

## Technical Information Note

### Energy Usage Reduction Measures

#### Removal of Surplus Lighting from Motorway Junctions – September 2018

#### 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 road lighting on national roads and tunnels represents c. 45% of the total electrical energy use for TII and therefore 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 measures which have a sound safety and financial rationale and includes removal of surplus lights, dimming, voltage regulation and replacement of existing fittings with more efficient LED technology.

#### Lighting Design

Up to January 2009 Irish road designers relied mainly on UK standards to address lighting requirements and provision of motorway lighting generally covered all parts of interchanges including the full extent of exit and entry slip ramps and the mainline motorway between exit and entry points. Up to 2007 this typically resulted in 3 km of mainline motorway being lit (referenced in subsequent sections as ‘Pre-2007 Design’, refer Page 5). 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’ Refer Page 5) which required lighting only at the ‘Conflict Areas’ such as at the top of ramps and on connecting roads and eliminated lighting of the mainline through junctions.

NRA standard “DN-GEO-03035- Layout of Grade Separated Junctions” was issued in January 2009 and is consistent with the 2006 UK design standard 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 issuing the lighting design standard in 2009 and the revised standard in 2018, the NRA and now TII, took into account various factors including international best practice and assessments that reduced lighting extents did not have any measurable impact on the safety of such junctions.

Up to the recent changes the following distribution of junction lighting design was present on the motorway/dual carriageway network which includes c.180 junctions:

Design Type	Extent of Lighting	Extent of Application
Pre-2007 Design Lighting Footprint	Mainline, Conflict Areas and Connecting roads	Circa 30% of the motorway network is designed using this approach.
Post-2007 Design Lighting Footprint	Conflict Areas and Connecting roads only. No mainline lighting.	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 Design Type Lighting Footprint) over the past approximately 10 years of operation. A study of accident rates, using An Garda Síochána sourced data, by independent consulting engineers concluded that the lighting of the mainline at motorway/dual carriageway junctions does not measurably improve operational road safety when compared with those junctions where the mainline is unlit.

Analysis of additional data sources for RTC's in the vicinity of motorway junctions in the period 2014 to date has reached a similar conclusion. This outcome is not surprising as this evidence is generally consistent with that which informed the change in UK standards 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 switched off at the following junctions;

Route	Junction Number	County
M1	Junction 6 (Balbriggan)	Fingal
M4	Junction 9 (Enfield)	Meath
M6	Junction 3 (Rochfortbridge)	Westmeath
M9	Junction 3 (Athy)	Kildare

Following a year of operation and monitoring, there have been no adverse effects reported due to the implementation of the new schemes.

### 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 would 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 infrastructure 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 negotiate.

### 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 has assessed a further 24 motorway junctions constructed in accordance with the ‘pre-2007 Design’ standards which contain significant surplus lighting when compared with the current standard ‘Design of Road Lighting for the National Road Network’ (August 2018). The following 24 junctions have had surplus lighting switched off as of the end of September 2018.

Route	Junction Number	County
M1	J4 (Donabate)	Fingal
M1	J5 (Balbriggan South)	Fingal
N1	J19 (Ravensdale)	Louth
M2	J2 (Cherryhound)	Fingal
M4	J5 (Leixlip)	South Dublin
M4	J6 (Celbridge)	Kildare
M4	J7 (Maynooth)	Kildare
M6	J4 (Tyrellspass)	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
M8	J8 (Fethard)	Tipperary
M9	J2 (Kilcullen)	Kildare
M9	J4 (Castledermot)	Kildare
M9	J5 (Rathcrogue)	Carlow
M9	J6 (Powerstown)	Carlow
M9	J8 (Kilkenny)	Kilkenny
M18	J15 (Crusheen)	Clare

TII will monitor the operational performance of these junctions over the period, September 2018 to April 2019 and information obtained, combined with other evidence; will assist in informing TII strategy in relation to future energy reduction measures.

## 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 Design use 150,000 kWh of energy per year which costs around €25,000 p.a. A move to the reduced lighting footprint (post 2007 Design) would yield savings on energy cost alone of approximately €16,000 p.a.

In parallel with elimination of surplus lighting, TII is 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. This project which incorporates 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 circa. €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 motorway junctions as a result of providing lighting at Conflict Areas only ;
- The requirement for provision of lighting only at the Conflict Areas of motorway junctions is continued in the new TII standard ‘Design of Road Lighting for the National Road Network’ (Aug 2018);
- TII now has 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 2007 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 reduction in energy usage including dimming technology which matches light levels to the traffic volume and other factors, substitution of older SON lighting with more efficient LED technology where appropriate in addition to removal of surplus lighting.

