Safe roads, Reliable journeys, Informed travellers

HIGHWAYS AGENCY

Good Energy Guide

A REFERENCE SOURCE
FOR LINKS TO
ENERGY SAVING MEASURES

Click here to enter

Network Services

Lighting, Innovative Technologies and Traffic Signals team.

RoadLightingEnquiries@highways.gsi.gov.uk

January 2011

Process map

Objective: Carbon Reduction by reducing electricity consumption

HOW TO USE THIS GUIDE

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HOW TO USE THIS GUIDE

This guide is intended as a quick reference source for more detailed information on measures that can reduce the Agency's electricity consumption (and therefore its carbon footprint) of lighting and roadside equipment through improved design, management, operation or technologies. This is a wide subject area with many different standards etc. The main objective is to gather together in one place references relevant to electricity savings. The aim is to encourage Project Sponsors and Designers to challenge the status quo and apply electricity consumption reduction measures where applicable. The guide details methods under assessment (with predicted delivery dates) so that their use can be built into future schemes.

The guide makes extensive use of hyperlinks on all icons, contents table and underlined text to access reference documents on SHARE, websites and/or PartnerNet. The intention is that a user can find a reference to advice and/or standards as quickly as possible without necessarily having to read the whole document. The document is not designed to be read from start to finish. Users may wish to read some of the introductory sections for further information on scope, the need for the document, its applicability etc. However the assumption is that users will have a specific need, and need to find information to develop a solution quickly and easily. The process map shows the structure of the guide.

NOTE!
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HOW DO YOU KNOW IF THESE IDEAS WORK?

All the methods and products referenced within this guide have been (or are being) trialled on the network and are assessed against the following criteria:

- ✓ Value for money - we look at whole life costs, that is, installation, maintenance and decommissioning.
- ✓ Road worker safety - how many hours of on-road time is required to install, maintain and decommission this equipment
- ✓ Resilience and availability - we are a 24/7 organisation, our asset has to be as well
- ✓ Road user safety - how does impact on the DfT safety targets
- ✓ Journey Time Reliability - how does this impact on the PSA target
- ✓ Sustainability – what is the contribution over the short and long-term?
- ✓ Fast & reliable roll-out - how simple is this to roll-out?
- ✓ Impact on the TOS – the intervention should not require additional TOS resource.

FURTHER INFORMATION ADVICE AND SUBMITTING SUGGESTIONS

If required, further information and advice can be obtained from;

Network Services Division

Lighting, Innovative Technologies and Traffic Signals (LITTS) team.

mailto:RoadLightingEnquiries@highways.gsi.gov.uk

LITTS team are also looking for examples of energy reduction measures implemented on the network.

Any successful ideas, methods or equipment used should be notified to LITTS team for consideration for inclusion in this guide. For examples see 'ENERGY REDUCTION MEASURES IMPLEMENTED ON THE NETWORK'.

Ideas for consideration should be submitted as a 'Technical Case Study'. Click here for guidance on contents of Technical Case Study.

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TECHNICAL CASE STUDY - Guidance for Submission

A Technical Case Study is intended as a method of disseminating information across the Agency to ensure consistency of best practice, and reducing duplication of effort in assessing energy reduction measures and equipment.

If any commercially available equipment is identified in a Technical Case Study, it must be understood that this is not an endorsement of this product. Other commercially available equipment may also be available which will meet the required criteria. Use of new products is encouraged to stimulate innovation and keep up to date with advances in technology.

Technical Case Study should contain some evidence of the following:

- ✓ Value for money - we look at whole life costs, that is, installation, maintenance and decommissioning.
- ✓ Road worker safety - how many hours of on-road time is required to install, maintain and decommission this equipment
- ✓ Resilience and availability - we are a 24/7 organisation, our asset has to be as well
- ✓ Road user safety - how does impact on the DfT safety targets
- ✓ Journey Time Reliability - how does this impact on the PSA target
- ✓ Sustainability – what is the contribution over the short and long-term?
- ✓ Fast & reliable roll-out - how simple is this to roll-out?
- ✓ Impact on the TOS – the intervention should not require additional TOS resource.

If equipment is identified, some evidence of, or a statement made to confirm the following:

- ✓ it's performance meets or exceeds the manufacturer's claims
- ✓ it is reliable and effective in service
- ✓ it does not require an onerous maintenance regime
- ✓ there are no 'significant issues' that need to be managed

Any Technical Case Studies should be sent to Lighting Innovative Technologies and Traffic Signals team.

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WHY USE THIS GUIDE?

The driver for this guide is the Agency's Energy Strategy which is mandated by Central Government. Central Government is committed to reducing the UK's carbon footprint. Each government department has been given targets to meet this commitment.

The Agency has a Key Performance Measure, in the 2010-11 Business Plan, to reduce energy consumption by 3%. There is in-year monitoring of this target, which is segmented to ensure that all Regions & Area Performance Teams contribute appropriately to this target.

The HA network may be energy rated on a link-by-link basis during. Bad or poor practice with respect to scheme design and electricity usage will be highlighted by that process. Therefore it is in the interests of all that the electricity reduction methods referenced in this guide are given careful consideration and implemented where appropriate. Implementation should be planned to coincide with other programmes of work to facilitate access to roadside equipment.

There are many ways to reduce electricity consumption on the HA network, and unfortunately a number could be considered the wrong way when looked at in the wider context of Agency objectives.

The methods referenced in this guide reduce electricity consumption while:

- ✓ improving workforce safety
- ✓ have no discernible impact upon road-user safety
- ✓ reducing maintenance costs
- ✓ improving the environment

All methods are supported by a safety case, (developed using good practice from the rail sector), which provides justification for the actions to be taken.

This guide is referenced in the 'Managing Down Costs' toolkit which is a requirement of the PCF process.

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WHO SHOULD USE IT?

This guide is intended for use by all Agency staff and their agents involved with installing or maintaining lighting and electrical equipment on the network. This includes (not an exhaustive list);

- Regional Technology Teams
- TechMACs
- MACs & EMACs
- Area Performance Teams
- Consultants
- Contractors
- Major Projects
- Suppliers
- Project Sponsors
- DBFO Companies
- NRTS

NOTE!

This guide, and the advice given in it and the associated reference documents is only for use on Highways Agency Motorways and All Purpose Trunk Roads.

WHEN SHOULD IT BE USED?

When any work (installation, maintenance, refurbishment, replacement/renewal) is undertaken to lighting or electrical equipment on the HA network, the relevant section of this guide should be consulted to ensure that the latest sources of information on electricity reduction are used to achieve ‘best practice’.

Wherever possible, all work should be carried out as part of planned activities as funds for electricity reduction measures have to come from existing budgets. This approach will reduce traffic management costs and road workers exposure to hazards.

WHAT DOES THIS GUIDE AIM TO ACHIEVE?

The aim is to give users a quick, easy to use reference source to methods, standards, advice and Technical Case Studies that will assist in achieving 'best practice', or at least 'good practice' for measures that reduce the Agency's carbon footprint via a reduction in electricity consumption**.**

It is recognised that the number of documents and products relating to electricity reduction could rapidly increase. This document aims to give users the most appropriate and up-to-date information to access these documents, and sources of advice.

SCOPE

This guide is intended as a quick reference source for more detailed information on measures that can reduce the Agency's carbon footprint by reducing it's electricity consumption through improved design, management, operation or technologies.

It does not give advice on how to compile a programme of work or deliver these savings.

It is not mandating the use of any method or promoting the use of any technology. Each use of a method or technology referenced in this guide must be considered on a case by case basis.

The details of each method or technologies are contained within the source documents or points of contact listed. The documents can be accessed via the 'SHARE' links or the links to the PDF files on PartnerNet.

Not all the electricity reduction methods or types of technologies are available yet. However, they are listed, together with expected available dates, so that users are able to plan to achieve best practice for energy/carbon savings.

PROCESS MAP

QUICK WINS

ENERGY REDUCTION MEASURES IMPLEMENTED ON THE NETWORK

??????????????????????????????

BEING A DEMANDING ELECTRICITY CONSUMER

??????????????????????????????

Road Lighting

New Schemes

Renewals

Maintenance

Sign Lighting

New Schemes

Renewals

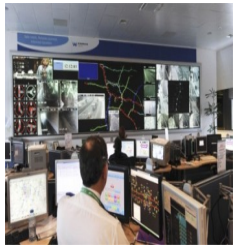
Maintenance

Traffic Lights

New Schemes

Renewals

Maintenance



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ROAD LIGHTING

The aim is 'Right Place, Right Time, Right Level'.

The Agency's annual electricity consumption for powering roadside equipment which includes road lighting, signs, and overhead gantries is around 220M kWh, costs approximately £22M and equates to 130,000 tonnes per annum of carbon emissions. Almost 70% of this consumption is used for road lighting.

In order to reduce our carbon footprint in line with government policy the Agency needs to achieve its aim for lighting which is;

Right Place – is lighting really necessary? For example, it is a misconception that all roundabouts and/or junctions have to be lit. Have changes occurred which mean that lighting is no longer a major contributor to safety? For example, road widening or geometric layout improvements.

Right Time – is it necessary to have lighting on motorways when there is virtually no traffic? For example, between midnight and 5am.

Right Level – Can the required lighting levels be achieved with lower energy lamps? For example, Light Emitting Diodes or Metal Halide discharge lamps.

Consideration for lighting is:

Is it necessary? → Is it the right level? → Can Full Switch Off be implemented?→
Can midnight switch off be implemented? → Can trimming be implemented?

Refer to the Road Lighting Efficiency Questionnaire

Is this a new scheme, renewal or maintenance?

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ROAD LIGHTING - New Schemes

Is lighting necessary?

The Agency is not mandated to light any roads.

Refer to TA 49 for appraisal criteria ***(Right Place)***

This Advice Note currently does not include Midnight Switch off (*Switches off lights at midnight if traffic flows are sufficiently low)* which may affect the whole life costs sufficiently to allow a lighting scheme to proceed if lighting is essential for safety.

If lighting is necessary then refer to TD 34 for design criteria ***(Right Level)***

Care must be taken to ensure that roads are not over lit. Refer to the Road Lighting Efficiency Questionnaire

The trial of Midnight Switch Off, found that five out of its six sites were over lit. So if a design shows that lighting to class ME 2 is sufficient, then ensure that designers have not been over cautious and lit to class ME 1.

This Technical Directive currently does not include the following, which should also be considered:

Midnight Switch off	***(Right Time)***
Trimming	***(Right Time)***
Electronic Control Equipment	***(Right Level)***
Reduced energy Lamps	***(Right Level)***
Dimming	***(Right Level)***
Central Management System (CMS)	***(Improving road worker safety)***

ROAD LIGHTING - Renewal

Is lighting still necessary?

There is no such thing as a lighting renewal. There should be no automatic replacement of 'like' with 'like'. At the end of the planned life of a lighting scheme, the need for lighting should be reassessed. The Agency is not mandated to light any roads.

Refer to TA 49 for appraisal criteria ***(Right Place)***

This Advice Note currently does not include Midnight Switch off (*Switches off lights at midnight if traffic flows are sufficiently low)* which may affect the whole life costs sufficiently to allow a lighting scheme to proceed if lighting is essential for safety.

If lighting is still necessary then refer to TD 34 for design criteria ***(Right Level)***

Care must be taken to ensure that roads are not over lit. This is an opportunity to reduce the energy consumption of the scheme with a new and innovative design. Refer to the Road Lighting Efficiency Questionnaire

The trial of Midnight Switch Off, found that five out of its six sites were over lit. So if a design shows that lighting to class ME 2 is sufficient, then ensure that designers have not been over cautious and lit to class ME 1.

This Technical Directive currently does not include the following, which should also be considered:

Midnight Switch off	***(Right Time)***
Trimming	***(Right Time)***
Electronic Control Equipment	***(Right Level)***
Reduced energy Lamps	***(Right Level)***
Dimming	***(Right Level)***
Central Management System (CMS)	***(Improving road worker safety)***

ROAD LIGHTING - Maintenance

At lamp change intervals, consider whether the lamps can be replaced with reduced energy lamps.

After 10 years in maintenance, consider whether lighting is still necessary?

At this time there is sufficient accident data and maintenance costs records to determine whether the assumptions made in the initial appraisal of the need for lighting are justified. If sufficient cost to benefit ratio has not been achieved, then consideration should be given to removal. The money saved from not maintaining the scheme through to 'end of life' can then be used on more productive safety measures. Before deciding on removal, Full Switch Off (FSO) should be considered to determine that there will be no increase in risk of accidents.

If removal or FSO are not deemed appropriate, reconsider after another 5 years in maintenance.

A trial for a process for 'Taking Safe Decisions' will be carried out next financial year. The process is expected to be available in Q2 2011.

If lighting is still necessary then refer to TD 34 to ensure that the road is not over lit. ***(Right Level)***

The trial of Midnight Switch Off, found that five out of its six sites were over lit. So if a design shows that lighting to class ME 2 is sufficient, then ensure that designers have not been over cautious and lit to class ME 1.

Refer to the Road Lighting Efficiency Questionnaire

This Technical Directive (TD 39) currently does not include the following, which should also be considered:

Midnight Switch off	***(Right Time)***
Trimming	***(Right Time)***
Electronic Control Equipment	***(Right Level)***
Reduced energy Lamps	***(Right Level)***
Dimming	***(Right Level)***
Central Management System (CMS)	***(Improving road worker safety)***

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LIGHTING - Standards

These are links to the Highways Agency website for the DMRB

TA 49 Appraisal of New & Replacement Lighting on the Strategic Motorway & All Purpose Trunk Road Network

TD 34 Design of Road Lighting for the Strategic Motorway & Trunk Road Network

The following is a link to the Department for Transport website for the TSRGD

The Traffic Signs Regulations and General Directions

Network Services (NetServ) **Sign Lighting Guidance**

Full Switch Off (FSO)

- The Highways Agency has no mandatory requirement to provide road lighting. The 1980 Highways Act gives road authorities the power to light roads but this is not a legal duty. Only 30% of the total network of motorways and major trunk roads that we manage are currently lit, and between 40-50% of the motorways.

- Though the agency has the power to remove lighting, it would not be removed at this stage. As existing lighting reaches the end of its life, we will review whether it should be replaced, and always be guided by the Standards and assessment of the safety benefits that the lighting provides.

- Road lighting, like any other service the Highways Agency provides, needs to be regularly assessed to determine if it is still providing a cost effective service. Currently, road lighting operating costs are increasing above the rate of inflation, particularly with energy costs, and benefits are less evident due to impact protection of vehicles improving significantly, driver aids being more prevalent (e.g. ABS, ESP, Traction Control), improving compliance with seatbelt law and speed limits, plus road design has improved as has driver behaviour.

- Research by the Agency found that the safety benefits of motorway lighting were less than previously thought. In the early 1970s, it was thought that road lighting could reduce night-time personal injury accidents on UK roads by up to 30%. Our more recent analysis of accident data found that the possible night-time accident saving on motorway links was on average no more than 10%. So evidence is showing that, whilst lighting can contribute to road safety in some circumstances, its widespread application on the network is sometimes not justified in safety terms.

- Under the revised standard for road lighting on the Strategic Road Network, published in 2007, many roads that are currently lit would not meet the cost-benefit criteria for installing new lighting. Potentially lighting could therefore be switched off with no discernable increase in accident rate.

- Any decision to remove existing lighting requires careful assessment. This is not currently covered by any other issued guidance or advice (For example TA49, Appraisal of New and Replacement Road Lighting). New guidance for FSO has therefore been issued in an AMM expected in March 2011 accessible via the following link:

- **AMM**

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MIDNIGHT SWITCH OFF (MNSO)

MNSO switches off lighting after midnight. This is based on examination of historical traffic flows for each selected site. If traffic flow drops below a predetermined level after midnight, then it is permissible to switch lighting off. Manual override is provided for use in the event of an incident, or extremely poor weather conditions such as snow or fog.

MNSO is a mature product with proven benefits when deployed in the right location and in accordance with the following MNSO Guidance Documents:

Site Selection Guidance:

"1_MNSO site selection report 15 December 2009 RevE - FINAL_10 doc" can be accessed via the following link:
http://share/Share/livelink.exe/overview/5468029

Site Selection Excel Worksheet:

"1_Site Selection Work Sheet Oct 09 Revised for new Safety Method_4.XLS" can be accessed via the following link:
http://share/Share/livelink.exe/overview/4651758

Safety Case Guidance:

"1_263405_004_A_12.doc.pdf (attachment)" can be accessed via the following link:
http://share/Share/livelink.exe/overview/4636813

Stakeholder Communications Guidance:

"2_Stakeholder Guidance Report Rev02_1.pdf (attachment)" can be accessed via the following link:
http://share/Share/livelink.exe/overview/4196103

Once installed, ensure that the MAC has updated the lighting inventory.

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TRIMMING

The majority of the Agency's road lighting is switched on/off at dawn and dusk using photoelectric control units. Trimming refines switching thresholds using current technologies, to standards and good practice used both in the UK and Europe. This refined switching is estimated to save a few minutes both at dawn and dusk; yielding both carbon and electricity savings. Though the figures may appear small, the savings in terms of carbon and cost are significant when implemented across the lit road network. The estimated savings are £ 148,000 on the cost of electricity, and 754 less tonne of carbon produced each year.

The concept has been successfully proven in an ‘off’ and ‘on’ road trial. Deployment procedures are available in an AMM available in March 2011 via the following link;

AMM

Once installed, ensure that the MAC has updated the lighting inventory.

ELECTRONIC CONTROL EQUIPMENT

Use of electronic rather than electromagnetic ballast is recommended, as it uses less energy. It is also a prerequisite for dimming and low energy lighting. TD 34 states that it is policy to use electronic control equipment wherever possible. However, electronic control equipment is currently only available for lamps up to 250W. Further developments are expected for higher power lamps.

Note! For higher rated lamps, more efficient electromagnetic ballast is available.

Note! Not all electronic ballast is dimmable, or dimmable to ‘off’ state. Ensure that the correct product is procured with the appropriate level of future proofing.

Once installed, ensure that the MAC has updated the lighting inventory.

DIMMING

The introduction of BS 5489:2003 lighting standard introduces the possibility of reducing lighting levels when traffic flow are lower than normal on a given road. This enables the Agency to introduce new technologies in order to reduce electricity consumptions such as Central Management systems.

In order to achieve dimming, electronic ballast is required. It is also necessary to have a Central Management System (CMS is also referred to as a Lighting Control Interface (LCI)).

In locations where MIDAS is present, lighting will be dimmed when traffic flows (as recorded by MIDAS) fall below predetermined levels and restored to full level when flows increase. ANPR data from NTCC may also be used to determine traffic flows to enable dimming automatically.

Manual overrides are available for use by the RCC or the maintenance staff if incidents, special events, roadwork's or severe weather occur.

In areas where there is no MIDAS, dimming will have to be controlled using timers based on historical or predicted traffic flows. Developments in detectors other than the inductive loops used in MIDAS may allow incident detection and traffic flow measurement to be economically and quickly deployed in non MIDAS areas. This will allow much better control of dimming.

The concept was successfully proven in an off road trial. An on road pilot is planned for October 2010. If successful, guidance for deployment on the network will be available by March 2011.

Once installed, ensure that the MAC has updated the lighting inventory.

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CENTRAL MANAGEMENT SYSTEM (CMS)

Approximately 40% of the Agency's lighting is controlled by a group switching arrangement with a photocell located by the feeder pillar. This is not an energy efficient control mechanism and does not support dimming or accurate measurement of electricity consumption.

Recent developments in CMS have increased their benefits (particularly in carbon reduction) which can offset their high installation costs. The benefits of CMS are as follows;

- ✓ Better information on lamp performance consisting of operation times, illumination time, power factor, and electricity usage.
- ✓ Better maintenance as a result of monitoring. This reduces/eliminates night time patrols thus improving road worker safety & reducing carbon emissions from vehicles.
- ✓ Faults are identified more quickly resulting in improved repair time with resultant improved public service.
- ✓ Gives improved information for metering, thus saving the Agency money.

CMS will be monitored by the maintenance providers. Information regarding meter readings will be collected by an energy management company appointed by the Logistics & Energy Procurement team. On & off times will be forwarded to NetServ for research purposes.

Standards for Agency requirements for CMS will be available in Q2 of FY 10/1. Installation is subject to approved safety and business cases plus sufficient funding available for installation.

Once installed, ensure that the MAC has updated the lighting inventory.

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REDUCED ENERGY LAMPS

Standard lamps in use are high and low pressure sodium discharge, and high pressure mercury discharge. Other forms of lighting are available as follows:

Metal Halide Lamps - These appear to be a brighter light for the same energy input. The reason is that they emit a white light which is a broader visible spectrum that is better suited to the eye's natural twilight vision capability. Therefore they offer the possibility of using a lower energy input to achieve the same perceived luminance level.

Standards for Agency requirements will be available in Q4 of FY 10/11at the earliest.

Mesopic Lighting - This type of lighting emits a green light which is better suited to the eye's natural night vision capability. Therefore it offers the possibility of using a lower energy input to achieve the same perceived luminance level.

These lamps will be assessed when funding is available.

LED Sign Lighting – Commercial off the Shelf LED lighting units are available for signs.

LED Road Lighting – LED Road lighting is commercially available. Currently none is deployed on the Agency's network.

No specific guidance for LED use will be issued. Provided they reach the luminance and uniformity levels required for a particular class of road, then they can be installed. Any departures required will be viewed positively. However, check that the electricity consumption is less than standard lamps, as often more LEDs are required to achieve the same luminance levels.

Once installed, ensure that the MAC has updated the lighting inventory.

LIGHTING INVENTORY

Many of the Agency's supplies are unmetered. Electricity bills are therefore estimated from the known or estimated load at each supply point.

The advice given in this guide is all aimed at reducing electricity consumption. It is therefore essential to register any reductions in load (e.g. replacing 400W lamps with 250 W, or removing sign lighting) so that a reduction in our electricity bill can be claimed.

A reduction in electricity consumption is directly equitable to a reduction in the Agency's carbon footprint. It is therefore essential to update or inventory so that we can demonstrate that we are meeting Government targets for carbon reduction.

It is also a principle of asset management that it is not possible to manage efficiently unless it is know what is owned, where it is and what condition it is in. Therefore the importance of the lighting inventory cannot be over emphasised.

SO AFTER ANY CHANGES TO THE LIGHTING STOCK OR ELECTRICAL EQUIPMENT, ENSURE THAT THE INVENTORY IS UPDATED!

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TAKING SAFE DECISIONS

Lighting is, and is perceived as, a safety measure. Therefore its removal may sometimes be judged to be a reduction in safety levels. This is not necessarily true. Often lighting is installed at the same time as other road schemes. These other schemes may have more significant impact on improving safety, e.g. widening or improved geometric layout. It is therefore appropriate to question the value of lighting to overall safety levels at certain times such as renewal, or mid life. Money saved on removal or not replacing can often be spent on more cost effective safety measures.

In order to ensure that designers and operators have the confidence to make a decision to remove lighting, a robust methodology for making these decisions needs to be in place. Railtrack have spent considerable time and effort in developing a methodology for 'Taking safe decisions' (detailed description of Railtrack procedures available through the link below) that has been accepted by the Health & Safety Executive. The Agency is using these procedures and adapting them to each individual electricity saving method. The usability and effectiveness of these processes is being assessed on two on road trials. Processes tailored to each electricity reduction method are expected to be rolled out in Q2 2011.

http://www.rssb.co.uk/SAFETY/Pages/SAFETYDECISIONMAKING.aspx

This link will be replaced by links to Agency specific procedures in the relevant sections.

LIGHTING ROUNDABOUTS

Policy on lighting of roundabouts and their linking roads at the moment is:

All lighting schemes are subject to TA49 or equivalent for Major Projects PAR. This applies to both new or replacement lighting schemes.

The only exceptions to this appraisal rule are:

a) **Roundabouts** - If local approach roads have been lit (either by the HA or Local Authority) then the junction at the end of the lit stretch should be lit.

b) **Links** - If the unlit distance between two (geographically close) lit junctions is less than 4 times min desirable sight stopping distance then the link should be lit.

Both of these exceptions are captured as part of the TA49 appraisal process so conducting a TA49 process will expose these exceptions where relevant. However, any proposal to light roundabouts should be challenged along the following line:

There is no mandate to light a road under normal operating conditions. The Agency is empowered to light roads if it chooses. The criteria to be used is, 'if there is an identified hazard for which lighting (and only lighting) will mitigate the risk then the road should be lit'. The Agency should prove that lighting really is the most appropriate measure to mitigate the hazard.

LIGHTING JUNCTIONS

For junctions, the Agency's minimum legal obligation is:

There is no mandate to light a road under normal operating conditions. The Agency is empowered to light roads if it chooses. The criteria to be used is, 'if there is an identified hazard for which lighting (and only lighting) will mitigate the risk then the road should be lit'. The Agency should prove that lighting really is the most appropriate measure to mitigate the hazard.

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LIGHTING ROADS

There is no mandate to light a road under normal operating conditions. The Agency is empowered to light roads if it chooses. The criteria to be used is, ‘if there is an identified hazard for which lighting (and only lighting) will mitigate the risk then the road should be lit’. The Agency should prove that lighting really is the most appropriate measure to mitigate the hazard.

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HIDDEN BENEFITS

A road scheme/improvement costs of £10M. Benefits are valued at £21M. Therefore CBR is 2.1. This meets the Agency criteria for a scheme to proceed.

A lighting scheme costs £100K to install. The safety related benefits of lighting are valued at £150K. Therefore CBR is 1.5.This does not meet the Agency criteria for a scheme to proceed.

If the cost of lighting is included in the overall scheme, then the cost is £10.1M. The benefits of the scheme are now estimated to be £21.15M. The CBR is now 2.09 which still meets the Agency criteria for a scheme to proceed. Therefore the low CBR of lighting is hidden by the high costs and CBR of the whole scheme. The true CBR for the scheme is in reality further reduced by the cost of 30 years of electricity purchase, maintenance costs. There is also an increase exposure of road workers to hazards due to maintenance requirements.

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SIGN LIGHTING

Currently TSRGD is being reviewed to see which signs must be illuminated and those that do not need to be.

Sign Lighting Guidance has been issued to give advice on lighting signs which may be lit.

Is this a new scheme, renewal or maintenance?

SIGN LIGHTING - New Schemes

Is the level of signage at the minimum level commensurate with safety?

Consider improving sight lines rather than duplicating signs.

Consider re-siting signs to give better visibility, rather than automatically installing at the prescribed distances from hazards. Apply for departures when necessary.

Is sign illumination necessary?

Review which signs need to be lit. TSRGD should be consulted to ensure that only those signs that must be lit are lit.

Those signs that may be lit should be reviewed with the bias being towards not lighting them. See Sign Lighting Guidance

Consider using retro reflective signs. They are easily visible and their whole life costs are lower than standard signs with illumination.

Signs that are lit should not be illuminated during daylight hours. The lighting should be fitted with either a timer or photocell to prevent this from occurring.

New signs are to be illuminated should lit to the minimum standard using LED lamps.

Once installed, ensure that the MAC has updated the lighting inventory.

SIGN LIGHTING - Renewals

Is the sign still necessary?

The hazard that the sign was installed to give a warning of, may have been removed. If so, do not replace the sign.

Is the level of signage at the minimum level commensurate with safety?

Consider improving sight lines rather than duplicating signs.

Consider re-siting signs to give better visibility, rather than automatically installing at the prescribed distances from hazards. Apply for departures when necessary.

Is sign illumination necessary?

Review which signs need to be lit. TSRGD should be consulted to ensure that only those signs that must be lit are lit.

Those signs that may be lit should be reviewed with the bias being towards not lighting them. See the Sign Lighting Guidance

Consider using retro reflective signs. They are easily visible and their whole life costs are lower than standard signs with illumination.

Signs that are lit should not be illuminated during daylight hours. The lighting should be fitted with either a timer or photocell to prevent this from occurring.

Replacement signs that are to be illuminated should lit to the minimum standard using LED lamps.

Once installed or removed, ensure that the MAC has updated the lighting inventory.

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SIGN LIGHTING - Maintenance

At the planned maintenance interval ensure the following:

Signs should not be illuminated during daylight hours. The lighting should be fitted with either a timer or photocell to prevent this from occurring.

Signs that are illuminated should lit to the minimum standard using LED lamps.

Once installed, ensure that the MAC has updated the lighting inventory.

TRAFFIC SIGNALS

Traffic signals includes signals at junctions for controlling traffic and signals at all types of pedestrian, cycle and equestrian crossings.

Is this a new scheme, renewal or maintenance?

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TRAFFIC SIGNALS - New Schemes

Is signalising the junction, or crossing the best option for improved safety and/or traffic flow?

Consider layout improvements, improving sightlines or restricting turning movements to achieve the desired outcomes.

If signals are necessary, consider;

LED traffic signal heads

Extra Low Voltage (ELV) controllers

Once installed or removed, ensure that the MAC has updated the lighting inventory.

TRAFFIC SIGNALS - Renewals

There is no such thing as a renewal. Reassess whether the need for signals is still valid based on accident data for the site to determine whether the original assumptions on safety and/or traffic flow improvements were met.

Changes to the road network or local surroundings may have reduced the hazards and/or congestion. If sufficient cost to benefit ratio has not been achieved, then consideration should be given to removal. The money saved from not renewing the signals could then be used on more productive safety measures.

Consider layout improvements, improving sightlines or restricting turning movements to achieve the desired outcomes.

A trial for a process for 'Taking Safe Decisions' will be carried out next financial year. The process is expected to be available in Q2 2011.

If signals are still necessary, consider;

LED traffic signal heads

Extra Low Voltage (ELV) controllers

Once installed or removed, ensure that the MAC has updated the lighting inventory.

TRAFFIC SIGNALS - Maintenance

(Improving road worker safety)

Can traffic signal heads be changed from filament lamps to LEDs at bulk lamp change?

Filament lamps at a traffic signal site are changed every 6 months (bulk lamp change). Bulk lamp changes are carried out to ensure that a lamp does not fail and possibly result in unclear indications being given to road users. This is a hazard to road workers, is expensive, and has adverse environmental impact due to disposal of lamps. LEDs use less electricity and have a longer life than filament lamps. Consider implementation at next bulk lamp change period in line with guidance for LED traffic signal heads

Once installed/removed, ensure that the MAC has updated the lighting inventory.

LIGHT EMITTING DIODES (LED) TRAFFIC SIGNAL HEADS

If there is a suitable business case (see below), traffic signal heads can to be changed from filament lamps to LEDs at the earliest opportunity when bulk lamp changes are due.

Investigation of Low Energy/ Long Life Light Emitting Technology for Traffic Signals

ELV TRAFFIC SIGNAL CONTROLLERS

Not yet populated contact;

RoadLightingEnquiries@highways.gsi.gov.uk

QUICK WINS

- ✓ Ensure that the MAC has updated the lighting inventory so that the Agency can apply for a reduction in payments to electricity suppliers where applicable, and register the associated carbon saving.
- ✓ If any lighting scheme is approaching the end of its life, don't automatically assume it should be replaced with like-for-like. Reassess the need for lighting and if it is still necessary, reassess its design.
- ✓ For sign lighting, at lamp change intervals, consider whether reduced energy lamps can be fitted.
- ✓ For sign lighting, at lamp change intervals consider fitting photocells or timers to sign lighting to prevent 24 hour illumination.
- ✓ Determine if any part of the network in your area is suitable for Midnight Switch Off.
- ✓ For group control lights, cut back any foliage that is shadowing the photocell on the control cabinet. Trials have shown that this causes lighting to come on early, and switch off late thus increasing electricity consumption.
- ✓ If there are any redundant roadside cabinets that have had equipment removed, ensure that the cabinet heaters are disconnected.
- ✓ At bulk lamp changes for traffic lights, consider replacing filament lamps with 'like for like' plug in replacement Light Emitting Diode (LED) replacement reflector assemblies.
- ✓ Ensure consistency with other areas. Consider energy reduction measures implemented on the network
- ✓ For sign lighting, at lamp change intervals consult TSRGD to determine whether sign needs to be lit. If TSRGD states that signs may be lit, refer to Sign Lighting Guidance.

BEING A DEMANDING ELECTRICITY CONSUMER

There are some misconceptions about the need for lighting which can result in lighting schemes being installed where they are unnecessary or they do not achieve best value for money when considered as a safety measure. This results in the Agency paying for more electricity than is really necessary and raising rather than lowering its short and long term carbon footprint. Therefore all new and renewal lighting schemes should be questioned in depth on all of the points in the following sections.

Awkward questions to ask of lighting design.

Is the lighting level appropriate to the AADT?

ME1 is only for flows > 40,000 AADT, or main carriageways with complex junctions.
Ensure that the road has been correctly classified. Is ME 2 or lower class acceptable?

If the stage 3 safety audit for a road scheme/improvement asks for lighting to be installed, ask 'Why?'

Evidence should be requested as the money spent on lighting could be used for more cost effective measures, e.g. improving sight lines. Other more expensive safety improvements, e.g. improving junction layout, should be considered on a whole life basis, (i.e. cost of 30 years of electricity, maintenance, lamp replacements, etc.)

How many Watts per square metre of carriageway is this lighting scheme using compared to an adjacent or comparable scheme?

How many Watts per vehicle is this lighting scheme using compared to an adjacent or comparable scheme?

Refer to the Road Lighting Efficiency Questionnaire

BEING A DEMANDING ELECTRICITY CONSUMER

- **Useful things to know…**
- It is not mandatory to light APTR roundabouts.
- It is not mandatory to light junctions.
- It is not mandatory to light any road.
- Every £1 spent on buying electricity is £1 less that can be spent on other safety measures. It's all ultimately from the same budget.
- A low cost to benefit ratio (CBR) for lighting can be hidden in a high CBR for a major scheme. (see example)

Refer to the Road Lighting Efficiency Questionnaire

ENERGY REDUCTION MEASURES IMPLEMENTED ON THE NETWORK

Midnight Switch Off has been successfully deployed on six sites on the motorway network.

This has saved 403 tons of carbon.

There has been no increase in recorded accidents thus confirming the safety case.

There has not been any adverse affect on traffic flow or speed.

Predicted maximum savings on electricity costs are up to 40%. Expected savings from the trial sites are in the region of 30% due to the lighting being reinstated (overridden by RCC) due to road works/maintenance.

ENERGY REDUCTION MEASURES IMPLEMENTED ON THE NETWORK

Trimming has been successfully deployed on one site. A further large scale deployment is underway.

The predicted annual reduction in electricity consumption is 2.9 million kWh across the network.

This equates to 1,600 tonnes of carbon saving per annum.

Lamp life is extended by approximately 160 hours per year. This could be used to increase the maintenance interval, thus improving road worker safety and reducing maintenance costs.

GREEN IT

This area of electricity reduction concerns RCC equipment, roadside equipment and office equipment. Office equipment is out of scope for this guide. NetServ and NDD are undertaking work packages to improve RCC and roadside equipment reliability, safety and efficiency. Improved efficiency (For example running control systems & databases on common servers) will reduce electricity consumption with notable savings in air conditioning in RCCs. Improved reliability at the road side will reduce the need for maintenance staff to attend failures with resultant reduction in carbon footprint.

This section will be populated at a later date.

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AMM

NOTE! These AMMs are currently awaiting approval. They are not to be circulated outside the Agency. They are provided for information only so that Area Managers can undertake preparatory actions (such as information gathering) to enable speedy implementation once approval for the appropriate AMM is given.

New guidance for FSO has therefore been issued in an AMM expected in March 2011 accessible via the following link:

http://share/Share/LLISAPI.dll?func=ll&objaction=overview&objid=8988199&viewType=1

Deployment procedures for trimming are available in an AMM available in March 2011 via the following link;

http://share/share/livelink.exe?func=ll&objaction=overview&objid=9534963&viewType=1

Once installed, ensure that the MAC has updated the lighting inventory.