

Completion of Heysham to M6 Link

Planning Application December 2005
Response to Objections and Comments



6.1 Street Lighting Impact Assessment

This assessment is intended to investigate the possible environmental impacts of artificial lighting associated with the Lune Bridge section of the proposed M6 – Heysham Link Road. Concerns have been raised by the Environment Agency regarding the effects that artificial lighting will have on the diurnal rhythms of a range of wildlife, both using and inhabiting the River Lune and its corridor.

Terms and Definitions.

For the purposes of this assessment, the following terms and definitions apply:

Luminous flux: The amount of light passing a given point per unit time

Luminance: photometric measure of the density of luminous intensity in a given direction. It describes the amount of light that passes through or is emitted from a particular area, and falls within a given solid angle (unit is candelas per square metre cd/m^2).

Illuminance: the luminous flux incident upon a surface, per unit area (unit is lumens per square metre or lux).

Longitudinal Uniformity (UI): ratio of the lowest to the highest road surface luminance found in a line in the centre along a driving lane.

Overall Uniformity (Uo): ratio of the lowest to the average value of road surface luminance.

Threshold Increment (TI): measure of the loss of visibility caused by the disability glare of the luminaires of a road lighting installation, (expressed as a percentage).

It must be appreciated that at this stage no detailed lighting design has been undertaken, and therefore it will be necessary to make certain assumptions. The predicted modelled opening year traffic flow is 33,400 vehicles (AADT). Based on this assumption, and with reference to Table B2 of BS 5489-1:2003 Code of Practice for the Design of Road Lighting, an ME2 lighting class (1.50 cd/m^2 – Uo. 0.4 – UI. 0.7 – TI. 10%) is considered appropriate.

In terms of a lighting installation for a dual carriageway over a bridge, 2 different arrangements were considered:

- Opposite Arrangement
- Twin Central arrangement

Opposite Arrangement – this arrangement would require the lighting columns to be mounted on platforms built outside of the bridge parapet. One major disadvantage of this arrangement would be the distance between the lantern and the edge of the North-bound 3-lane carriageway. The proposal to incorporate a combined Footway/Cycleway will result in the lantern being sited approximately 5.0 metres from the kerb line. This combined with a total carriageway width of 12.95 metres (including Hard Strip), results in a reduced design spacing of approximately 23 metres. Mounting of the lighting columns on the outside of the bridge parapet may also present future maintenance access difficulties.

Twin Central Arrangement – the advantage of this arrangement, with the columns mounted within the central reserve, is the close proximity of the lanterns to both carriageways (the lantern will overhang the carriageway by approximately 0.5 metres). This arrangement results in an increased design spacing of 38 metres (against a spacing of 23 metres for an Opposite arrangement). This will reduce the number of lighting columns, across the river, from four to three (and consequently the number of lanterns from eight to six). It is considered that in order to minimise the effects of artificial lighting, the greater spacing offered by the Twin Central arrangement, is preferable.

Design calculations determined that in order to achieve the ME2 lighting class over the 3-lane carriageway, with a spacing of 38 metres, it would be necessary to utilise a 12 metre mounting height and a 250w son/t Full Cut-off (FCO) lantern. While this combination will provide the appropriate lighting levels on the North-bound 3-lane carriageway, it will result in over-lighting of the South-bound 2-lane carriageway (typically 2.0 cd/m² against a target of 1.5 cd/m²). This has implications for the spill lighting levels on the East side of the bridge (as the central reserve is closer to the parapet on the South-bound 2-lane carriageway).

Design calculations were undertaken to determine the spill lighting levels incident on the river surface. It was assumed that the bridge deck will be approximately 10m above the river surface, with the lanterns being sited a further 12 metres above the bridge deck. Initially, calculations were undertaken using the WRTL Vectra 250w son/t FCO lantern, which produced the following spill lighting levels:

West Side – 25m wide band – lighting level between 0.3 – 4.0 lux

East Side – 45m wide band – lighting levels between 0.3 – 14.0 lux

The levels produced were considered excessive (particularly so on the East side of the bridge), and enquiries with the manufacturer, WRTL, confirmed that shields could not be fitted to this particular lantern. It was suggested that further calculations, using the Arc lantern should be considered, as both front and rear shields are available for fitment. Calculations using the Arc 250w son/t FCO lantern produced the following spill lighting levels:

West Side – 25m wide band – lighting levels between 0.3 – 4.0lux

East Side – 50m wide band – lighting levels between 0.3 – 11.0 lux

While the Arc lantern produced lower spill lighting levels, the width of the light band across the river increased by approximately 5.0 metres. However, the lower lighting levels, up to 11.0 lux, were still considered excessive. As previously stated, the use of a 250w son/t FCO lantern on the South-bound 2-lane carriageway results in the lighting design target being exceeded by approximately 33%. This obviously contributes to the excessive levels of spill light on to the river. In order to further minimise this spill light, calculations were repeated using an Arc 150w son/t FCO on the South-bound carriageway, with retention of a 250w son/t lantern on the North-bound carriageway. This combined installation produced the following spill light levels:

West Side – 25m wide band – lighting levels between 0.3 – 4.0 lux

East Side – 40m wide band – lighting levels between 0.3 – 7.0 lux

While fitment of a 150w son/t FCO lantern on the South-bound carriageway further reduces the spill lighting levels, there are implications for the carriageway lighting levels. Retention of the 38 metre column spacing and 12 metre mounting height also reduces the carriageway lighting levels to 1.20 cd/m² (against a design target of 1.50 cd/m²). This may be considered a reasonable compromise, as the South-bound carriageway does not incorporate either a footway or cycleway. In addition, high levels of Longitudinal Uniformity (UI) have been achieved (typically 0.83) and this tends to minimise the perception of reduced luminance levels.

As previously stated, the Arc lantern has the facility for fitment of front and rear shields, to further reduce spill light. Unfortunately, photometry for the lanterns, with shields fitted, is not currently available, and therefore its effectiveness cannot be determined by calculation. The manufacturer, WRTL, have undertaken to supply this photometry, but this is likely to take a number of weeks, and I would therefore propose that the design calculations are repeated once this photometry is available.

The existing Lune Bridge, which carries the M6 Motorway, is located approximately 75 metres to the East of the proposed Heysham Link bridge. Based on the information supplied, it would appear that the M6 Bridge deck will be approximately 6 metres higher than the Heysham Link Bridge deck. The proposal to use a 12 metre mounting height on the Heysham Link Bridge, will site the lanterns approximately 6 metres above the M6 bridge deck, although they will be approximately 85 metres to the West of the M6 North-bound running lanes. Design calculations have confirmed that under current proposals, the East side spill light will fall short of the M6 bridge by approximately 35 metres at river level. No glare problems are anticipated with respect to vehicles using the North-bound carriageways of this currently unlit section of M6 Motorway. The use of Full Cut-off lanterns, together with the relatively low height difference between lanterns and the M6 bridge deck, should restrict any potential glare. It is anticipated that the proposal for fitment of front mounted lantern shields will further restrict any potential glare.

It is generally accepted that the provision of artificial lighting within an intrinsically dark landscape, such as that proposed for the Heysham Link Bridge, will impact on both wild life and flora/fauna. The Environment Agency's objections made specific reference to the disruption of a "range of wildlife" and to the "ability of anglers to catch fish". In order to determine the potential effects, the following organisations were contacted:

- Environment Agency (EA)
- English Nature
- Campaign for the Protection of Rural England (CPRE)
- Professional Anglers Association (PAA)
- Institution of Lighting Engineers (ILE)
- Bat Conservation Trust

In addition to the above organisations, Francis McManus of Napier University, Edinburgh, who has previously lectured on a Scottish Law case involving the effects of artificial lighting on river based wildlife associated with fish breeding grounds, was also contacted.

In respect of English Nature and the CPRE, it was confirmed that their database did not contain any relevant information. At the time of writing, no response has been received from the Professional Anglers Association.

A response was received from Francis McManus, which stated, "I was not directly involved in the case which you refer to" and that "I have, however, an interest in the legal aspects of light pollution". Unfortunately, Francis McManus did not provide any information regarding the potential effects of lighting on wildlife.

With respect to the Environment Agency, a response was received from Andrew Clarke, whom it is understood works in the North West Office. This response confirmed, "Sea Trout migrate at night and avoid brightly lit area's" and that the presence of light "will affect night fishing as Sea Trout won't take fly's when there is light on the water". Following further enquiry's, Andrew Clarke stated that "bright moonlight stops Sea Trout taking anglers lures at night and anything brighter than this will have effects on migration patterns" In addition, it was stated that "Otters also use this area and could be disrupted by lighting", but with no indication of at what lighting level this may occur.

A response was received from Dave Coatham – Technical Services Manager – Institution of Lighting Engineers (ILE), which contained a copy of an article published in the ILE Journal dated October/November 1997. The article was an edited version of a paper entitled "The Possible Ecological Implications of Artificial Lighting" by Alan Outen of the Hertfordshire Environmental Records Centre. This paper is referenced by a number of other publications, and it is intended that for the purposes of this assessment, it constitutes the main source of information. The paper states, "It has been known since the 1940s that it is the length of night (i.e. uninterrupted darkness) rather than day, that governs most of the patterns of geographical distribution, seasonal biology, growth, metabolism and behaviour of animals and plants. It is also a well established scientific principle that artificial disruption of these rhythms can induce unnatural activity in flora and fauna". The paper also states "literature on the effects of artificial light on the natural environment is sparse, and much of the existing research is theoretical or designed for food production or pest control programmes".

With respect to plants, it is generally accepted that day length has an effect on flowering, leaf fall, and in some cases seed germination. These effects appear to differ between "Short Day" and "Long Day" plants. In addition to the above are "Day Neutral" plants, (such as dandelion and many other common weed species), which are unaffected by day length. It is claimed that a short day plant given even a brief exposure to light during the night will not flower, whereas long day plants will flower if exposed to light during long nights. The document concludes "this suggests that the effects of artificial lighting on plants could be considerable, yet as far as we know no studies have been carried out on possible changes in natural vegetation structure and composition as a result of artificial lighting".

With respect to nocturnal animals, it is considered that they are likely to be disturbed by bright lights, with many, such as Badgers and Otters, being protected species. It is claimed that Motorway lighting could have a safety benefit, by keeping animals such as Deer and Badgers away from the road. However, where such lighting is located within foraging areas, or close to open countryside, it could be detrimental. It has been confirmed by the Environment Agency that this area is populated by Otters, but the presence, or otherwise, of Badgers is unknown.

An enquiry with the Bat Conservation Trust has confirmed that the whole of the Lune area is one of the most important sites for Bats in North Lancashire. There are several important Daubentons Bat (*Myotis Daubentonii*) colonies along the River Lune corridor, some of which are very close to the proposed bridge location. There are also known colonies of Noctule and Brown Long Eared Bats together with populations of other *Myotis* species (Whiskered/Brandts and Natterers) and both species of Pipistrelle (*p.Pipistrellus* and *p.Pygmaeus*). The Bat Conservation Trust provided an information leaflet entitled Impact of Lighting on Bats (which is based on a document produced by Dr Jenny Jones – May 2000). This leaflet details how artificial lighting can affect the feeding behaviour of bats. Studies have shown that while certain species of Bats, such as Leislars, Serotine and Pipistrelle, will swarm around White Mercury type lighting, feeding on insects, this behaviour is not true for all Bat species. The slower flying broad winged species, such as Plecotus, *Myotis* and *Rhinolophus*, avoid streetlights. It is believed that both the Plecotus and *Myotis* shun bright lights as a predator avoidance strategy. It is claimed that lighting can be particularly harmful if used along river corridors, near woodland edges and hedgerows used by Bats. Studies have shown that continuous lighting along roads creates barriers, which some Bats cannot cross, for example Daubentons Bats, which move their flight paths to avoid street lighting. As stated above, it is understood that there are several colonies of *Myotis* species in this vicinity, and it may be prudent to undertake further consultations with the Bat Conservation Trust, in view of the protected status of Bats.

With the exception of brief comments provided by Andrew Clarke of the Environment Agency, there appears to be little information regarding the potential effects of lighting on fish. Enquiries to clarify the lighting levels at which fish may be affected, have been unsuccessful. The only practical comparator level is that produced by moonlight, which is generally accepted to be approximately 0.3-lux. However, it must be appreciated that this 0.3-lux level will be spread evenly over a large area of the river, and it is understood that problems arise where a bright band of light is present across a river, effectively forming a barrier through which fish may not pass. This is the typical effect produced by bridge mounted lighting, as demonstrated by the lighting design calculations. In order to minimise this effect, it will be necessary to restrict spill lighting to the bridge deck, by fitment of shields, or reduce the spill lighting levels on the river, to that produced by moonlight.

Richard Hey of Lansil Sports and Social Club (who own the fishing rights to this section of the River Lune) confirmed that this is a popular fishing area for Sea Trout, Salmon and Bream. He also confirmed that the type of fishing practiced in this vicinity was spinning, as opposed to fly-fishing.

In 1998, Stonehaven & District Angling Association secured a landmark UK Court judgement on Light Nuisance. The case concerned the impact of adjacent Tennis Court floodlights on a productive Sea Trout pool on the River Cowie at Stonehaven, Scotland. Various expert witnesses, in the fields of lighting design, Salmonid Physiology and game fishing, gave evidence on the angler's behalf. The Courts accepted that up to 50 times the brightness of moonlight was falling onto the waters surface, and that angler's were being exposed by silhouette, shadow and illumination to these "wary and light shy" fish. The Scottish Courts concluded that the floodlights had so disrupted the physiological night-adaptation and subsequent behaviour of the Sea Trout, and the angler's ability to fish for them, that the Tennis Club was guilty of a civil nuisance. The expert evidence revealed that Sea Trout, in common with most nocturnal creatures, only night-adapt into an active

roving and feeding role when natural light falls to between 0.5-0.2 lux, owing to the greater risk of predation at higher illuminance levels. The importance of this low illuminance level seems to underline the widely held opinion amongst experienced Sea Trout anglers that an un-shaded full moon (approximately 0.3 lux) is highly ominous to fishing success.

In conclusion, it is recommended that every effort be made to restrict the spill light on to the river to at or below that produced by moonlight (typically 0.3 lux). As previously stated, the supply of photometry from the lantern manufacturer, WRTL, is still outstanding. Once this photometry is received, the design calculations will be repeated, to determine the effectiveness of the shields. Should this measure still not reduce the spill light to the required level, it will be necessary to consider other physical measures. It is understood that one such measure, employed on a river bridge in Holland, are parapet extensions.

6.2 ADAS Comments on Street Lighting Report

With regards to the Street Lighting Report, ADAS is in broad agreement with its observations and in particular its main recommendation that every effort should be made to prevent light spillage in to the River Lune corridor and on to the river itself. Presuming that lighting is required for over-riding reasons of road safety, if the design and placement of the lights fittings themselves cannot prevent light spillage, then other engineering solutions e.g. parapet extensions or horizontal light baffles should be employed.

Comments with regards to lit roads forming potential barriers to bats are valid and again it assumed that the lighting design for the scheme as a whole will take this in to account and that light spillage in to off-highway areas will be minimised in, what is correctly described as, an essentially dark, rural, environment. The requirement to light the whole of the scheme length for reasons of road safety should be critically assessed against the impact this could have on bats, other wildlife and the landscape impact of lighting the scheme. A road of this size, lit or unlit, is potentially a barrier to bats and this has been taken into account in assessing the impact on bats. The mitigation strategies put forward in the ADAS bat report acknowledge this and seek to maintain habitat connectivity, roosting and foraging opportunities.

The bat survey carried out by ADAS in the field survey area only found two small roost sites, both used by Pipistrelle. Bat activity studies showed greatest activity over water with a range of species active, particularly over the Lancaster Canal and River Lune.

The Street Lighting Report makes reference to the potential presence and impact on Otters and Badgers in relation to the Lune corridor. Based on desk study data and field work results, the presence of the former in the River Lune corridor is presumed, however detailed survey work failed to find any evidence of the latter in the vicinity of the crossing point or elsewhere in the field survey area.

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