



## ILP Professional Lighting Guide

### Prioritising Investment in Public Lighting

#### A Framework for Developing a Street Lighting Value Management Model



## **Foreword**

In order to promote consistency across London in developing street lighting value management models (LVMMs), the London Lighting Engineers Group (LoLEG) bid through the London's Transport Asset Management Board (LoTAMB) to fund the production of this framework document. It provides general guidance on developing a plan focusing particularly on the practical aspects which would assist London boroughs in developing their own unique model in a standard format with common methodology. Where examples have been presented, these reflect the work carried out by Westminster City Council for its street lighting LVMM. The LVMM approach is of relevance to all authorities especially in times of diminishing budgets, and with that in mind the Institution of Lighting Engineers (ILP) approached LoLEG and LoTAMB to broaden the document to cover the United Kingdom and publish it through the ILP.

It focuses on making the best use of resources to manage the street lighting stock within an authority by developing a process that identifies exactly where funding is required based upon an auditable prioritisation process, and thus provides a sound framework methodology for prioritising such works on a risk management basis. An integral part of an authority's asset management plan, it will be of significant benefit to the London and wider lighting community, especially in the current financial climate, and is wholly endorsed by LoLEG.

LoLEG are pleased to see the work they have undertaken recognised nationally and supported by the ILP.

**Dave Franks**  
**Chair of LoLEG**  
**July 2012**

## **Preface**

The production of a street lighting value management model (LVMM) is not a statutory requirement. However an LVMM can be a key tool for the street lighting professional. It is a system that calculates and prioritises the highest risk columns and lighting installations at any given time, taking into account factors such as structural condition, crime data, lighting performance and maintenance history.

The LVMM is intended to maximise the impact on the annual budget and provide the best value returns for a lighting replacement prioritisation programme. The prioritisation process takes into account all the factors relating to the renewal of an existing lighting scheme, and, by appropriate weighting of these factors, gives the installations most in need of replacement the highest listing by priority.

The LVMM is a risk management tool and a means of prioritising the street lighting budget spend through a ranking system for every street within an authority. The prioritisation process balances safety and cost savings with other considerations.

The LVMM will become an integral element of an asset management plan which is believed likely to become a statutory document and to be produced by all local highway authorities in England in the near future.

Producing an LVMM will enable an authority to demonstrate compliance with the Health and Safety at Work Act 1974 which requires organisations, employers and employees to act in a safe manner. This management model is therefore a means by which evidence may be demonstrated regarding HASAW compliance since it prioritises the highest risk columns and lighting installations at any given time.

Although the framework document has been produced primarily for London boroughs, it is applicable to all local highway authorities in the UK.

This document provides the framework around which a street lighting LVMM can be developed.

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## **Abbreviations**

ADEPT	Association of Directors of Environment, Economy, Planning and Transport (formerly the County Surveyors Society CSS)
AMS	Asset management system
EuP/ErP	Energy using Products/Energy related Products Directives
GIS	Geographical information system
GPP	Green public procurement
ILP	Institution of Lighting Professionals (formerly Institution of Lighting Engineers)
LoLEG	London Lighting Engineers Group
LoTAMB	London's Transport Asset Management Board
LVMM	Lighting value management model
MCDA	Multi-criteria decision analysis
MCDM	Multi-criteria decision making
OS	Ordnance Survey
TRO	Traffic regulation order
TRL	Transport Research Laboratory

## **1 Introduction**

The role of street lighting within the street scene is to provide the overall background level of lighting, and good public lighting can be considered an art as well as a technical street furniture matter. The aim of street lighting is to encourage a safe environment for all highway users and pursuits, where people and vehicles can see and be seen.

In addition there are secondary light sources such as shop fronts and the floodlighting of buildings and monuments which contribute to the street scene, but these do not provide the base lighting requirement. Public lighting can also create imaginative effects in its own right.

## **2 Legal considerations – Powers and Duties**

When reviewing the provision, maintenance and operation of street lighting systems, an authority should take account of the following items:

- A highway authority has a power, not a duty, under the Highways Act 1980 to provide and maintain road lighting.
- A highway authority should act reasonably. If it acts in a way that no reasonable authority would act then the decision of that authority could be subject to review in the courts.
- A highway authority is required under s.17 of the Crime and Disorder Act 1998 to have regard to the need to do all it reasonably can to prevent crime and disorder.
- Unless provided by separate order, restricted roads and their associated 30 mph speed limits are established by the presence of a 'system of lighting'. For instance, a highway authority may be challenged if it removes a system of road lighting or fails to maintain one in operation unless it can clearly demonstrate that the reason for which the system of street lighting was installed is no longer applicable. Similarly, an authority would be negligent if its street lighting apparatus was in such a state of disrepair as to cause an accident such as the collapse of a lighting column not maintained to recognised industry standard, or personal injury caused by faulty electrical equipment.
- It also needs to be remembered that, in accordance with the Road Traffic Regulation Act 1984, restricted roads and their associated 30 mph speed limits are established by the presence of an 'appropriate system of street lighting' unless provided by a separate traffic regulation order. If such lighting were removed, a new order would be required to reinstate the 30 mph limit.
- The provision of street lighting has many community benefits, including the prevention of night time road accidents, the provision of a safe environment for both car drivers and pedestrians, assisting in the reduction of street crime and the fear of crime, and contributing to the local night time economy. There is no overriding duty on an authority, as a highway authority, to provide or keep street lighting systems lit to prevent crime.

### **3 Lighting value management model**

A lighting value management model (LVMM) is a key tool for the street lighting professional. It is a system that calculates and prioritises the highest risk columns and lighting installations at any given time, taking into account factors such as structural condition, crime data, lighting performance and maintenance history.

The LVMM is intended to maximise the impact on the annual budget and provide the best value returns by spending funds precisely where required through a lighting replacement prioritisation programme. The prioritisation process takes into account all the factors relating to the renewal of an existing lighting scheme, and appropriate weighting of these factors gives the installations most in need of replacement the highest priority.

The LVMM is a risk management tool and a means of prioritising the street lighting budget spend through a ranking system for every street within an authority. The prioritisation process balances safety and cost savings with other considerations.

It is important that all decisions made regarding the criteria used (and not used) and developing a scoring method are documented during the development process.

It may also be applicable to consider the LVMM along with other value management approaches used or being considered within an authority to ensure that they align where required.

### **4 Relevant factors**

Every authority will have different factors that affect their prioritisation. The following are just a number that may be relevant to the process for the replacement of the existing street lighting system. This list is not exhaustive or prescriptive and each authority should consider what should be included in its own LVMM.

- Structural condition – are columns safe and have they a serviceable life remaining based upon known installation date and non-destructive testing results in accordance with national guidance, ILP technical report 22?
- Optical performance of the existing lighting, compliance with appropriate standard such as BS5489-1, and national guidance on best lighting practice such as that published by the Institution of Lighting Professionals (ILP).
- Energy efficiency and carbon usage could also be considered, to address how each asset/equipment type might be made more energy efficient. In addition existing equipment may not be compliant with the Energy using Products (EuP) and Energy related Products (ErP) Directives and legislation on permissible equipment in the street lighting sector. This will include, but not limited to, mercury lamps (due to be phased out in 2015) and magnetic control gear (not permitted after 2017).
- Electrical condition – does the installation comply with the requirements of the electrical regulations, BS7671?
- Street crime and perception of crime.
- Accident statistics, such as accident black spots.
- Traffic flows.

- Aesthetic appearance, streetscape, heritage equipment, clutter reduction and meeting the requirements of the authority in terms of equipment types and styles used.
- Maintenance History – is the whole street a problem or just one column? Do 80% of the faults lie within 15% of the stock?
- Social influences such as safer routes to school and pedestrian zones.
- Change of use including new developments, traffic calming, bypassed roads and changes in speed limits.

## 5 Weighting System

It is important to develop a weighting system applicable to the relevant factors to determine a prioritisation programme, although this must not distract from the most important function and overall priority of replacing at the earliest opportunity any equipment considered to be dangerous.

Each of the proposed factors for the authority should be considered, reviewed and for ease of ranking be grouped into core aspects with supporting and contributing factors. The following table is taken from Westminster City Council’s LVMM and shows, as an example, where the various factors applicable to them at the time have been grouped into common core objectives ready for ranking.

<b>Core</b>	<b>Supporting/Contributing</b>
Safety	Structural Condition
Local Issues	Crime Rating Accidents Aesthetic Appearance
Performance	Lighting Levels vs Standards
Social	Network Hierarchy Social Locations
Value for Money	Maintenance History

Each core aspect should then be ranked against the others using multi-criteria decision analysis (MCDA), which is sometimes called multi-criteria decision making (MCDM). This is a discipline aimed at supporting decision makers faced with making numerous and sometimes conflicting evaluations. MCDA aims at highlighting these conflicts and deriving a way to come to a compromise in a transparent process and then assigning them a weighting.

In the case of developing an individual LVMM, the MCDA/MCDM process can be used to compare each core aspect in relation to each of the others in order to gauge a priority of their relevance to each other, and therefore ranking and weighting in order of importance. The more stakeholders involved in the process the better the final weightings assigned.

The following is taken from Westminster City Council’s LVMM and shows the grouping and weighting factors after the MCDA/MCDM process was carried out.

<b>Core</b>	<b>Weighting</b>
Safety	0.55
Local Issues	0.17
Performance	0.16
Social	0.08
Value for Money	0.04

## **6 Development of the condition factors**

### **6.1 Condition factors**

The following looks at a range of condition factors that can be considered and how a weighting might be considered/applied to each as part of the overall LVMM development. The factors would be assigned either against each asset depending upon its condition or in consideration of crime, performance or other issues within that street.

The system should have a flexibility that will allow for the input of different ratings as the authority’s priorities change, for example ‘all columns are now structurally sound’.

The following data analysis may be considered in order for the LVMM prioritisation to be undertaken using the appropriate weightings.

### **6.2 Visual and structural inspections**

Visual inspections of street lighting assets should be undertaken on a regular basis and every time a unit is visited. It is important that a process of visual and structural inspection is undertaken within an authority.

Tests regarding the structural integrity of the street lighting columns should be carried out on a programmed basis using various non-destructive testing systems. The frequency of such testing should be reviewed based upon comparing past load testing results with the latest results to determine the rate of corrosion. This data should then be used to review the frequency for the next cycle of testing within that street/area. This will also aid the formation of a detailed stock profile.

The recommendations contained within the Institution of Lighting Professionals (ILP) Technical Report TR22 form the national guidance and are the benchmark for such testing. The requirements should be followed regarding the testing and recording of resultant data.

Condition factors on a per unit basis:

- Structural condition – are columns safe and is their serviceable life left based upon visual and non-destructive testing being carried out in accordance with national guidance, ILP technical report 22?
- The condition of the asset is visually assessed at each maintenance visit applying the ILP TR22 visual condition guidance, which is a subjective assessment based on experience. However, the results of these

assessments can easily be profiled over time to provide a basic level of condition.

- The visual condition helps inform the structural testing regimes along with the asset age profiles, the structural testing provides confirmation that the asset is in good structural condition.
- These structural results should be profiled over a period beyond the guarantee period to optimise the value of this information.
- Structural failures identified at the time of testing through an authority's own risk assessments should be managed directly ensuring that the asset is replaced immediately and maintaining illumination to the highway.

### **6.3 Local issues**

#### **6.3.1 Crime and disorder**

Section 17 of the Crime and Disorder Act 1998 creates a general duty on each local authority to take account of the community safety dimension in all of its work. All policies, strategies, plans and budgets need to be considered from the standpoint of their potential contribution to the reduction of crime and disorder.

BS 5489-1:2003 'Code of practice for the design of road lighting, Part 1: Lighting of roads and public amenity areas' requires street crime levels to be considered at a local level, and this will in part determine the lighting performance class/levels required for an area. The Home Office review reports 251 and 252 have shown that there is a clear link between good lighting and both the perception and the actual reduction in street crime. Reducing the perception of crime encourages users out into public areas and thus increases the chance of a criminal act being observed or detected.

Local authorities should review street crime levels and understand that good lighting can provide a positive benefit. The authority should look to determine the crime rates per year on a per-street basis and rank these as low, medium or high crime. The following is taken from Westminster City Council by way of example:

0	Very low crime	< 25 incidents per annum
1	Low crime	≥ 25 to 49 incidents per annum
2	Medium crime	≥ 50 to 99 incidents per annum
3	High crime	≥ 100 to 499 incidents per annum
4	Very high crime	≥ 500 incidents per annum

#### **6.3.2 Collisions**

Night time accident statistics should be obtained from the authority's own traffic department. Details of accidents that cause damage to any of the street lighting infrastructure should also be investigated to see if there is a problem with the location of the equipment. It is recommended that accident statistics are evaluated and the results inputted into the model to produce more accurate requirements, even if these factors are addressed via other budgets.

#### **6.3.3 Appearance of asset and decluttering**

The appearance and style of equipment to be used within the authority as well as any requirement to declutter the streetscape may be a consideration.

## **6.4 Performance**

The performance of the existing public lighting installations is critical to road safety and can also affect crime levels. This is a measure of how well the existing lighting meets the current road lighting standards and should be considered to ensure that areas of low performance are addressed as a priority.

All roads within the council should be assigned a base lighting class and this can be referenced to the National Gazetteer. The road hierarchy descriptions generally align with those given in BS5489-1:2003 'Road Lighting' and are considered nationally to be an appropriate basis for determining the street lighting hierarchy. This provides the base lighting class which is then assessed against local crime rates and traffic flow levels to determine the final lighting performance class.

All roads can be GIS mapped against the highway hierarchy and assigned a lighting class.

Where the lighting performance of the existing lighting installations is not known then a desktop approach should be undertaken to determine an indicative performance level. The average road lengths and road widths can be obtained from existing data and OS mapping and average column spacing along each road calculated. This allows a desktop study to determine the assumed lighting levels achieved by the existing street lighting installations.

## **6.5 Social**

### **6.5.1 Network Hierarchy and Social Locations**

Key routes within an authority are an important consideration. Examples include strategic vehicle routes, safer routes to school and pedestrian zones or areas of special interest where movement is encouraged or promoted, and may include local clubs and areas around old people's homes. These are key areas and therefore form an important part of the highway hierarchy, requiring a higher level of attention to ensure that the lighting infrastructure is operating as required.

The network hierarchy enables an assessment of both the proposed and existing base lighting levels. However, in order to fine tune these assessments, we need to take into account the above factors and designate a scaling factor ready for input into the model.

## **6.6 Value for money/Maintenance history**

Essentially, this examines the maintenance history of the roads, areas and types of equipment to identify any key areas where problems may exist and look to include them within the prioritisation process. For example, do 80% of faults identified in a year only relate to 15% of the stock?

## **6.7 Energy efficiency and carbon usage**

Energy efficiency and carbon usage may also be considered, to address how each asset/equipment type should be made more energy efficient. In addition existing equipment may not be compliant with the Energy using Products (EuP) and Energy related Products (ErP) Directives and legislation on permissible equipment in the street lighting sector. This will include mercury lamps (due to be phased out in 2015) and magnetic control gear (not permitted after 2017).



A proposed scaling factor for safety/structural condition may be given as:

- 0 Acceptable
- 1 Medium to low priority
- 2 High and medium to high priority

## **7.2 Local issues**

### **7.2.1 Crime rating**

The lighting standards rate crime under three categories as previously discussed, these being low, medium and high. However Westminster City Council record street crime under five categories and it is proposed that these are used for the basis of assigning ratings to be included in the LVMM within the authority, as follows:

- |   |                 |                                  |
|---|-----------------|----------------------------------|
| 0 | Very low crime  | < 25 incidents per annum         |
| 1 | Low crime       | ≥ 25 to 49 incidents per annum   |
| 2 | Medium crime    | ≥ 50 to 99 incidents per annum   |
| 3 | High crime      | ≥ 100 to 499 incidents per annum |
| 4 | Very high crime | ≥ 500 incidents per annum        |

## **7.3 Lighting performance**

This is based upon assumed lighting levels where the performance of the existing installation cannot be confirmed through design records. It may be suggested that a scaling factor of 0 to 3 be used to reflect these levels, with 0 denoting deemed to comply and 3 as failing to meet the standards.

The rating could be based on the different lighting layouts – staggered, single sided and opposite – contained within the street, and how they comply or not.

- 0 The lighting installation meets the current 2003 standards and the councils lighting policy
- 1 The lighting installation meets the requirements of the British Standards between 1992 and 2003
- 2 The lighting installation consists of a network of columns but the lighting performance fails to meet the requirements of either standards. These would tend to be pre-1992 standards when during this time street lighting design was based upon performance requirements rather than a general 'rule of thumb' approach
- 3 The lighting installation is extremely poor/little lighting exists

In future it might be that lighting standards may reduce lighting levels compared to current 2011 standards. In this case it may be worth proposing a weighting to consider where some streets may be over-lit. This may also apply where a road's usage has changed, or the road's use has increased or decreased due to a change in function of the street.

## **7.4 Social**

### **7.4.1 Network hierarchy/social location**

The road classification record lists all roads and assigns both a road hierarchy as well as an associated pavement hierarchy. The rating is based upon the above

but with consideration given to where sections of roads are defined as safer routes to school, pedestrian zones or areas of special interest where movement is encouraged or promoted, and may include local clubs and areas around old people's homes. These are key areas, therefore forming an important part of the highway hierarchy and requiring a higher level of attention to ensure that the lighting infrastructure is operating as required.

The rating could be based upon a sliding scale from 0 to 5, for example, as follows:

- 0 Private or otherwise not applicable
- 1 Shared street
- 2 Local access road
- 3 Local link road
- 4 Distributor road
- 5 Strategic route

Where sections of road are identified as having local social requirements the above rating would be increased to the next level.

### **7.5 Value for money/Maintenance history**

A review has been undertaken to determine the average maintenance history of each item of equipment over a five year period.

The rating could be based upon a sliding scale from 0 to 5 as follows:

- 0 < 0.5 visits per annum
- 1 > 0.5 to 1 visit per annum
- 2 > 1 to 2 visits per annum
- 3 > 2 to 3 visits per annum
- 4 > 3 to 4 visits per annum
- 5 > 4 visits per annum

## **8 Maintenance of the information**

### **8.1 LVMM Upkeep**

The LVMM system can only be as good as the data that it contains and relies heavily on the public lighting asset inventory/management system being fit for purpose, up to date and containing all the fields necessary for a full LVMM assessment.

Each authority planning an LVMM will need to ensure that it is developed to integrate with the asset management system and run at such a time as to be used to feed into the budget process each year. For this reason it will be important to set a date each year by which time all of the input data required for assessment has been entered and checked. The LVMM can then be run and a priority list of streets requiring attention can be produced with supporting evidence. This can then be reviewed and improvement budget estimates for each street assessed and formulated for inclusion in the annual bidding process. This will ensure that the available funds are prioritised to exactly where they are most needed.

Street lighting consists of a number of elements that perform different functions: some are structural, some are electrical and some are optical. These elements

have particular maintenance regimes which are generally different for each authority. Therefore each maintenance/programme activity will have a major influence on the Weighting Points System.

## **9 System considerations**

### **9.1 General overview**

When implementing the application of the LVMM across individual or multiple authorities, consideration needs to be given on how the data is to be collected and collated as it will be derived from various sources, departments and systems. This includes, but is not limited to, crime statistics, structural testing records, electrical testing, age profiles, maintenance regimes and lighting performance levels, and not just the asset management system fault history.

There are many dedicated asset management systems/inventories available for highway authorities to use, each with a variety of different methods of data storage and manipulation. For example, the Confirm system is capable of both the storage of the appropriate data required for the LVMM, and with suitable development of the report writer it can generate the LVMM report.

The benefits of holding the LVMM data in the asset management system (AMS) is that, providing all of the data is up to date, the system is effectively live and a snapshot LVMM report can be obtained at any time. However as discussed earlier within this framework, the main aim of the LVMM is to produce forward asset management programmes based upon addressing the highest risk columns and lighting installations within an authority as well as aiding budget development, thus maximising the impact of any budget spend. The LVMM is likely to be run at key times within the year to input into this process, it is therefore of importance that all data fields are updated and checked before the LVMM is run.

For those systems which are not able to hold all the data in the AMS and generate the reports needed, the alternative is to use an offline database or spreadsheet. Depending upon how the data is held and how regularly it is maintained this approach can have the disadvantage that it is a point in time snapshot and the data will need to be updated every time the authority wishes to rerun the reports. However this will mainly affect any snapshot view required during the year and not necessarily the results at the key points within the year.

It is recommended that the LVMM data is incorporated into the AMS whenever possible.

### **9.2 Data Storage**

The data used for the LVMM should be backed up on a regular basis in line with good industry practice. All authorities have specific information technology policy documents which will cover the safe keeping of this data.

### **9.3 Data manipulation**

To produce the LVMM report as a list of streets, street sections or areas that require attention in descending order, the report writer essentially has to multiply the appropriate scaling factors for each lighting asset/street. Those scoring the highest value require the highest level of attention.

When deciding how the output should be presented, consideration should be given to the level of information required, whether at street level or individual asset level. There are arguments for both options as it is essential to have an overview of the entire lighting installation for planning whole street replacements. But it is also essential to ensure that the highest priority replacement individual assets are not overlooked.

An ideal scenario would be to have a street by street priority listing for consideration for capital funding and an individual unit level for ad hoc attention/replacement funding where such units are within non-critical streets.

This will reduce the chance of units not being identified as a priority if street level only assessments are carried out.

Work to date within Westminster City Council has shown that a combination of the two helps to generate a priority replacement strategy appropriate for budget allocations.

#### **9.4 Data Updates**

The value of the LVMM is only realised when the data set is kept up to date. It is recognised that priorities change over time and the system needs to be flexible to allow data to be changed as near to a live environment as possible. This also applies to the weighting factors, scale factors and local initiatives which may change over time. For example, if an authority wishes to investigate lighting and crime they should be able to suppress the structural element within the LVMM. A report can then be produced that indicates areas of high crime and poor lighting as well as areas of high crime where the lighting is appropriate. Other crime reduction factors can then be considered rather than looking to improve lighting performance.

All of the above factors should be built into the system in such a way that updates and maintenance of data are as simple as possible.

#### **10 Further Enhancements**

To enhance the system further, it is possible to link this prioritisation process to a standard bill of quantities. This will allow an estimate of the costs involved for each street or section of street to be derived, allowing the best use of available budgets for strategic replacements to be targeted at the highest priority needs within the authority's set criteria.

#### **11 Summary**

The LVMM will be highly influential to an authority for the purposes of maximising the annual budget allocations for street lighting and future budgets to bid for. It will provide a prioritised capital investment for long term planning and enable forward works programmes to be developed and implemented ensuring that funding is directed exactly where it is required.

It is important that each authority consider the times within the year that the LVMM will be run and thus when all relevant data must have been collected and stored within the system. This will relate to each authority's own internal budget setting and forward workload planning dates.

To achieve the best with respect to asset management and the LVMM it is important that the inventory, maintenance records and LVMM data are accurately maintained.

The LVMM is only the first step in identifying and prioritising works and determining where street lighting budgets should be focused.

Options appraisal for the replacement lighting scheme, specifically what equipment should be used to replace the asset, comes in following the LVMM process. The principles of green public procurement should be followed.

This will be a footnote with the framework but would be a different process and depends upon the policy and approach of each authority.

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