

Bassaleg Bridge Detailed Design

Traffic Geometrical Lighting Review

Project:	Bassaleg Bridge Design and Associated Works		
Our reference:	100119581-MMD-XX-XX-RP-LI-0002	Your reference:	N/A
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Subject:	Traffic Geometrical Lighting Review		

Following feedback from the Local Planning Authority during the pre-application advice stage, a review is required to investigate the consequences of changing artificial lighting paths resulting from vehicle headlights from the existing to the proposed road arrangement.

1 UK Vehicle Headlamp Lighting Review

Whilst it should be acknowledged that headlamp position and light intensity can vary significantly between vehicle models and lighting types, this section discusses the standard dipped headlight requirements for UK vehicles to pass the MOT inspection manual in accordance with the Driver and Vehicles Standards Agency requirements.

For European type dipped beams, and to be deemed roadworthy, the following is to be complied with (MOT inspection manual: cars and passenger vehicles - 4. Lamps, reflectors and electrical equipment - Guidance - GOV.UK):

- beam image 'kick up' is visible on the screen, unless it has been masked or it has a flat top beam pattern
- for headlamps with centres at 850mm or less from the ground, the beam image horizontal cut-off is between the 0.5% and 2.75% horizontal lines
- for headlamps with centres more than 850mm from the ground, the beam image horizontal cut-off is between the 1.25% and 2.75% horizontal lines
- white light does not show in the zone formed by the 0% vertical and 0.5% horizontal line

The below extract demonstrates the criteria for European beam headlamp aim which demonstrates the above, with no white light appearing the right of the 0% vertical line and above the 0.5% horizontal line.

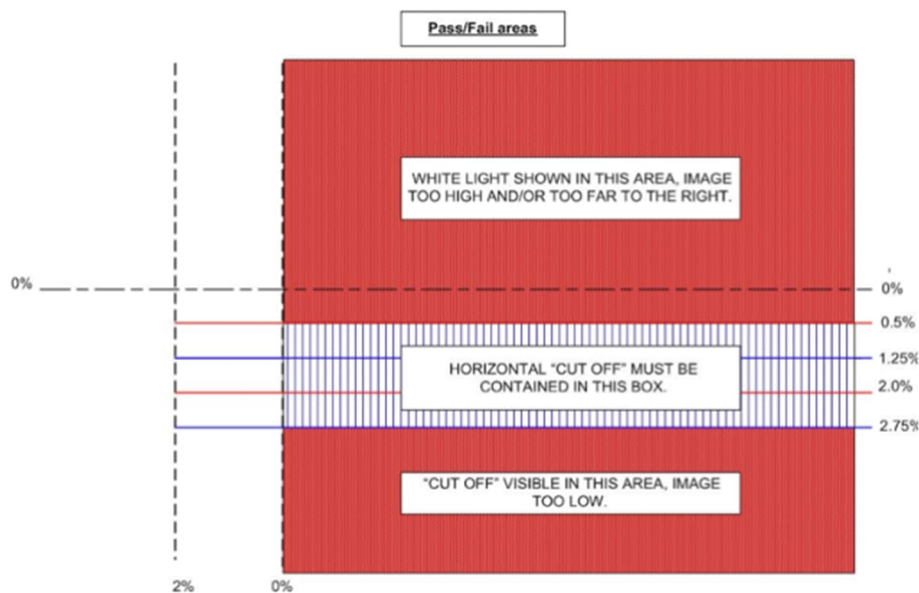
Appreciating that full beam may occur, this has been disregarded within this review given the area is sufficiently lit by existing street lighting.

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Figure 1 - Criteria for European dipped beam headlamp aim



The following long sections can be extracted from the above for vehicles two different headlamp levels to comply with UK MOT requirements.

Figure 2 - Headlamp beam for vehicle with headlamps positioned at or less than 850mm above carriageway level

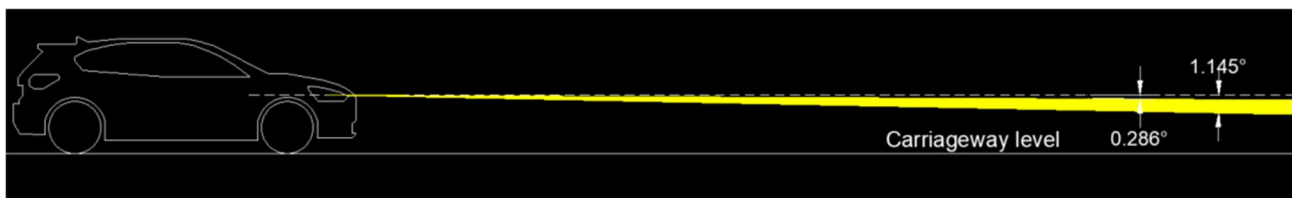
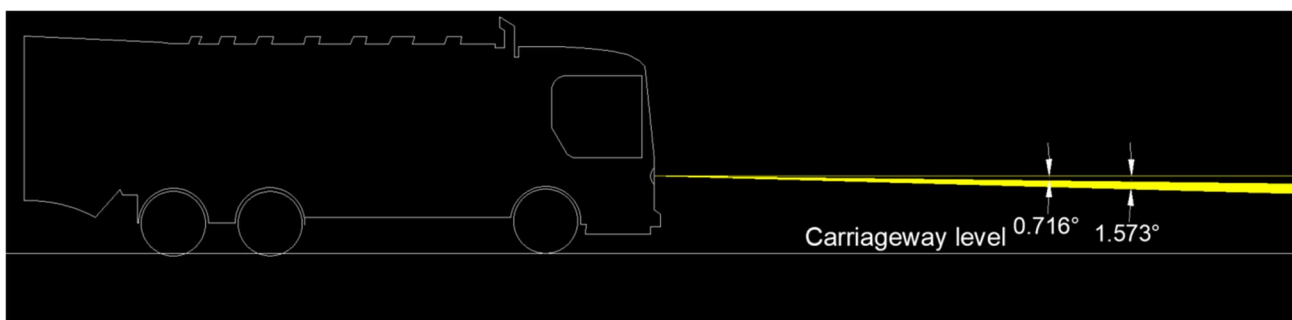


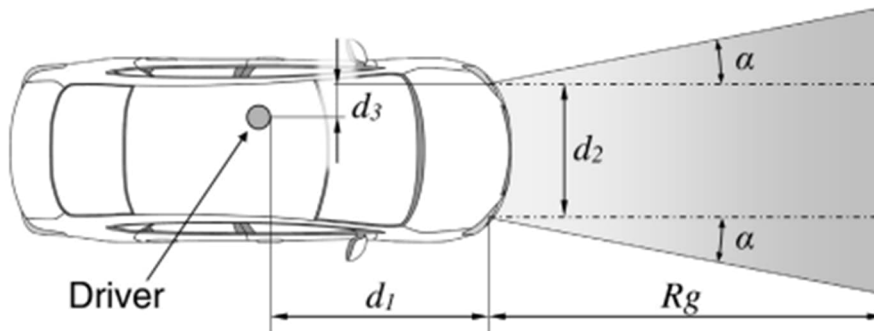
Figure 3 - Headlamp beam for vehicle with headlamps positioned at more than 850mm above carriageway level



The figure below demonstrates the horizontal light spray from a 2019 study by Department of Transportation, Territory and Urban Planning Engineering, Polytechnic University of Madrid, Spain: Effect of vehicle

swivelling headlamps and highway geometric design on nighttime sight distance where α is assumed to be 5° although this can vary and is asymmetrical between each headlamp i.e. left side headlamp with a higher intensity to light the road with the right side having a sharp cut-off to mitigate glare for oncoming traffic. For the purpose of this study and extent of area of concern, it will be assumed that the glare from the headlamps will continue for 30m in front of the vehicle. This is considered conservative given the right headlamp, to pass MOT is designed and aligned to reduce glare for oncoming traffic.

Figure 4 - Example geometric parameters of headlamp beam



Source: Department of Transportation, Territory and Urban Planning Engineering, Polytechnic University of Madrid, Spain: Effect of vehicle swivelling headlamps and highway geometric design on nighttime sight distance

Following the above, only the light distribution from standard vehicular traffic i.e. cars with headlamps measured up to 850mm above carriageway level will be used. It is deemed not necessary to consider vehicles with headlamp above 850mm due to the requirements of Forge Mews i.e. only residential vehicular access required and refuse vehicles will mainly operate during daylight hours and be infrequent i.e. non-recyclable waste every three weeks and recycling once a week

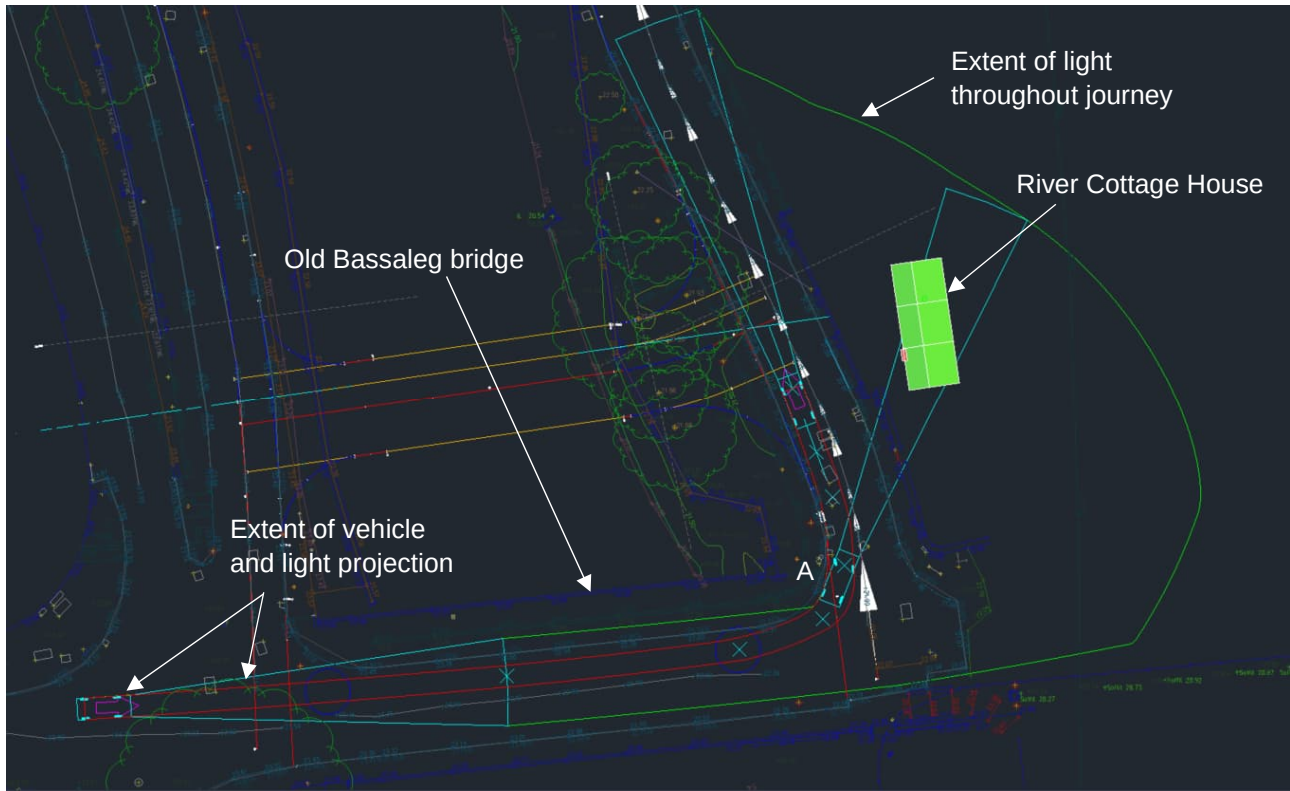
2 Existing Arrangement

This section discusses the current lighting scenario and associated effects on River Cottage House. A modified Autotrack model was developed which includes an example lighting arc emitted from the front of the vehicle and driven across Old Bassaleg Bridge to understand the existing effect on River Cottage House.

Figure 5 - Existing arrangement headlamp lighting distribution demonstrates the assumed light distribution for the existing arrangement. The light blue lines indicate the vehicle outline and the projected

light at specific points along the alignment, with the green representing the extents of the light for the full alignment.

Figure 5 - Existing arrangement headlamp lighting distribution



As can be seen in the above figure, when a vehicle is in position A, performing a turning manoeuvre off Caerphilly Road onto Forge Mews, the extent of light from the vehicle headlamp engulfs both the two windows on the south side and the window on the first floor of the west side (indicated with red block for location on property) of the house. The below extract from Google Maps demonstrates the angle in which a car may be directed whilst turning this corner. Given the carriageway vertical alignment and boundary wall and vegetation, it is not anticipated that glare is an issue of the south face of the house, however light pollution is expected to disturb residents, mainly the 1st floor windows.

Figure 6 - Google Maps extract from vehicle position A facing River Cottage House



Source: Google Maps – Image capture - Aug 2012

3 Proposed Arrangement

Figure 7 - Proposed arrangement headlamp lighting distribution below demonstrates the proposed position of the bridge structure with the Autotrack vehicle crossing and the 30m headlamp light distribution.

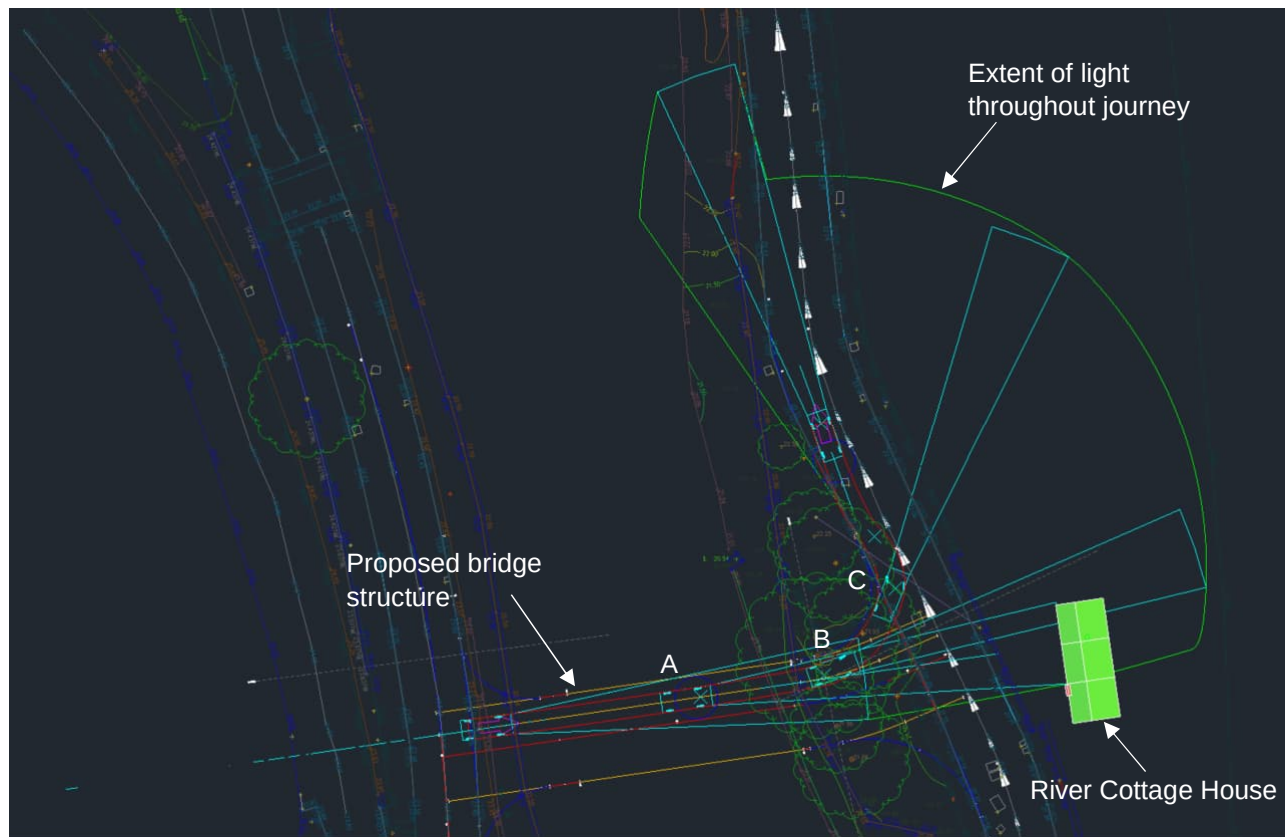
Figure 7 - Proposed arrangement headlamp lighting distribution

Figure 7 - Proposed arrangement headlamp lighting distribution demonstrates the extent of the light projection along the alignment where the extent of light (green line) does appear to be in the proximity of the western window, however this is the extremities of the light where the intensity is not at its highest and therefore is not considered to introduce glare or headlamps being aimed directly at the window. This is justified further due to the right-side headlamp on vehicles being aligned such that they do not blind oncoming traffic in the opposite direction. Position A is the most severe for light interaction with the western window but not considered blinding and disruptive. Position B starts to direct light away from the window as the turning manoeuvre onto Forge Mews is performed. The skylight set further back on the roof of the house is within the light extremities, however it is suspected that this is a non-habitable room i.e. bathroom and also given its angle and height from ground level, further limits the light intrusion. Finally, the ground floor window on the western face is considered to be obstructed and protected from invasive light from the hedge row in front.

4 Conclusion

Although a standard light projection/distribution from vehicles on UK roads is not defined given the wide range of vehicle types and lighting products, a review of what is likely has been produced for this report. Comparing the existing and proposed arrangements, it is considered, in terms of light pollution and its effect on River Cottage House, that the situation is being improved as the direction of light from vehicles leaving Old Bassaleg bridge and turning onto Forge Mews is being removed. In addition, the light produced and projected by vehicles crossing the new bridge alignment is not considered to have a detrimental effect overall on the western window of River Cottage House. Given the downward angle of standard dipped headlights,

this further mitigates the likelihood of vehicle headlamp directly projecting onto the western window. It is therefore considered an improvement on the existing scenario.

In summary, given the horizontal splay of the light from the oncoming traffic over the new structure is not deemed to directly shine into the western windows, it is not considered necessary to review the vertical alignment of the headlamps albeit this is anticipated to further mitigate light pollution into the west side of the house through:

- Headlamps being dipped
- Right hand headlamp mitigating lighting splay to not light oncoming lane.