1]	Within 35 working days
New installations (11–50 columns)[1]	Within 35 working days
New installations (larger schemes >50)[1]	By agreement

NOTE: [1] Installation quantities refer to the cumulative total of connections, disconnections and transfers per scheme.

On receipt of a request for an estimate the DNO should respond within 10 working days for estimates based on standard published schedules of rates and within 15 working days for non-standard works. The DNO should endeavour to use standard prices from their published schedule of rates wherever possible to reduce administration and time.

The estimate from the DNO should be individually numbered and include the following information:

1. A plan showing the extent of the works together with any civil engineering works (for instance ducts) required from the authority.

2. A schedule detailing the estimated costs based on the standard schedule of rates where applicable.

3. Details of any estimated costs not covered by the standard schedule of rates.

The authority on accepting the estimate shall provide an order for the works together with a programme of works. The order shall cross reference the estimate received from the DNO.

On installation of the new equipment, or when existing equipment is ready to be disconnected/transferred, the authority shall issue a notice to the DNO advising that the site is now ready for their works.

Table 6.2 – Suggested minimum times for the supply of information by the local authority to the DNO following installation of new apparatus or before disconnection of old apparatus

Activity	Minimum notice period
New installations (1–10 columns)[1]	Within 2 working days
New installations (11–50 columns)[1]	Within 10 working days
New installations (larger schemes >50)[1]	By agreement

Note: [1] Installation quantities refer to the cumulative total of connections, disconnections and transfers per scheme.

The DNO should, within five working days of completion of their works, advise the authority that the works have been completed and that the authority can complete their works.

The authority should within 15 working days of commissioning, decommissioning or transfer of a DNO electricity service amend the Asset Management System accordingly.

Connection of new/transferred equipment shall be carried out in accordance with agreed procedures. See Appendix C – Competence.

6.6 PROCEDURES FOR REPAIRS

The agreement or contract should detail the procedures to be followed by both parties when:

- Placing orders.
- Making request for emergency attendance.
- Notifying faulty service connections and/or cut-outs.
- Notifying the completion of repairs to faulty service connections and/or cut-outs.

With the exception of emergencies, the authority shall on determination of a fault on a DNO electricity service connection inform the DNO of such fault within five working days. Such notification shall include the following information:

1. 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).
- Ordnance Survey co-ordinates or GIS co-ordinates.

2. A description of the work involved and the number of points involved.
3. The priority of the work (see Table 6.2).
4. The type of work.

The DNO will normally repair at its own cost the following:

a) Faulty services including:

- Services with no current.
- Services with low voltage.
- Services with loss of neutral connection.
- Services with high earth loop impedance.

b) Faulty cut-outs including:

- Cut-outs suitable only for fuses which can be rewired.
- Cut-outs without an insulated shroud to the live incoming terminal.
- Cut-outs where the shroud to the live incoming terminal can be removed without the use of a tool.
- Cut-outs which are unsafe due to deterioration, e.g. with tracking or breakdown of insulation or burnt or corroded contacts and terminals.

Under the Unmetered Connection Agreement entered into with the DNO the authority is responsible for providing a safe enclosure for the DNO's equipment. Therefore, the authority will normally be required to meet the cost of the following works:

- Make safe service of cut-outs following damage (including vandalism or damage).
- Permanent disconnection.
- Temporary disconnection.
- Reconnection after make safe or temporary disconnection.

Emergencies shall be informed to the DNO immediately the authority has determined them.

6.7 TIMESCALES FOR CONNECTIONS AND REPAIRS

The following time scales are indicative of those currently offered by some DNOs. However, authorities should endeavour to negotiate improved response times. The

times are from receipt of notice of equipment being installed or service fault or notice of removal of existing service by the DNO.

Table 6.3 – Maximum response times for DNO servicing works

Activity	Maximum response time
Attendance at emergency	Within 2 hours
High priority fault repair of service. Includes units acting as a supply point to traffic signals or feeder pillars	Within 1 working day
Fault repair of service to unit acting as supply point to a mandatory traffic sign	Within 5 working days
Fault repair of service to feeding multiple units	Within 1 working day
Fault repair of service to single unit	Within 8 working days
Service reconnection of individual replacement units acting as a supply point	Within 1 working day
Service reconnection of individual replacement units	Within 8 working days
New installations (1–10 columns)[(1)]	Within 15 working days
New installations (11–50 columns)[(1)]	Commence within 15 working days with completion within 25 working days
New installations (Larger schemes >50)[(1)]	By agreement
Following completion of task, return of completed paperwork	Within 5 working days

NOTE: [(1)] Installation quantities refer to the cumulative total of connections, disconnections and transfers per scheme.

6.8 CUT-OUTS

The service-level agreement or contract should specify the type(s) of public lighting cut-out to be provided by the DNO, and confirm that the authority or their agents or contractors may have access to the cut-out for the purpose of connecting internal wiring, withdrawing fuse carriers during maintenance of equipment, and replacing fuse cartridges, subject to the competency of operatives (see Appendix C – Competence).

Types of cut-out specified might include single or double pole units or units with a facility for more than one fused outgoing circuit.

6.9 PERFORMANCE MONITORING

The agreement should detail the procedures for monitoring the DNO's performance in meeting the agreed timescales and should specify any remedial action to be taken, and non-performance rebates to be applied following any failure to meet the timescales. Authorities should seek to have a clause in any such service-level agreement which includes the principles in the following paragraph:

> Except in the case of planned supply interruptions, where the DNO fail to complete the works within the response times set out in Table 6.3 the authority shall be entitled to a payment of £5 per failure. A further payment of £5 per failure shall be made for each period of five working days over the original response time for which the works are not completed. Such payments shall be claimed by the authority.

Authorities should appreciate the necessity to ensure that DNOs are provided with accurate and reliable information when they are requested to carry out work. Failure to do so may lead to a failure to enforce any remedial action or non-performance rebates. DNOs may reasonably expect to be paid for any abortive work resulting from inaccurate information provided by authorities.

Similarly, failure by the DNO to provide accurate and correct information which results in delays or lost time to the authority may result in the authority imposing an abortive call charge. The authority shall claim such payments.

6.10 REINSTATEMENT

The agreement or contract should detail procedures for the permanent reinstatement to public lighting works in the carriageway, footways, footpaths, cycle tracks and any cultivated highway land. For further details see Appendix E – Reinstatements.

Chapter 7
Procurement

7.1 MAINTENANCE CONTRACTS

7.1.1 Introduction

The maintenance of public lighting by its nature consists of many individual small repairs being carried out to equipment spread over a wide geographic area. Repairs may consist of a simple replacement of a single component, such as a lamp or photocell, to the complete replacement of a lighting unit.

Maintenance contracts usually include both cyclic and reactive maintenance operations in the same contract.

Seeking competitive contracts for the maintenance of public lighting can be part of the process of achieving value for money for authorities.

7.1.2 Type of contracts

Contracts can take many forms and need to take account of both quality and cost but all are generally variations on three main types:

1. Combined Highway and Public Lighting Maintenance Contracts where the authority enters into one combined tender for all highway functions including bridge, highway and public lighting maintenance with a single contractor.

   Advantages:

   - One contractor to manage.
   - Better use of traffic management with multiple maintenance works being undertaken simultaneously.
   - High flexibility of contract staff.

   Disadvantages:

   - Limited number of contractors with full range of skills.
   - Sub-contracting of specialist works.
   - Potential for contractual disputes.
   - Disproportionate pricing of specialist works.

2. Bill of Quantities/Schedule of Rates Contracts where the authority seeks schedules of rates for all activities against which the contract is priced.

   Advantages:

   - Use of specialist public lighting contractors.

- Only works undertaken and materials used, paid for.

- Authority provided with a high level of statistical information and accountability.

- Limited risk for contractor.

- Authority able to control level of works and costs.

Disadvantages:

- High level of administration.

- Duplication of administration by client and contractor, although the use of networked computers can reduce duplication.

- Potential for contractual disputes.

3. Performance Contracts where the contractor is required to achieve a predetermined level of performance each month. Performance is usually monitored by the authority carrying out a limited night-time inspection each month of a representative area(s) of lighting. Lump sum payments for reactive maintenance works are also included.

   Advantages:

   - Use of specialist public lighting contractors.

   - Predetermined level of payment allows for easier financial control.

   - Reduced level of administration.

   - Reduced conformation.

   - Night-time inspections undertaken by contractor can be combined with first pass repair providing enhanced service.

   Disadvantages:

   - Reduced level of accountability and statistical information.

   - Reduced level of authority control over works.

   - Higher risk for contractor.

NOTE: In recent years new-style Maintaining Agent Contractor Contracts (MACs) have been used by the Highways Agency. Unlike the traditional term maintenance contracts, which may have a client, consultant and contractor, MACs have only a client and a “competent” company having the skills to manage and maintain the network. The company is usually a joint venture between a traditional term maintenance contractors and consultants. The contracts are performance based, whereby the contract is priced on lump-sum fees for carrying out the routine works, and are measured through performance indicators and audits.

7.1.3 Contract documents

Standard public lighting maintenance contracts cannot be purchased off the shelf. The alternatives are to use a heavily amended model document, have a document internally written by the authority's contracts section or negotiate a partnership agreement.

Model contract documents that are currently available tend to be written for new works and are predominantly for highway works. Some maintenance contracts are based on the model document *Specification for Highway Works* and the interrelated *Method of Measurement for Highway Works* issued by the Highways Agency. These documents are designed for the installation of new schemes and are not ideal for maintenance, lacking the detail needed for such works. Therefore, these documents have to be heavily modified and adapted for use as lighting maintenance contracts.

The choice of methods to be used to procure and manage a public lighting maintenance contract need to be considered carefully taking account of what resources and expertise are available to write and manage the contract.

Typical conditions of contract used include:

- Institution of Civil Engineers Conditions of Contract, 5th, 6th or 7th Editions.
- New Engineering Term Services Contract (draft June 2003).
- JCT.

Typical specifications used include:

- Specification for Highway Works, adapted as necessary.
- Purpose written specification.

7.1.4 Inspection and monitoring of contracts

The authority should ensure that sufficient, suitably qualified and experienced staff are appointed to inspect, monitor and check the contractor's works. This will help to determine if the contractor is performing their duties as per the contract and to the specification and will give the client the confidence that finances are being well spent and accounted for.

7.1.5 Inclusions into contract

When preparing the contract documentation the authority should be aware of the condition of the existing stock and any existing problems that may require special treatment.

It is normally preferable for the contract to include the provision of all materials, as this provides clarity of risk and responsibility in the event of failure.

7.1.6 Payment deductions

It is important that a system to recompense the authority for the poor performance of the contractor is included in any agreement/contract with the maintenance contractor. This system should be related to the response times given in Clauses 4.9 and 5.4.

Losses due to non-performance should be calculated to only take account of the actual cost of the lost facility to the authority and may include factors such as the cost of energy or alternative arrangements for carrying out the work. The level of risk being transferred to the contractor and value for money to the authority should be considered when determining such deductions. The aim should be to encourage the contractor to complete the works within the required period. Payment deductions against the contractor for non-performance should not be set at a level that could be considered as punitive.

7.1.7 In-house contractor performance

Authority in-house contractors carrying out public lighting maintenance will generally be operating through a negotiated agreement rather than a formal contract. In such cases, the negotiated agreement should be a service-level agreement setting out the requirements for performance in the various cyclic and reactive maintenance elements of the work with methods of monitoring the performance by both contractor and client.

Such arrangements should be no less onerous than the requirements for competitive maintenance described in this section.

7.2 ELECTRICITY PROCUREMENT

7.2.1 Introduction

Since 1995 the market for unmetered highway electricity supplies has been gradually de-regulated to allow electricity to be purchased from any licensed electricity supplier. In April 1998, an “approved” Electricity Pool (Pool) Procedure (AP520) was introduced and implemented in England and Wales which allowed both Half-Hourly (HH) and Non-Half-Hourly (NHH) supplies to be competitively traded. The unmetered supplies process was finalised in June 1999 when all customers regardless of size and type of load connected were able to seek competitive quotations. Similar competitive supply procedures limited to non-half hourly supplies have been agreed and implemented in Scotland.

A new settlements system, the Balancing and Settlement Code (BSC), was initiated in April 2001, and ELEXON, a new body, took over from the Pool. AP520 was modified and updated as BSCP520, but essentially the content is the same. BSCP520 specifies the procedures and roles of the Distribution Network Operator (DNO), the Electricity Supplier and the Meter Administrator (HH trading only).

An authority may seek to procure their electrical energy for public lighting and associated equipment via competitive tender. There are several ways in which a competitive tender can be procured, including the pooling of equipment of several authorities to obtain a more competitive price due to the larger load involved. This may benefit smaller authorities who cannot achieve the best price with their relatively small loads.

7.2.2 Trading arrangements

Under the current arrangements for unmetered supplies there are two methods of trading that customers can use to obtain energy. These are detailed below:

1. Non-half-hourly. The non-half hourly market requires the calculation of an Estimated Annual Consumption (EAC) by the unmetered supplier operator (UMSO) at the distribution network operator (DNO) to enable the

consumption to be settled through the Balancing and Settlement Procedures.

2. Half-hourly. The half-hourly market requires that the electrical consumption of the load be recorded at half-hourly intervals throughout the day. For unmetered supplies this is done by means of an Equivalent Meter (EM), which comprises of two elements. The first is a Photo-Electric Cell Array Unit (PECU Array), which logs the operating hours of various types of photo-electric cells in use. The PECU array is fitted with photocells that are representative and proportionate to the authority's installation, i.e. thermal, electronic, etc. and their age profile. Care should be taken to ensure that as older thermal photocells are replaced on-site those on the PECU array are also replaced so they remain representative.

The second element of the EM is a software package known as LAMP or Flare, which is in the ownership of the UMSO. This is used to download the operating hours data obtained from the PECU array(s) and to combine this with the customer's inventory data to calculate the consumption in kWhs. The customer must appoint a Meter Administrator for this task. Elexon/UMSUG holds a list of accredited meter administrators.

When deciding which trading agreement to use the following consideration should be taken into account:

a) Meter Administrator's costs and the cost of PECU Array(s) are borne by the customer and will have to be absorbed into any savings made when trading on half-hourly contracts.

b) It is widely accepted that half-hourly trading may not be cost effective for loads less than 100 kW.

c) Half-hourly tariffs should where possible be fixed for the life of the contract.

7.2.3 Unmetered supplies certificate

Both trading methods require the customer to submit an accurate inventory to the UMSO for validation. There are appendices in BSCP520 that show tables of approved equipment, charge codes (with watt ratings) and switching regime codes which must be used by customers in their inventory data. The standard BSCP520 inventory file format required by the UMSO is shown in Appendix G – BSCP520 File Format and Flow Chart.

On validation of the inventory, the DNO will issue an Unmetered Supplies Certificate (UMSC), which must be made available to the prospective Electricity Supplier during the tender stage.

Currently, all unmetered loads can be considered for inclusion on the Unmetered Supplies Certificate. BSCP520 states that provided the equipment has a predictable load and operating hours and is less than 500 w it can form part of an unmetered supplies agreement. However, the UMSO has the discretion in certain circumstances to allow equipment to be connected without a meter if it does not comply with BSCP520 requirements.

When compiling an Unmetered Supplies Certificate the UMSO will consider metering for equipment with an installed load greater than 500 w. This is particularly relevant for equipment fed via highway power supplies from a feeder pillar. These types of supply should be discussed with the DNO before the inventory is submitted and at the time the

application is being made for new supplies. As a general rule, equipment in use before April 1998 would retain its UMS status.

7.2.4 Agreements

a) Connection Agreement. All customers are required to enter into a connection agreement with the Distribution Network Operator (DNO). This agreement sets out the terms and conditions under which a supply is taken from the DNO's network. The major part of the connection agreement will deal with the validation of the load connected to the network. It is essential that the inventory fairly represent the customer's connected load, as it can be subjected to audit by the UMSO. Any inaccuracies in the inventory could result in a factor being applied to the inventory to compensate for them. Power factor correction is one source of possible inaccuracy in measuring the electricity consumed and the DNO have the right to apply a factor to compensate for low power factor if they can demonstrate that it is below the level specified in the agreement.

b) Meter Administrator's Agreement. The PECU Array is normally located at the DNO's premises, but may be located anywhere suitable by agreement. The array is populated with 30 PECUs, which must be representative of those used within the authority's area. The PECU array is purchased by the authority and maintained by the appointed Meter Administrator. The flow chart in Appendix G – BSCP520 File Format and Flow Chart shows how the MA fits in to the UMS process.

c) Supply Agreement. The customer must enter into a supply contract with their chosen supplier of electrical energy.

d) MPRS. The supply contract (i.e. inventory) will be given a supply number (an MPAN), which must be registered through the Metering Point Registration Service (MPRS) by the electricity supplier.

Appendix A
Inventory Data Sets

GEOGRAPHICAL DATA (STREET GAZETTEER)

No.	Category
1	Road name
2	Road number
3	Ward name or number
4	Unique road identifier (as per 7 below)
5	Lighting standard
6	Compliance certificate date (date when compliant with 5 above)

APPARATUS DATA

No.	Category
7	Unique road identifier (as per 4 above)
8	Unique apparatus identity number
9	Ordnance Survey positional data
10	Unit type
11	Lighting column / illuminated traffic sign post manufacturer
12	Lighting column / illuminated traffic sign post cross-section shape
13	Lighting column / illuminated traffic sign post mounting height
14	Lighting column / illuminated traffic sign post material
15	Lighting column / illuminated traffic sign post protective coating
16	Lighting column / illuminated traffic sign post fixing
17	Lighting column / illuminated traffic sign post root protection
18	Lighting column / illuminated traffic sign post flange base
19	Date unit commissioning
20	Bracket type
21	Number of brackets
22	Bracket projection
23	Traffic sign illumination

24	Number of luminaires
25	Luminaire manufacturer
26	Luminaire model reference
27	Luminaire distribution and profile
28	Luminaire setting
29	Luminaire ingress protection
30	Lamp type
31	Lamp wattage
32	Lamp control gear type
33	Total circuit wattage
34	Lamp charge code
35	Number of lamps per luminaire
36	Control type
37	Switching regimes codes
38	Control location
39	Service owner
40	Supply point
41	Number of outgoing circuits at the supply points
42	Traffic sign diagram number (if attachment)
43	Traffic sign category
44	Attachment / traffic sign size (if fitted)
45	Number of approved attachments (if fitted)
46	Type of approved attachment (if fitted)
47	Trans-illuminated traffic bollard body manufacturer
48	Trans-illuminated traffic bollard body material
49	Trans-illuminated traffic bollard body type
50	Trans-illuminated traffic bollard base manufacturer
51	Trans-illuminated traffic bollard base material
52	Trans-illuminated traffic bollard base type
53	Feeder pillar body manufacturer
54	Feeder pillar body material

55	Feeder pillar body protection
56	Number of phases
57	Isolator rating
58	Number of outgoing circuits
59	Outgoing circuit protection device
60	Feeder pillar drawing no.

RISK ASSESSMENT DATA

No.	Category
61	Ground conditions
62	Salting of road
63	Road environment
64	Environment situation
65	Wind exposure
66	Designed for fatigue
67	Traffic flow
68	Traffic speed
69	On a bridge
70	Traffic disruption caused by failure
71	Pedestrian density

OPERATIONAL DATA

No.	Category
72	Date of last cyclic maintenance visit
73	Date of last group lamp replacement
74	Date of last re-application of protective coating
75	Date of last structure inspection and condition level
76	Structure inspection and condition level
77	Structural test certificate reference no.
78	Date of last electrical test and test results
79	Electrical test certificate reference no.

80	Date of last electrical test to authority cable network by circuit
81	Authority cable network electrical test certificate reference no.
82	Date of last fault including emergency faults
83	Fault type and history including emergency faults

GENERAL

It is considered that this data should be managed as part of an asset management system, which also manages fault repairs and cyclical maintenance. It is recommended that the system allows data to be exported to suitable software packages that allow filtering and reporting of raw data if this is not already available on the system.

RISK ASSESSMENT DATA

It is recommended that the additional data as specified in the ILE Technical Report No. 22 be collected and stored in the asset management system as part of the assessment of the risk of structural failure of the public lighting stock.

UPDATES

An auditable system for ensuring that inventory data, records and systems are updated whenever alterations are made to the physical installations is essential.

Inventory changes due to maintenance activities such as group lamp change, and more major works, such as re-lighting or conversion schemes, should be made within periods recommended in Table 3.1.

Computerised inventory systems and record plans where appropriate should be updated simultaneously.

UNDERGROUND CABLES

All highway power supplies shall be recorded in accordance with the New Roads and Street Works Act 1991, the Code of Practice for Recording of Underground Apparatus in Streets and the Electricity Safety, Quality and Continuity Regulations 2002.

It is necessary to record accurately underground cable networks so that:

- Repairs to highway power supplies can be carried out effectively and safely in compliance with the Electricity at Work Regulations.
- Testing of cable networks is facilitated.
- Extensions or alterations to highway power supplies can be adequately designed.
- “Supply point” data can be entered on the asset management system enabling supply failures at supply points to be treated as priorities for repair.
- Information showing highway power supplies can be provided to any organisation excavating in the highway in compliance with the New Roads

and Street Works Act and the Electricity Safety, Quality and Continuity Regulations 2002.

- Joint repairs can be identified as weak points of failure in the cable network for future maintenance faults.

A record of plans released should be kept to identify receipt of requests and actions.

Highway power supply records should record the following information:

- Source of supply (supply point).
- Route of cables.
- Position of cables (including offset and depth).
- Type and size of cables.
- Position of cable joints.
- Three-phase or single-phase.
- Location, type and rating of protective devices.
- Feeder pillars shall be fitted with cable circuit schedules.

FORMAT OF DRAWINGS

To manage the highway power supply effectively it is recommended that a GIS system or stand alone AutoCAD drawing file system be put in place to record highway electric equipment on layout drawings.

COLLATING INFORMATION

Advancements in technology now allow inventories to be collected on-site using handheld computers that are downloaded onto the asset management system at the end of the day. GPS locating systems can also be incorporated into these systems to reduce equipment location inputting errors.

Appendix B
Fault Reporting

INTRODUCTION

Single activity based (e.g. public lighting) report centres can be difficult to justify and consequently many organisations have instituted “One Stop Shop” centres which can handle public enquiries and reports relating to all their business activities. These centres can only be successful if the staff has a depth of knowledge and understanding sufficient to assure the public that action will follow.

Larger authorities may be able to justify more specialised report centres concentrating on departmental activities, such as highways. This approach brings the report centre under the control of the department’s management and, consequently, is responsible for its operation and for the training of the support staff.

Consideration should be given to the introduction of a free phone number (details of which are given below) linked to a fault-reporting system.

Public satisfaction with this service depends on trained staff and a robust process to extract relevant information. Access to the asset management system by the report centre staff can help positively identify particular public lighting units and provide details of any known fault or repair instruction.

FREE TELEPHONE

Telephone calls are the main method used by the public to report problems and therefore any improvements that can be made in this area should bring significant benefits.

The introduction of a free telephone number or low-cost local number is one method of improving accessibility, providing ease of use and ensuring contact with the correct individual as well as creating a feeling of greater involvement by the public. Prior to introducing a scheme careful planning is required and the following points should be considered:

- Will the free phone be used for public lighting faults only or include reports for road problems in general or extend to other authority services?
- Will the free phone take emergency calls?
- Which hours should the service be available, will it include weekends?
- How will the service be publicised?
- How will calls be handled, recorded and passed to the appropriate person for action?
- Monitoring of system to ensure correct response.
- Effect on existing methods of reporting faults.

If the free phone is to be used for emergency calls then it should be manned 24 hours per day, seven days a week. Otherwise alternative arrangements should be made for the receipt and passing on of emergency calls.

ANSWER PHONES

Answer phones can provide a valuable out of hours facility but the public should be dealt with on a person-to-person basis during office hours.

All telephone calls, whether by answer machine or otherwise, must be transcribed and interpreted by a member of staff for entry into the asset management system.

Fax machines and e-mail facilities can be used for the transfer of information between offices and night inspectors working in rural areas to avoid excessive travel. These facilities could also be made available to the general public for the reporting of faults.

PRE-PAID POSTCARD

Postcard systems seldom produce reports of faults on traffic routes or illuminated traffic signs. However, in remote rural areas this system may have advantages, particularly if administered by the local parish council or a similar community-based group.

The public should be encouraged to provide sufficient information to allow a work instruction to be issued without the need for a pre-inspection.

A pro-forma report can be made available on the authority's web site; answer phones can have an embedded message requesting specific details and advising the contact number for emergencies. Report centre staff will be able to interview callers to obtain pertinent information and so decide the appropriate action.

There is a minimum of basic information required to start the repair process:

a) What's wrong? … light out, burning red, flashing, partial burning, wilful or vehicle damage, etc.

b) Where is it?…. location by road and house number, equipment reference number, footpath from/to, etc.

As a courtesy, the caller should be given a reference number for their call and be advised of the action that will be taken or what action is already programmed. The number will be a key to any follow up enquiries they wish to make.

Not all calls will relate to faults or emergencies, information on new schemes, provision of additional lighting, dealing with light intrusion and light pollution are areas of interest to the public. It is possible that these callers will need to be referred to technical staff either immediately or on a call-back basis when the appropriate staff are available.

Appendix C Competence

ELECTRICAL COMPETENCE

INTRODUCTION

All employers of persons working on public lighting installations, including client and contractor's personnel, must 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. Authorities should inspect all competence certificates prior to a contract commencing and at regular intervals during the operation of a term maintenance contract.

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".

Only a competent person, duly authorized, and trained to the required level of competence and able to recognize electrical hazards, must carry out the work.

Operatives must not be placed at risk due to a lack of skills on their part or others' in dealing with electrical equipment.

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

Some work, such as testing, may need to be carried out on live equipment and must only be carried out by an appropriately qualified and authorized person who has received additional training and only when in full compliance with Regulation 14 of the Electricity at Work Regulations.

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.
- Ability to recognise at all times when it is safe for work to continue.

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.

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.

EMPLOYEE DEVELOPMENT

For many years The Electricity Association Engineering Recommendation G39/1 has been considered to be the “benchmark” for the measure of competency of which a public lighting operative is capable. However, the Model Code of Practice actually states that in no way is it intended to deal with fundamental approaches to safety or re-statements of safety policy or the way in which these are implemented by the various parties concerned. Neither does it deal with methods of work, tools and equipment developed to deal with a wide range of problems separately encountered by the individual organisations.

TRAINING FOR COMPETENCY

All operatives shall be assessed for competency and undertake a recognised training course, as appropriate, leading to an NVQ / SVQ or similar qualification to agreed national occupational standards. Competency certificates shall be valid for a maximum of 5 years and shall be reviewed thereafter, with refresher training being instituted as appropriate.

Reference should be made to the National Occupational Standards, the national training specification and the ASLEC Scheme for the Assessment of Competence of Service Providers Carrying out the Erection and Maintenance of Public Lighting Equipment.

For guidance purposes, assessment and training should cover, as a minimum:

- The identification of electrical installations.
- The recognition of hazards and appropriate safety requirements.
- The signing, lighting and guarding of works as appropriate to the tasks to be carried out.
- Manual handling.
- Emergency first aid procedures.

Plus additional assessment and training specific to the range of tasks expected of the operative.

SUPERVISORS

Supervisors should be trained to a level appropriate to the required tasks; typically this would be to an NVQ / SVQ level 3 or similar. In addition they should have sufficient experience to enable them to discharge their responsibilities, such experience being for a period of not less than two years.

CONNECTION OF AUTHORITY EQUIPMENT

When the connection to the authority’s equipment is required to be commissioned this may, by local agreement, be carried out in one of two ways:

1. The authority may, subject to the conditions below, remove the fuse carrier from the cut-out, and connect its installation and replace the fuse carrier thereby energising the connection. The applicable conditions are:

    i) The authority should not allow any persons other than competent persons as defined in the Electricity at Work Regulations 1989 to do the work.

    ii) The competent person should visually inspect the DNO's equipment at the point of connection to ensure that it is safe and intact.

    iii) If the visual inspection is satisfactory the competent person may remove the fuse carrier from the DNO's cut out.

    iv) Provided the competent person is satisfied that the authority's electrical installation is constructed, installed, protected and used or capable of being used so as to prevent, so far as practicable, danger or interference with the authority's installation or the DNO's network or any third party installation or the supply of electricity to any other consumer's installation or street electrical fixture, then the competent person may connect up the authority electrical installation and replace the fuse carrier in the cut-out thereby energising the connection; or

2. The DNO may, subject to the following conditions below, connect an authority's electrical installation to their cut-out and energise that connection. The applicable conditions are:

    i) The authority's installation must have an inspection label on it or other evidence satisfactory to the DNO that it has been tested. (The expression tested means that authority is satisfied that its electrical installation is constructed, installed, protected and used or capable of being used so as to prevent, so far as practicable, danger or interference with the authority's or the DNO's or any third party installation or the supply of electricity to any other consumer's installation or street electrical fixture.)

    ii) If the authority's installation has an inspection label on it or such other evidence as the DNO considers satisfactory, then the DNO may connect the authority's electrical installation to their cut-out and by inserting the fuse carrier energise the connection.

    iii) If there is no inspection label or other evidence that the authority's installation has been tested then the DNO will not connect the authority's installation and will not energise the connection.

    iv) The DNO will report its actions to the authority.

The authority should give the DNO a warranty to the effect that:

1. Any persons employed or engaged by the authority to remove or replace a fuse carrier or fuse to a DNO cut-out or connect the authority's installation to the DNO's cut-out will be a competent person as defined in the Electricity at Work Regulations 1989.

2. Where there is an inspection label (or other evidence is provided as outlined above) on the authority's installation then that installation complies with the requirements of BS 7671.

The authority will indemnify the DNO from and against any claims for all loss, injury or damage caused by or arising out of any breach of its obligations as set out in the warranty above but excluding any liability for death, personal injury or damage caused by the negligence of the DNO or its employees.

Appendix D
Electrical Inspection and Testing

VISUAL INSPECTIONS

When carrying out a visual inspection of the electrical equipment and wiring, attention should be paid to cable connections, glands, protective conductors and devices, means of isolation and the suitability of shrouds, barriers and protective covers, with regard to the following:

- Safety.
- Wear and Tear.
- Corrosion.
- Damage.
- Rating of device.
- Age.
- External Influences.
- Suitability.

Adequate and legible means of identifying all conductors, including protective conductors, should be provided and maintained. Any deterioration or damage to conductor insulation must be noted on the operative's report. All conductors must be checked to determine that they are of the correct size and type for the purpose.

The temperature within many luminaires can be extremely high. Therefore, the absence of heat resistant sleeving and any consequent heat damage to the conductor insulation should be noted.

It should be established that the means of protection against direct contact with any live conductors meets the requirements for the safety of persons, livestock, property or equipment. The provision and suitability of shrouds and intermediate barriers should be checked to ensure that they are providing protection against direct contact to a minimum of IP2X. Missing or damaged barriers or enclosures or alterations to enclosures must be noted in the inspection report.

The presence or omission of danger notices, warning notices, diagrams, instructions and similar information must also be noted.

ELECTRICAL TESTING

The following tests should be carried out on all public lighting equipment and associated highway distribution systems:

- Visual inspection.
- Continuity of protective conductors.

- Polarity.
- Earth loop fault impedance.
- Insulation resistance.
- Operation of devices for isolation and switching.
- Operation of residual current device.
- Operation of circuit breakers.
- Earth electrode resistance (where applicable).
- Voltage / voltage drop.

A record should be made of any departure from the regulations.

Tests should be regularly carried out to all lighting equipment, illuminated traffic signs, illuminated traffic bollards and any associated cable networks, including power supplies to remote electrical equipment, such as bus shelters and telephone boxes. Electrical attachments on lighting columns, such as power outlets for festive decorations, should also be fully tested at the same time.

Appendix E
Reinstatements

In England, until the High Court decision referred to in 6.3 above, the connection and disconnection of street furniture onto the electricity distribution system was classified as “street works” and would normally have been reinstated in accordance with the HAUC Specification for the Reinstatement of Openings in Highways 2002.

Now that the works are deemed to be “works for road purposes”, the authority should detail specific requirements in the agreement or contract. Such details would normally be derived from the HAUC Specification.

In Scotland, Wales and Northern Ireland equivalent specifications to the HAUC specification are used.

There is inevitably an overlap when public lighting equipment is installed or removed between the excavation carried out by the authority or the contractor on behalf of the authority and that carried out by the electricity company.

One method of overcoming this problem based on the HAUC scenario is set out in the table below. This scenario envisages that at any given location, the organisation which is “last in” will carry out reinstatement to Method A (all permanent) to the combined excavation following reinstatement by the organisation carrying out the first excavation to Method C (permanent sub-base and temporary surfacing). The procedure is consistent with the requirements on “Subsequent Works” in Section 73 of the New Roads and Street Works Act 1991.

Nature of work	**Organisation**	**Work within 3 m of Column (1)**	**Work not within 3 m of column (1)**
Transfer service	DNO	Method C	Method A
	Contractor	Method C(2) Method A(3)	Not applicable
Disconnect Service	DNO	Method C	Method A
	Contractor	Method A(4)	Not applicable
New service	DNO	Method A	Method A
	Contractor	Method C(2)	Not applicable

NOTES:
1. Measured along centre line of trench.
2. On installation of public lighting equipment.
3. Subsequent work after service connection.
4. Subsequent work after service disconnected (unit removed).

It may be possible to simplify this approach if specific requirements are detailed in the agreement or contract.

Appendix F
Protection of Lighting Columns and Illuminated Traffic Sign Posts

LIGHTING COLUMNS AND ILLUMINATED TRAFFIC SIGN POSTS

All new steel lighting columns and illuminated traffic sign posts should be protected against corrosion both internally and externally. Hot dip galvanizing provides such protection and it is therefore recommended that all new steel lighting columns and illuminated traffic sign posts be hot dipped galvanised to provide a first level of protection. Consideration should be given to the application of further protective coatings particularly on the root of the lighting column or illuminated traffic sign post and in areas of heavy atmospheric pollution (see The Zinc Millennium Map published by the Galvanizers Association). Additional protective coatings applied over galvanizing will help to protect it, increasing its life and the life of the lighting column or illuminated traffic sign post. All additional protective coatings to new lighting columns or illuminated traffic sign posts should be applied under controlled conditions by the manufacturer to gain the maximum benefit from them.

It has now become standard practice with many local authorities to have an additional protective system applied to the exterior surface of the root section of new galvanized lighting columns and illuminated traffic sign posts. The standard G1 root protection system, which comprises of a high-build epoxy finish applied over a zinc phosphate primer applied over the galvanizing, has been shown to fail after 10/15 years of service. Alternative high-build multi-coat systems which have longer estimated lives are now being offered as alternatives and consideration should be given to their use.

There is some evidence of interior corrosion of root sections due to ground water collecting in the root of the lighting column or illuminated traffic sign post. In areas where this is considered to be a potential problem consideration should be given to extending the root treatment system to the inside of the root to give extra protection.

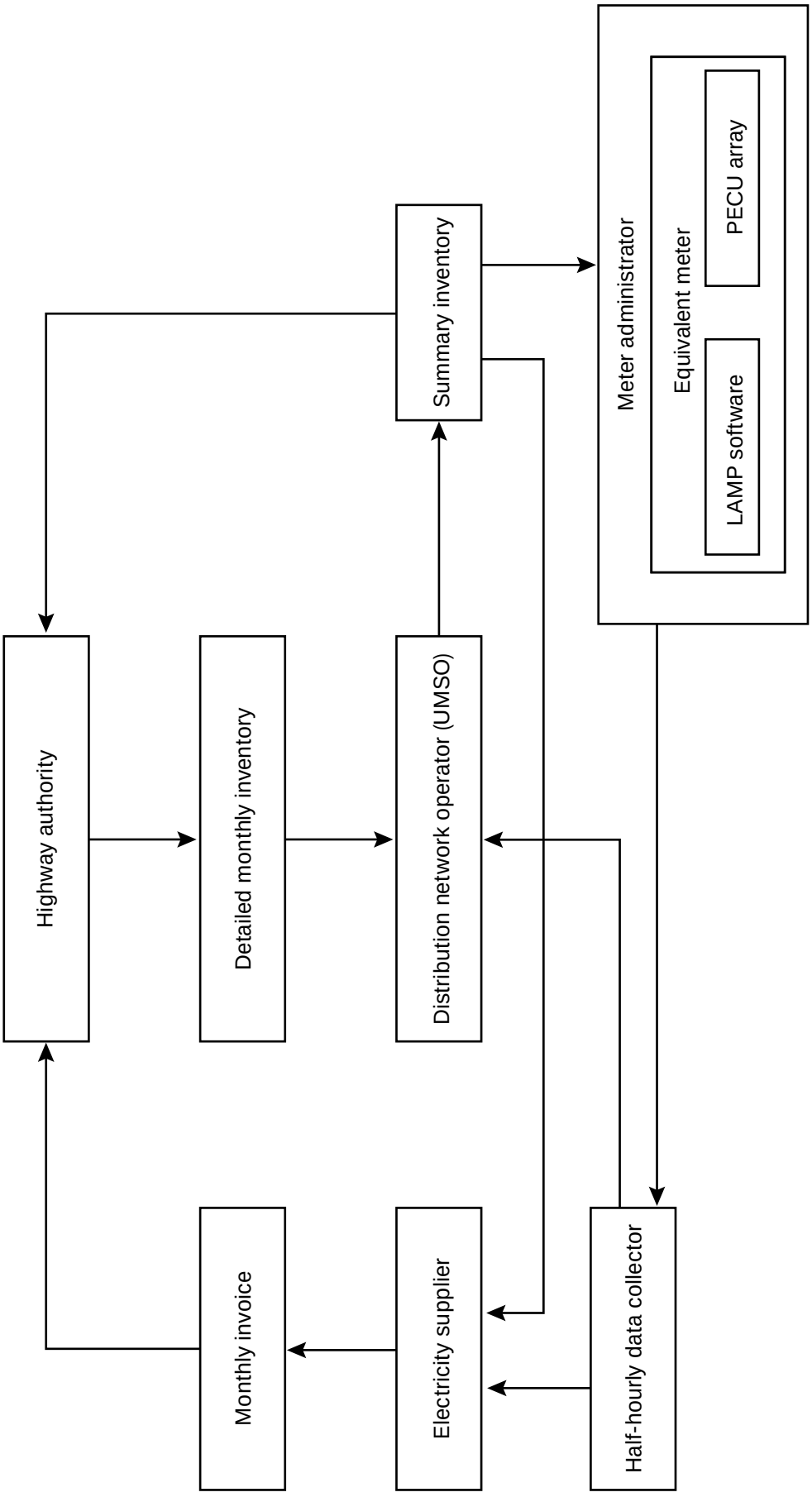
An alternative to the application of a paint system to new galvanized lighting columns is to have a thermoplastic co-polymer fusion-bonded powder coating applied at the place of manufacture. This type of coating provides a hard gloss surface finish over the entire length of the lighting column including the door and bracket if fitted. The finish is claimed to require no further maintenance for the life of the column. Cuts and scuffs can easily be repaired on site.

When considering the type of protective coating to be applied to new lighting columns, consideration should be given to the whole life cost of providing and maintaining the lighting column, including the cyclic reapplication of any paint finishes.

Appendix G
BSCP520 File Format and Flow Chart

3. Standard file format for detailed inventories						
Either a fixed format text file or a comma separated file for each item of inventory.						
Field No.	Name	Details required	Type	Length	Position	
					Start	Finish
1	Road reference	National street gazetteer reference, motorway number e.g. M42 or other agreed unique road reference	Text	8	1	8
2	Town, parish, district		Text	30	9	38
3	Road name		Text	30	39	68
4	Location, e.g. O/S No. 10		Text	20	69	88
5	Unit type	Identifies the record as a lamp or a sign, etc. B = bollard; L = lamp; M= miscellaneous; P = pillar S = sign; T = traffic signal equipment.	Text	1	89	89
6	Unit identity	Identity shown on unit (if any)	Text	12	90	101
7	Charge code	Appropriate BSCP520 code	Numeric	7	102	108
8	No. of items	Number of items of this charge code at this location	Numeric	3	109	111
9	Switch regime	Appropriate BSCP520 code	Numeric	3	112	114
10	No. of controls	Number of PECs or time switches on the item	Numeric	1	115	115
11	Control charge code	Appropriate BSCP520 code for the PEC or time switch	Numeric	7	116	122
12	Ordnance survey grid ref. 'East'		Text	7	123	129
13	Ordnance survey grid ref. 'North'		Text	7	130	136
14	Exit point	Y if yes, N if no, U if unknown	Text	1	137	137
15	Multiple equipment	M if this item has multiple charge codes	Text	1	138	138

Half-hourly electricity trading flow chart



Appendix H
Lamp Disposal Legislation

CURRENT LEGISLATION FRAMEWORK

The disposal of discharge lamps is controlled by the Environmental Protection Act 1990, The Duty of Care Regulations and the Special Waste Regulations Act 1996. Monitoring and enforcement is carried out by the Environment Agency in England and Wales, in Scotland by the Scottish Environmental Protection Agency and in Northern Ireland by the Northern Ireland Environment and Heritage Service.

DUTY OF CARE

Companies handling used lamps have a duty of care to their employees to ensure they have the correct safety equipment and procedures to carry out their duty safely.

The Control of Substances Hazardous to Health (COSHH) Regulations 1994 place duties on employers to protect employees and other persons who may be exposed to substances hazardous to health, e.g. solids, liquids or gases that may be toxic, harmful, corrosive or irritant. These regulations require that anyone employed on the disposal or treatment of discharge lamps must be fully trained in the methods of work and equipped with the necessary safety equipment to ensure their safety and that of anyone nearby.

STORAGE OF WASTE

Many companies and local authorities collect large quantities of lamps at their depots before arranging for them to be crushed or transported for disposal at another site. The storage of lamps awaiting disposal is covered by Paragraph 40 of Schedule 3 of the Waste Management Licensing Regulations 1994 which permits “the storage of non-liquid waste at any place other than the premises where it is produced if:

- it is stored in a secure building or container(s), does not at any time exceed 50 cubic metres in total and is not kept for a period longer than 3 months,
- the person storing the waste is the owner of the building or container(s) or has the consent of the owner,
- the place where it is stored is not a site designed or adapted for the reception of waste with a view to it being disposed of or recovered elsewhere, and
- such storage is incidental to the collection or transport of the waste.”

TRANSPORTATION OF WASTE

Companies carrying waste should be registered as carriers under the Controlled Waste (Registration of Carriers and Seizure of Vehicles) Regulations 1991: Companies collecting and transporting discharge lamps for recycling.

SUPPLIER SELECTION

Companies and organisations are legally responsible for their waste from cradle to grave. They must ensure that:

1. Companies who collect or transfer their waste are suitably licensed to do so (Waste Carriers Licence).

2. Companies who receive or process their lamps hold a Waste Management Licence or a Pollution Prevention Control Licence (PPC) if they recover mercury on their site.

3. They have a full audit trail from cradle to grave for all recovered / recycled materials.

4. The selected supplier is accredited to ISO 9001 for the provision of a lamp recycling service including transportation.

NEW LEGISLATION

The legal framework controlling the disposal of lamps and tubes is about to be substantially changed through the introduction of the Waste Electrical and Electronic Equipment (WEEE) Directive, the review of the Special Waste Regulations and introduction of the Landfill Directive.

New EU legislation means that certain wastes are now categorised as “Hazardous” (under the European Waste Catalogue) and as such can only go to a suitably licensed recycling facility or to a landfill site authorised to take hazardous waste. Lamps, tubes and crushed lamp debris containing mercury or sodium are examples of hazardous waste. Fluorescent tubes and mercury-containing lamps, such as SON lamps, are absolute entries in the catalogue and sodium-containing lamps, such as SOX lamps, which are flammable and explosive when exposed to water (see category H3a in Hazardous Waste Catalogue assessment criteria) must also be classified as hazardous.

Following the introduction of new regulations in July 2004, the number of landfill sites permitted to take hazardous waste fell from 250 to approximately 11. Of these only two are licensed to accept mercury or mercury-bearing waste. This reduction will result in hazardous waste producers incurring dramatic cost increases resulting from additional transport and disposal costs. On implementation of the WEEE Directive in August 2005 it will be a legal requirement to recycle lamps and tubes as well as all other electrical and electronic equipment.

The replacement of the Special Waste Regulations by the Hazardous Waste Regulations, programmed for Spring 2005, will almost certainly mean that any company or organisation operating lamp disposal equipment will be required to obtain a Waste Management Licence or a Pollution Prevention Control Licence.

Appendix I
Gas Lighting

The maintenance of gas lighting equipment is a specialist activity, and should only be carried out by suitably experienced and qualified personnel who are registered with the Council for Registered Gas Installers (CORGI). Where equipment is of recent manufacture, advice should be sought from the manufacturer.

The three main aspects of maintenance relate to the control system, burner and lantern itself.

CONTROL SYSTEM

Depending on the age of the lighting, and the technology used, control can be time clock, central control, electricity mains powered with permanent pilot ignition, or battery operated. If the time clock has a clockwork 14-day mechanism, it should be rewound on the correct day. If the unit is battery operated, the batteries should be replaced at intervals related to battery life.

BURNERS

Burners consist of mantles or groups of mantles. Monitoring that mantles are operating satisfactorily should be carried out on a regular basis at night. The frequency will depend on the importance of the location and on the type and condition of equipment.

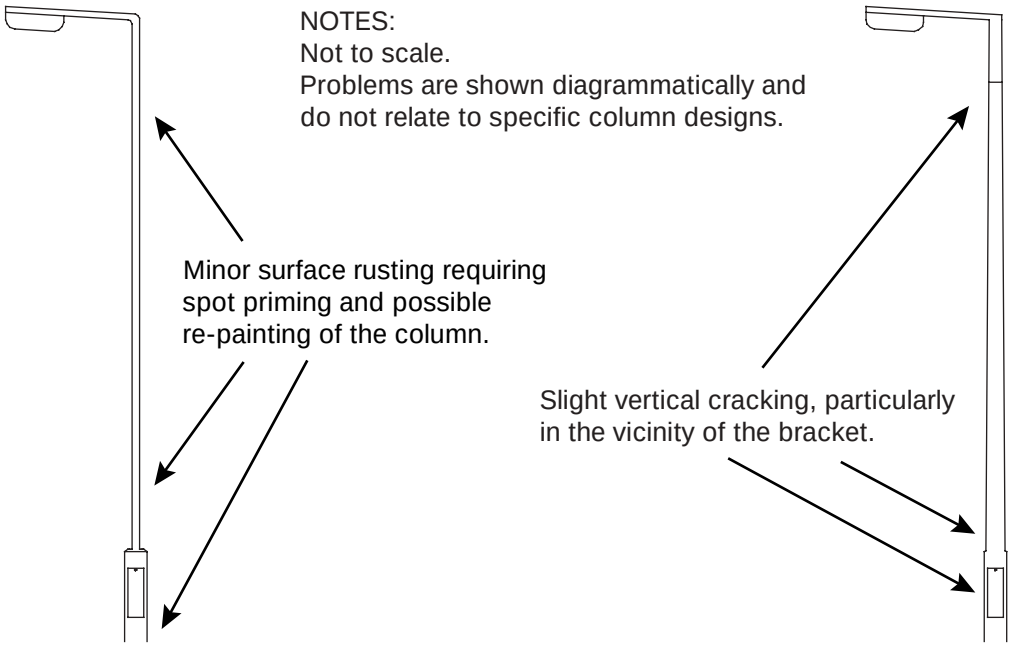
Burners should be renewed annually. If the unit operates from a pilot light, it should be checked for performance at the same time. If deteriorated so that the flame cannot be adjusted to ensure it remains on in all weather condition it should be adjusted. If the lantern fails to work, the cause is normally that the pilot light has extinguished.

LANTERN

At least annually, the lantern should be cleaned externally and internally, including the removal of cobwebs and insects in and around the gas–air mixing chamber.

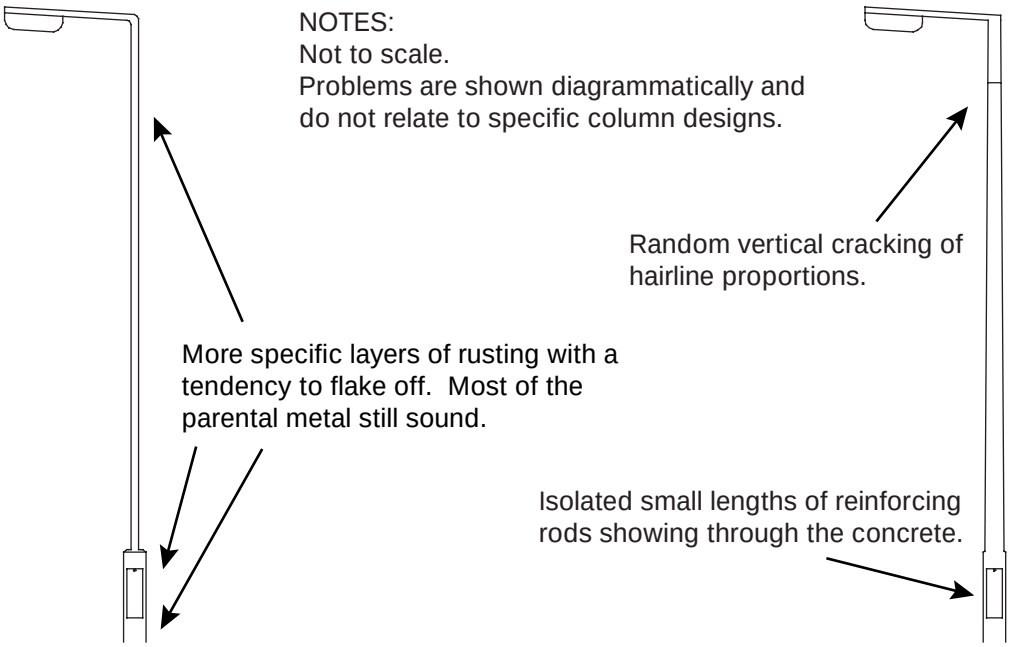
Some modern gas lanterns are vertical balanced flue appliances with the chimney arrangement being both the air inlet and flue. The body is thus nominally sealed, and if the glass is broken or removed, the balanced flue system fails. Glass should therefore be replaced promptly.

Appendix J
Lighting Column Structural Condition



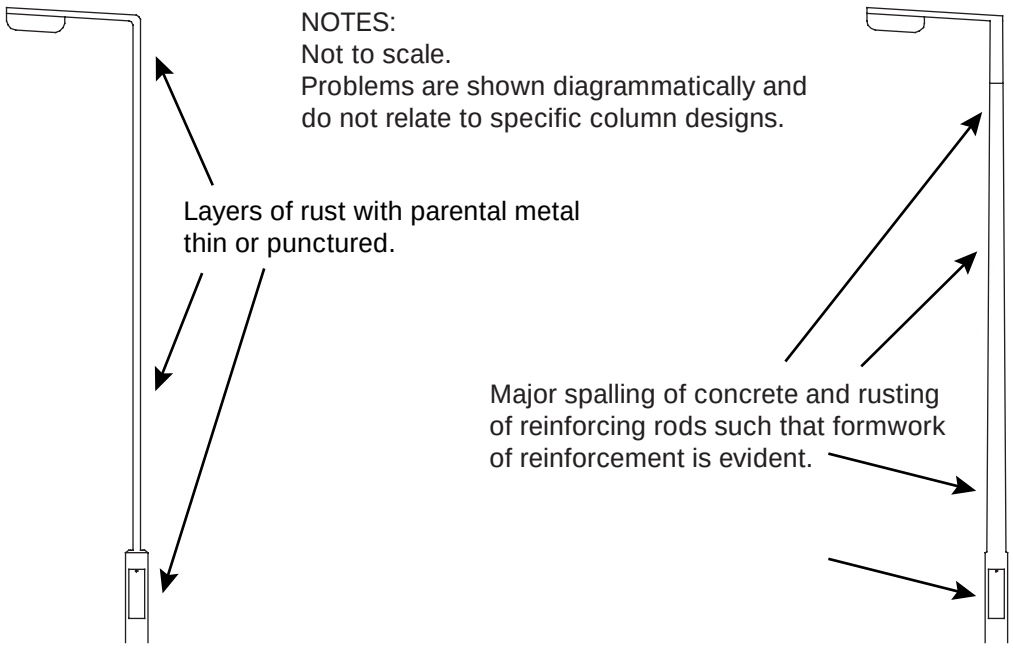
Minor deterioration giving rise to possible remedial measures (e.g. painting). Otherwise condition gives rise to possible need to replace within the next five years or so.

Lighting Column Structural Condition – Level 1



Random spalling of concrete becoming apparent requiring possible removal of small areas of loose concrete. Stability of column not in question.

Lighting Column Structural Condition – Level 2



Major local deterioration, extensive falling away of concrete exposing reinforcing bars such as to question the stability of the unit. Likewise, major corrosion and parental metal thin. Appearance of holes through the structure. Presence of horizontal cracks around the column probably caused by vehicular impact.

Lighting Column Structural Condition – Level 3

Appendix K
Useful Additional Reading and References

ILE TECHNICAL REPORTS

TR 5	Brightness of Illuminated Advertisements - Third Edition
TR 7	High Mast for Lighting and CCTV
TR 8	Maintenance of Public Lighting – Lantern Output Depreciation
TR 12	Lighting of Pedestrian Crossings
TR 13	Lighting of Pedestrian Subways
TR 14	Cost Effectiveness of Night-Time Patrolling
TR 17	A Study of Lamp Replacement for Discharge Sources
TR 18	The Planned Replacement of Lighting Columns
TR 19	The Effectiveness of Luminaire Cleaning
TR 22	Lighting Columns and Sign Posts – Planned Inspection Regime Second Edition
TR 26	A Practical Guide to the Painting of Steel Lighting Columns and Bracket Arms

Code of Practice for Electrical Safety in Highway Electrical Operations

Lasers Festival and Entertainment Lighting Code

Obtainable from The Institution of Lighting Engineers, Regent House, Regent Place, Rugby, CV21 2PN, Tel: 01788 576492, e-mail: info@ile.org.uk

BSI STANDARDS

BS 88: Part 2:	Specification for fuses for use by authorized persons (mainly for industrial application)
BS 921:	Specification for rubber mats for electrical purposes
BS 2754:	Construction of electrical equipment for protection against electric shock
BS 2769:	Hand-held electric motor-operated tools
BS 3998:	Recommendations for Tree Work

BS 4363:	Specification for distribution assemblies for electricity supplies for construction and building sites
BS 5378:	Safety signs and colours
BS 5467:	Specification for 600/1000 V and 1900/3300 V armoured electric cables having thermosetting insulation
BS 5489:	Road lighting
BS 5499-5:	Safety signs and colours
BS EN40:	Lighting columns
BS 6346:	Specification for PVC-insulated cables for electricity supply
BS 7375:	Code of practice for distribution of electricity on construction and building sites
BS 7430:	Code of practice for earthing
BS 7671:	Requirements for electrical installations, Sixteenth edition
BS EN 13201	Road lighting
BS EN 60309:	Plugs, socket-outlets and couplers for industrial purposes
BS EN 60529:	Specification for degrees of protection provided by enclosures (IP code)
BS EN 60900:	Hand tools for live working up to 1 kV a.c. and 1.5 kV d.c.
BS EN 60903:	Gloves and mitts of insulating material for live working
BS EN 60947:	Specification for low-voltage switchgear and control gear
BS EN 60742:	Isolating transformers and safety isolating transformers.
BS EN 61140:	Common aspects for installations and equipment for protection against electric shock.
BS EN 610204:	Electrical equipment of industrial machines.
PD 2754:	Classification of electrical and electronic equipment with regard to protection against electric shock.
PD 6519:	Guide to effects of current passing through the human body

Obtainable from British Standards Institution, 389 Chiswick High Road, London, W4 4AL, Tel: 0208 996 9001, e-mail: info@bsi.org.uk

ELECTRICITY ASSOCIATION PUBLICATIONS

Model Code of Practice, covering electrical safety in the planning, installation, commissioning and maintenance of public lighting and other street furniture. (Engineering Recommendation G39/1)

National Code of Practice on the Application of Multiple Earthing to Low and Medium Voltage Networks. (Engineering Recommendation G12/2)

Consumers earth fault protection on single-phase supplies up to 100 A for compliance with the 16th Edition of the lEE Wiring Regulations for Electrical Installations. (Engineering Recommendation P23)

The short-circuit characteristics of Electricity Suppliers' low voltage distribution networks and the co-ordination of overcurrent protective devices on 230 V single-phase supplies up to 100 A. (Engineering Recommendation P25)

The estimation of the maximum prospective short circuit current for three-phase 400 supplies. (Engineering Recommendation P26)

Obtainable from Energy Networks Association, 18 Stanhope Place, Marble Arch, London, W2 2HH, Tel: 020 7706 5100, e-mail: alan.southwell@energynetworks.org

HEALTH AND SAFETY EXECUTIVE PUBLICATIONS

HSE GS6 Avoidance of Danger from Overhead Electric Lines

HSE G141 Electrical Safety on Construction Sites

HSE GS38 Electrical Test Equipment for Use by Electricians

HSE HSG38 Lighting at Work

HSE HSG47 Avoiding danger from underground services

HSE HSG48 Reducing Errors and Influencing Behaviour

HSE HSG85 Electricity at Work

HSE HSG107 Maintaining Portable and Transportable Equipment

HSE HSG150 Health and Safety in Construction

HSE HSR25 Memorandum of Guidance on the Electricity at Work Regulations 1989

HSE lNDG163 Five Steps to Risk Assessment

HSE lNDG354 Safety in Electrical Testing at Work

HSE lNDG368 Use of Contractors

Obtainable from HSE Books, PO Box 1999, Sudbury, Suffolk CO10 2WA, Tel: 01787 881165, website: www.hsebooks.co.uk

CSS PUBLICATIONS

Notes for Guidance relating to the HSW Act 1974 as affecting personnel who are required to undertake work on motorways and trunk roads, 1985. (Superseded)

Guidance Notes on Electrical Safety on the Highway to Achieve Compliance with the Electricity at Work Regulations, 1995

Code of Practice for the Installation and Operation of Seasonal Decorations on or above the Public Highway, 1995

Obtainable from CSS Honorary Secretary and Treasurer, Derbyshire County Council, County Hall, Matlock, Derbyshire, DE4 3AG, Tel: 01629 585730, e-mail: dccesdir@globalnet.co.uk

HIGHWAYS AUTHORITIES AND UTILITIES COMMITTEE

Code of Practice for Recording of Underground Apparatus in Streets 2002

Specification for the Reinstatement of Openings in Highways 2002

Obtainable from The Stationery Office, PO Box 29, Norwich, NR3 1GN, Tel: 0870 600 5522, e-mail: book.orders@tso.co.uk

NATIONAL JOINT UTILITIES GROUP PUBLICATIONS

NJUG 1 Recommendations on the avoidance of danger from underground electricity cables

NJUG 3 Cable Locating Devices

NJUG 4 The Identification of Small Buried Mains and Services

NJUG 7 Recommended Positioning of Utilities' Mains and Plant for New Works

NJUG 8 Performance Guide for the Assessment of Metallic Pipe and Cable Locators

NJUG 10 Guidelines for the Planning, Installation and Maintenance of Utility Services in Proximity to Trees

Obtainable from National Joint Utilities Group, 30 Millbank, London, SW1P 4RD, Tel: 020 7963 5989, e-mail: njug@electricity.org.uk

THE STATIONERY OFFICE PUBLICATIONS

Traffic Signs Regulations and General Directions 2002

Obtainable from The Stationery Office, PO Box 29, Norwich, NR3 1GN, Tel: 0870 600 5522, e-mail: book.orders@tso.co.uk

HIGHWAYS AGENCY

Guidance for safer temporary traffic management

Obtainable from TRL Ltd, Old Wokingham Road, Crowthorne, Berkshire, RO45 6AU, Tel: 01344 773131, e-mail: info@trl.co.uk

Acknowledgements

UK LIGHTING BOARD CONSTITUENT PARTNERS

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