

## Information Note

### Energy Reduction Measures

#### Removal of Lighting from Motorway Junctions

#### BACKGROUND

In response to the EU Energy Efficiency Directive (2012/27/EU), the Department of Communications, Climate Change and Natural Resources published a series of National Energy Efficiency Action Plans (NEEAP), the most recent of which was in 2017. This sets out Ireland’s approach to delivering the 20% energy efficiency savings required by the Directive by 2020 and further recognises that Government must take a lead role in this process and sets a higher target reduction of 33% for the public sector.

In order to meet the ambitious challenges set down in the NEEAP, Transport Infrastructure Ireland (TII) has undertaken a review of its energy usage, examining each consumption type across all business areas in order to identify where energy and associated cost savings can be achieved. In the case of the national road network, any such proposed reductions should not compromise any aspects of the safety of the road network. The objective has been to identify inconsistencies in the provision of motorway lighting, particularly at motorway junctions and to commence a move towards general consistency which would be in line with current road lighting design standards.

Electricity consumption on route lighting on national roads and tunnels represents c. 45% of the total electrical energy use for TII. This represents a major element of the electrical energy consumption for TII and therefore this has become an important focus in terms of meeting the NEEAP requirements.

TII’s overall strategy is outlined in its policy document ‘Energy Reduction in Public Lighting on National Roads’ (2016). The strategy is based on targeting of measures which have a sound financial rationale and includes removal of surplus lights, dimming, voltage regulation and replacement of existing fittings with LED fittings.

#### Lighting Design

Up to Jan 2009, the NRA road design standards did not specifically address lighting requirements and provision of motorway lighting often included all parts of interchanges including the full extent of exit and entry slip ramps and the mainline motorway between exit and entry points. This resulted in typically 3 km of mainline motorway being lit (‘Pre-2007 Design’). The UK road design standards were updated in 2006 and most roads built in Ireland between 2007 and 2009 followed this new standard (‘Post -2007 Design’) which required lighting only at the ‘Conflict Areas’ such as at the top of ramps etc.

NRA standard “DN-GEO-03035- Layout of Grade Separated Junctions” was issued in January 2009 and is consistent with the UK 2006 design approach and so continued the ‘post-2007 Design’ practice up to the present. In August 2018 TII issued the new standard ‘Design of Road Lighting for the National Road Network’ and this is generally consistent with the ‘post- 2007 Design’ approach. In revising the standards in 2009 and again in 2018, the NRA and now TII, took into account various factors including international best practice and assessments that less lighting did not have any measurable impact on the safety of such junctions.

We now have a situation where the following distribution of lighting design exists on the motorway/dual carriageway network:

Design Type	Extent of Lighting	Extent of Application
Pre-2007 Type Lighting Footprint	Mainline, Conflict Areas and Connecting roads	Circa 30% of the motorway network is designed using this approach.
Post-2007 Type Lighting Footprint	Conflict Areas and Connecting roads only	Circa 25% of the motorway network is designed using this approach.
Bespoke Design Footprint	Depends on local alignment geometry	Circa 45% of the motorway network is designed using this approach.

## SAFETY

The provision of a safe and efficient national road network is TII's main priority and removal of lighting which is surplus to that required under current standards at motorway junctions and planned re-targeting of some of the energy savings to locations where it is justified is consistent with that policy. In addition, the removal of surplus lighting can bring certain safety benefits.

### Revised Design Standards

As part of its safety research, TII has looked at the performance of the two junction types (Pre-2007 and Post-2007 Type Lighting Footprint) over the past approximately 10 years of operation. A study of accident rates by independent consulting engineers concluded that the lighting of the mainline at motorway/dual carriageway junctions does not improve operational road safety when compared with those junctions where the mainline is unlit. This outcome is not surprising as this evidence is generally consistent with that which informed the change in UK in 2006 to a layout which omitted mainline lighting.

Research has also shown additional safety benefits, such as drivers remaining on the mainline not experiencing the need for their eyes to adjust to the light and then more importantly re-adjust for the loss of light i.e. dark adaptation.

In addition, TII carried out a Pilot Scheme commencing in August 2017 where lighting was turned off at the following junctions;

- M1 Junction 6 (Balbriggan)
- M6 Junction 3 (Rochfortbridge)
- M9 Junction 3 (Athy)
- M4 Junction 9 (Enfield)

Following a year of operation and monitoring no adverse effects, resulting from the changes to lighting, have been found at these locations.

### Improved safety – removal of hazards from the verge

Road lighting columns present a hazard to errant vehicles which accidentally leave the roadway. There have been incidents involving impact with road lighting or sign columns which have resulted in serious injury or fatality. In fact, TII Road and Tunnel Safety Section have identified that there is a 23% chance of an injury occurring when colliding with a lighting column. Removal of unnecessary road lighting columns from the road verge will reduce this risk significantly.

### Improved safety – reduced maintenance operations

A core principle of safety management is that hazardous activities should be eliminated where possible. When unnecessary road lighting is removed, so too will be the need to maintain them. This will mean less time on the roadway for maintenance workers and less temporary traffic management for drivers to navigate.

### Re-targeting of Energy Saved

TII standard DN-LHT-03038 'Design of Road Lighting for the National Road Network' was issued in August 2018 and contains an evaluation and justification methodology for provision of lighting on the network. It is envisaged that part of the energy saved on motorway lighting can be applied to locations where it is justified in accordance with the new standard.

## PROGRAMME

TII have assessed further motorway junctions constructed in accordance with the 'pre-2007 Design' standards which contain significant surplus lighting when compared with current standards. The following junctions are programmed for turning off of surplus lighting by end of September 2018:

Route	Junction Number	County
N1	J19 Ravensdale	Louth
M2	J2 Cherryhound	Fingal
M4	J6 Celbridge	Kildare
M6	J4 Tyrrellspass	Westmeath
M6	J5 Kilbeggan	Westmeath
M6	J6 Moate East	Offaly
M6	J7 Moate West	Westmeath
N6	J8 Athlone East	Westmeath
M7	J13 Kildare	Kildare
M7	J14 Monasterevin	Kildare
M7	J15 New Inn	Laois
M7	J16 Ballydavis	Laois
M7	J17 Portaloise	Laois
M9	J4 Castledermot	Kildare
M9	J5 Rathcrogue	Carlow
M9	J6 Powerstown	Carlow
M1	J4 (Donabate)	Fingal
M1	J5 (Balbriggan South)	Fingal
M4	J5 (Leixlip)	South Dublin
M4	J7 (Maynooth)	Kildare
M9	J2 (Kilcullen)	Kildare
M8	J8 (Fethard)	Tipperary
M9	J8 (Kilkenny)	Kilkenny
M18	J15 (Crusheen)	Clare

## ENERGY AND COST REDUCTION

While reduction in energy usage is the primary objective there are significant energy and maintenance costs associated with the provision of lighting at motorway junctions.

On average, junctions built to the older pre-2007 standard use 150,000 kWh of energy per year which costs around €25,000 p.a.

In parallel with elimination of surplus lighting, TII are also progressing works to implement other energy saving initiatives such as off-peak dimming at suitable locations and use of LED light fittings. Significant progress has been made in this area already with the completion of the M50 dimming project in 2017. The project which incorporated use of voltage regulation and dimming appropriate to traffic flows won the SEAI Small Business Award for 2017. The project is delivering approx. 40% energy saving. Technical options are currently being finalised with a view to rolling out dimming projects at other suitable locations on the network.

Also in 2016/17 TII funded a programme of route lighting improvement works, costing c. €2.5m on national roads in conjunction with Local Authorities, most of which related to SON lighting replacement with LED technology.

This reduction in energy usage will contribute to both TII and Local Authority commitment to reducing their overall energy consumption and assist in Ireland working towards its 2020 targets.

## SUMMARY

- Prior to the introduction of the standard DN-GEO-03035- Layout of Grade Separated Junctions” in January 2009 TII (then NRA) was satisfied that, based on available data, there would be no consequential reduction in safety at the junctions as a result of providing lighting at Conflict Areas only;
- The requirement for provision of lighting at the Conflict Areas of motorway junctions is continued in the new standard ‘Design of Road Lighting for the National Road Network (Aug 2018);
- TII now have the benefit of data from about 40 junctions of each type i.e Conflict Areas and mainline fully lit and a similar number with lighting at Conflict Areas only over the period circa. 2008 to 2018 and can conclude that the additional lighting of the mainline at motorway/dual carriageway junctions does not improve operational road safety when compared with those junctions where the mainline is unlit;
- Reduction in motorway route lighting footprint at junctions is consistent with Government policy aimed at a reduction in energy usage;
- TII is utilising all available strategies aimed at energy reduction including dimming technology which matches light levels to the traffic volume, substitution of more efficient LED lights where appropriate and removal of surplus lighting.

**TII Network Operations – August 2018**