Table 10.6: Image rate of change categories for illuminated advertisements including digital displays

Category	Description	Example
f1	Static non-changing displays	Unchanging display, traditional billboard, paper display in bus shelter, displays of fuel prices.
f2	Static displays that change sequentially	Digital displays, large and small format, showing static advertisements that change sequentially, road maintenance signage.
f3	Variable displays / partial motion	Pharmaceutical cross, stroboscope light
f4	Dynamic full motion displays	Video / movie advertising display, or live transmission

Note:

1. In accordance with the ILP PLG05, there shall be no moving images, animation, video or full motion images displayed unless consent has been granted for such displays.
2. Static images shall not change more frequently than every 10 seconds, unless approved to do so by the Local Planning Authority.
3. Where multiple displays appear together, then the rate of change of each display shall be co-ordinated and consistent. Where such displays appear as a line together, then the transitions for each display shall be set such that they change all at once, but do not change in sequence along the road.

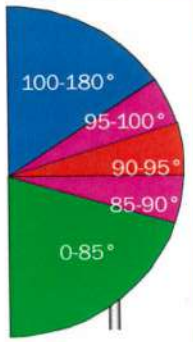
Skyglow

10.14 Skyglow is the general diffuse sheen that is visible in the direction of large cities, airports, and industrial complexes, and has become a greater concern over the years effectively preventing the night view of the stars.

10.15 Much has been successfully done to combat skyglow effects from street lighting and other artificial lighting installations, however illuminated advertisements, including digital displays, are a light source that emit light in directions beyond perpendicular from the display face, and more should be done to combat skyglow which can be achieved through optical design as is discussed later.

10.16 Skyglow occurs from both natural and artificial light sources, and does not depend exclusively on the lighting design. It also depends on the atmospheric conditions (humidity, aerosols, clouds, haze, atmospheric pollution, etc.). Light propagating into the atmosphere either directly from upward directed or incompletely shielded sources, or after reflection from the ground or other surfaces, is partially scattered back towards observers on the ground; the impact being shown in Table 10.7 taken from ILP GN01.

Table 10.7: The effect on the ability to view the night sky at various angles



Indicative diagram

Angle of light emitted (degrees)	Skyglow effect	Glare effect
100 - 180	Local	Little
95 - 100	Significant	Some
90 - 95	High	High
85 - 90	Significant	High
0 - 85	Minimum	Some

10.17 As can be seen the greatest impact on skyglow is light emitted between 85 and 100 degrees from the downward vertical.

10.18 For normal lighting installations skyglow can best be addressed by managing the upward light ratio (ULR) from the lighting installation. This is the proportion of light that is emitted at, or above, the horizontal when a light source is mounted in its installed position. This assessment approach is suitable for luminaires and associate light sources where full photometric photometry files are available and the detailed assessment can be undertaken. This information is not available for digital displays, so ULR is not a suitable metric to be applied.

10.19 Digital displays are normally mounted vertically, so resolution to mitigate skyglow from the displays should be through optical control, limiting the light emitted at various angles depending upon display location.

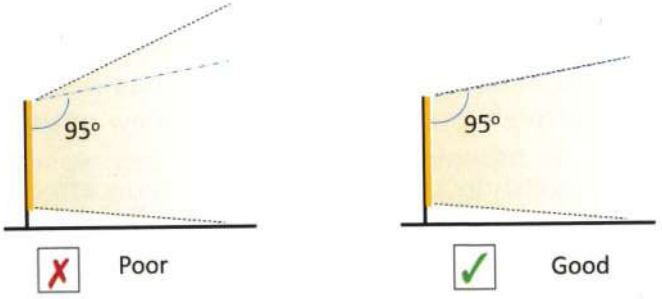


Figure 10.1: Digital display mounted at ground level, generally within an urban environment

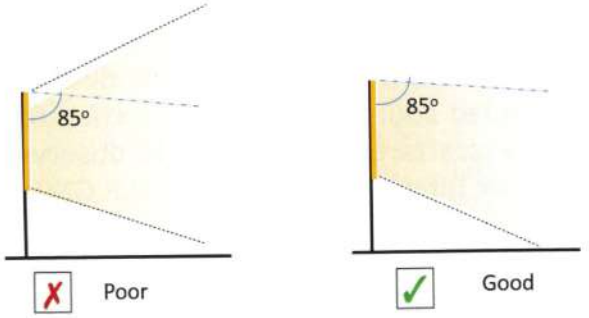


Figure 10.2: Digital display mounted on purpose-built structure / buildings up to 15m above ground level



Picture 10.3 – Digital displays ground mounted, and on purpose design structure.

10.20 For digital displays mounted over 15m above ground level, then the angle of emitted light should be such that it suits the display mounting height when considering the intended observer, for example digital displays such as those used for hotels. Digital displays at the upper storey of high-rise properties of say 20+ storeys may have a limiting angle of 45 degrees.

11. Digital display design

General

11.1 All illuminated advertisements should be designed and constructed so that the display performance meets the requirements within this document.

11.2 As discussed, as we move from a linear make, use, and dispose society the providers and manufacturers of illuminated advertisements are encouraged to consider net zero requirements which include for circular economy considerations which extend to the product being serviceable, repairable, maintainable, upgradable and can then be repurposed rather than recycled and disposed.

Digital media

11.3 A digital media installation is designed to convey information, imagery and messages to an intended audience, generally observing the installation from ground level. Depending upon the size and location of the digital media installation, the intended observer may be in close proximity to the installation, but for large media façade installations, where the display covers for example the whole side of a building, the intended observer may be over 1,000 metres away. The design objective is to ensure that the digital media installation display meets the performance requirements advised within this guide, by day and night, at levels to suit the environment within which it is located, with respect to ambient lighting levels, environmental zones and surrounding adjacent observers, such as those within premises or using the transportation infrastructure.

11.4 The objective is to ensure that light towards the unintended audience / obtrusive light is controlled to be within the limits advised within this guide.

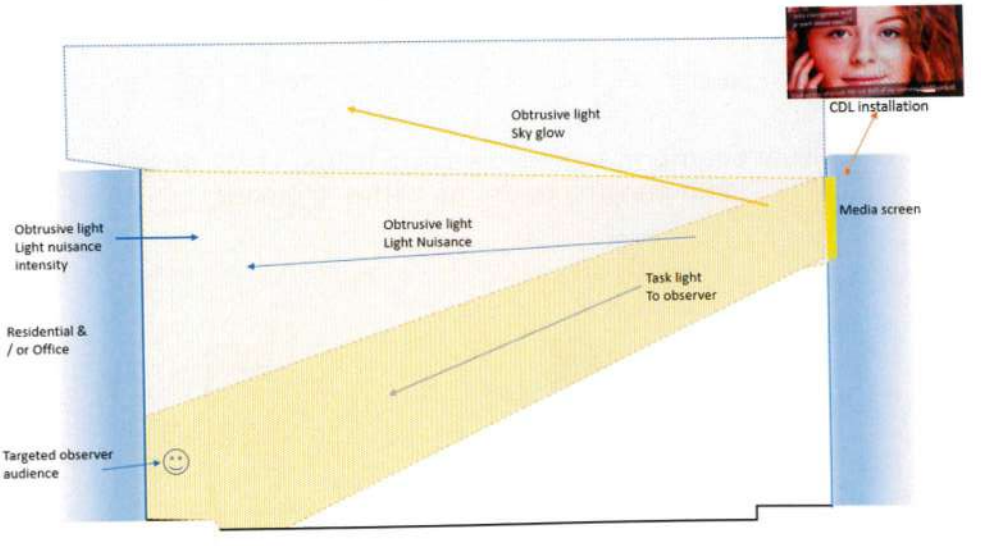
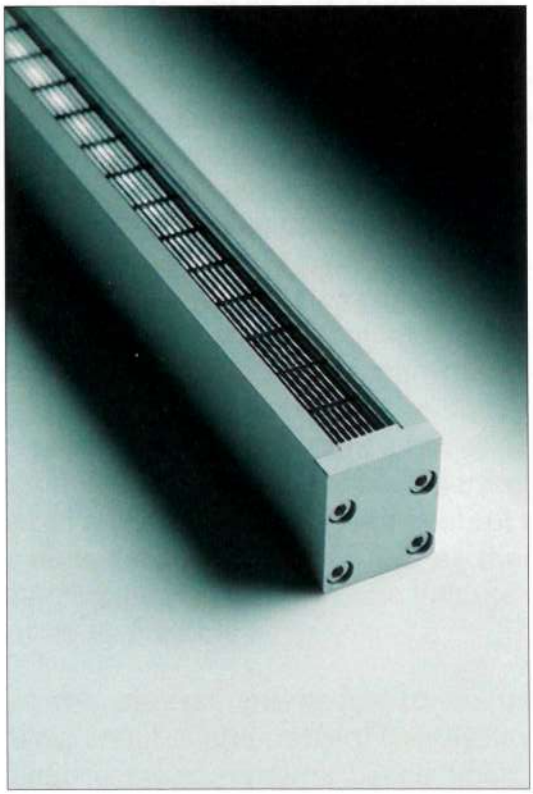


Figure 11.1: Types of obtrusive light

Design guidelines

11.5 It is clear that digital media displays need to become more directional and controlled. At the time of publication, the current industry displays (small format LCD and large format LED displays) make this very difficult without causing adverse impact on the quality of the display, and hence issues with advertisers. With current industry displays, themselves the result of long development cycles, optical control was not specified. Optical control displays that meet obtrusive lighting requirements need to be developed and tested in order to become available and commercially viable, and this will take some time.

11.6 Retrofitting optical controls to existing digital displays is not currently viable, but is worthy of investigation. Such technologies have been successfully applied in the exterior lighting industry to control obtrusive light and glare from luminaires, block light in undesired directions, yet permit the full performance of the luminaire in the desired task direction without compromise of light quality.



Picture 11.1: Micro-louvers fitted to luminaire for directional control

11.7 Looking to future installations, the industry needs to engage with suppliers and manufacturers over such innovations. That this may increase production and supply costs should not be a negative consideration as we seek to protect the environment and peoples' enjoyment of the night sky. Manufacturers that provide such solutions may become suppliers of choice, as concerns over obtrusive light, skyglow and waste energy / carbon grow, and net zero requirements increase helping the end client, and potentially advertisers, towards their efficiency targets.

11.8 The planning process can help drive momentum for improved optical control. In the short term, before such systems become readily available, planners should recommend the performance requirements advised within this guide, and optical control measures, as best practice.

Light source

11.9 The light source chosen to illuminate the advertisements should be selected such that it provides the right level of colour reproduction for the displayed images. Light Emitting Diode (LED) and Liquid Crystal Display (LCD) are the current general choices of light source for large format and small format digital displays respectively, although fluorescent lighting is still used. These light sources provide a white light, but are also supplied in a range of colour temperatures. The higher the colour temperature, the colder (bluer) it is, and the lower the colour temperature, the warmer (redder) it is.

11.10 In addition, when considering the choice of light source, the Artificial Optical Radiation (AOR) hazard must be assessed. This is a Health and Safety assessment requirement and it covers the effect of artificial optical radiation on observers. Essentially the wrong, or unintended, exposure can cause chemical damage within the observer's eye and loss of sight. The exposure needs to be at certain blue light wavelengths, above a certain spectral power (intensity of the blue light content) and the length of time / frequency of exposure is also a factor for consideration. The higher the colour temperature of the light source the greater the potential for any AOR hazard.

12. Testing, verification & performance assessment

12.1 The maximum recommended levels of luminance contained within this report are intended to be used in order to satisfy the requirements of all parties, and on the basis of sound engineering judgement and amenity considerations.

12.2 The checking of luminance levels to ensure compliance with the Advertisement Consent, or for the purposes of measurements in those cases when dispute or doubt arises, requires the use of a suitable, reliable instrument capable of direct measurement. It is possible that the Local Authority's Lighting Engineer will already possess a suitable instrument, but if this is not the case it is recommended that one should be acquired for the express purpose of obtaining luminance measurements of illuminated advertisements. It is recommended that any luminance meter used should comply with the requirements for a Type F meter as defined by *BS 7920:2005 Luminance meters. Requirements and test methods.*

12.3 Whenever a performance measurement is carried out there are a number of factors that may impact upon the performance of the lighting installation being tested. There are a number of issues associated with the lighting equipment and others that relate to the environment.

12.4 It is important to ensure that the output of the light source is stable. In general, for LED light sources, no aging period is required unless stated by the manufacturer and they have had time to run up and reach thermal stability, which may take half an hour or so. If the light sources have been in use for a long time then their output may be lower than the nominal output. Similarly, if the sign has been running for a long time the build-up of dirt on the surface may be reducing the light output. Many light sources are sensitive to changes in temperature, so it is important to record the temperature when taking readings. The supply voltage can significantly change the output of some light sources, so ideally the supply voltage should be measured. As there can be a voltage drop in the supply cabling, it is best to measure the voltage in the supply network as close to the luminaires as possible.

12.5 For digital displays the assessment needs to be undertaken on the white element of the display, and it is preferable if the display can be set to just white and a grid of luminance measurements based upon Table 12.1 undertaken, using a suitable luminance photometer. In general, this is not practicable and measurement of only the white section of any displays needs to be undertaken.

12.6 Signs using exposed light sources (e.g. cold cathode tubing) should be measured at right angles to the sign, at a distance such that the shortest dimension of the lit area fills a diameter of the viewing circle.

12.7 Readings should be taken by day and night. At night care should be taken to avoid any misleading readings, such as might be caused by other light sources in the measurement field of a luminance meter.

12.8 The number of points to measure is a function of the size of the sign. It is normal to measure the luminance on a regular grid of points, with the maximum

distance between the points (p) being given by the formula below, where d is the distance of the longest side of the sign.

$$p = 0.2 \times 5^{\log d}$$

12.9 The number of points in this dimension should be selected so that the distance between them is p or slightly less. Then, in the other direction select the number of points necessary to give a similar distance between points, thus giving an almost square grid. Table 12.1 gives information on the spacing of measurement points for a range of sign sizes. The points are laid out uniformly across the whole sign with the edge points being a half spacing in from the edge of the sign.

Table 12.1 Grid point requirements

Sign Size (m)		Points in Width		Points in Height	
Length	Width	No. Points	Spacing (m)	No. Points	Spacing (m)
0.6	0.4	5.0	0.120	3	0.133
1.0	0.6	5.0	0.200	3	0.200
1.5	0.9	6.0	0.250	4	0.225
2.0	1.3	7.0	0.286	5	0.260
3.0	1.9	7.0	0.429	4	0.475
5.0	3.1	9.0	0.556	6	0.517
7.0	4.4	9.0	0.778	6	0.733
10.0	6.3	10.0	1.000	6	1.050

Note:

1. Length relates to the longest edge, and width to the shortest edge of the advertisement

12.10 Measurements should be taken with the luminance meter as close to the centre of the sign as practically possible, and at a distance from the screen such that the diameter of the measurement field (see Figure 12.1) of the meter on the sign only encompasses the white area of the display.

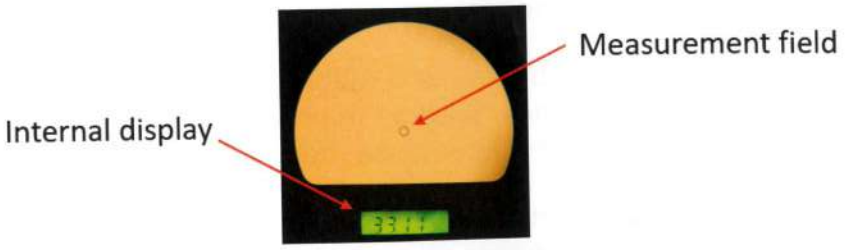


Figure 12.1: View through a luminance meter showing the measurement field

12.11 Assessment of displays can also be undertaken through the use of Image Luminance Measuring Devices (ILMD), such as a luminance camera. This is an electronic device with a lens, adequate photometric matching filter and Charged Coupled Device (CCD) or Complementary Metal Oxide Semiconductor (CMOS) sensor where every pixel is calibrated to determine the luminance values of the spaced image on its surface by the lens. The ILMD enables the entire display to be captured with one measurement, and to examine it for specific characteristics.

13. Maintenance

13.1 The Standard Conditions for all advertisements as contained in the Advertisement Regulations include that any advertisement must be maintained in a condition that does not impair the visual amenity of the site, and any advertisement hoarding or structure is to be kept in a condition which does not endanger the public.

13.2 For any signage to deliver best value, it needs to be maintained throughout its life, although there is no duty to ensure that the illumination is operational, unless this is a requirement of the original consent. All advertisements should be maintained to ensure that they operate within the design parameters, delivering the expected design performance (illumination and uniformity) throughout the installation's life, in accordance with the original consent and in accordance with the limits contained in this guide.

13.3 With advances in technologies:

- The sign design should consider the use of low energy, low maintenance solutions and perhaps with advanced control to ensure that the sign performance can be adapted in the future. By applying this approach, the installation can optimise maintenance obligations and manage energy use responsibly, thereby reducing the carbon impact of the installation.
- Remote monitoring systems within media displays which send alerts about faults and maintenance issues are recommended.
- Displays should incorporate automatic switch off when a fault is detected.

13.4 All advertisement installations should be subjected to general inspection, cleaning, and technical inspection and maintenance to ensure their safe and effective operation.

13.5 With digital displays, maintenance protocols should be developed to ensure they perform as per manufacturer specification, in accordance with the limits contained in this guide, throughout their operational life. These protocols should include:

- **Planned preventative maintenance –** The display operator to conduct planned regular inspection and maintenance of the display.
- **Reactive maintenance –** Typically, digital displays are connected via remote monitoring and management systems which provide data on key operational parameters. These systems alert the operator when operational issues arise, which are then responded to.

13.6 Sign maintenance and regular sign servicing plays an essential role; if managed properly and effectively it can deliver the benefits of enhanced sign performance and extend the design life, thus saving money in the long run.

13.7 Illumination Maintenance Services (IMS) available include preventative, proactive and emergency programs.

13.8 When it comes to maintenance, preventative or planned maintenance will ensure all sign components are as reliable as possible, maintaining brand image and integrity. This would include all aspects of cleaning, inspection, testing, re-lamping and reporting performed on a routine basis.

13.9 Reactive maintenance responds when signs fail and therefore revenue is lost in site closures while remedial work takes place within critical response times.

Planned sign maintenance

- A strategic sign maintenance programme will significantly reduce the possibility of complete sign replacement in the long-run.
- Sign maintenance work is planned around site activity, and can be completed while premises remain fully operational (critical for sites that operate 24hrs).
- Aimed at preventing sign / illumination failure and ensuring an unfaltering corporate image.
- Is significantly less expensive than emergency corrective action for failed sign illumination and can be used for promotional price changes.
- Ensures that all sign components covered by mandatory health and safety regulations are inspected and replaced as necessary.
- Reduces costs in travel, as work can be co-ordinated with other jobs in the surrounding areas.
- Engineers will become familiar with the sites and local problems associated with them.
- May appear pricey as an upfront cost is often incurred, but is significantly less expensive than emergency corrective action for failed sign illumination, and can be used for promotional price changes.
- Allows more reliable, long-term financial planning and forecasting, rather than surprise expense.

Reactive sign maintenance

- A sign maintenance solution that relies entirely on an emergency call-out basis.
- May lead to sites having an unkempt image.
- Each site visit is less cost-effective and will often lead to re-visits, as plans cannot be made for the required signage and servicing kit to be pre-loaded onto vehicles.
- Can sometimes cost less because only what is necessary at the time is spent.
- In the case of a site accident due to faulty or unregulated equipment, the legal and financial repercussions could be crippling.
- Relies entirely on the customer to keep up-to-date with any health and safety requirements.
- Can lead to sudden failure of signage, or a decrease in component quality/ performance over a period of time.
- Can be used in response to sign failure caused by vehicle impact, vandalism, storm damage or other problems.

14. Glossary / Definitions

The definitions in this section are practical definitions of terms based on the various regulations that impact on the use of signs and day to day practice.

Advertisement: Any word, letter, model, sign, placard, board, notice, awning, blind, device or representation, whether illuminated or not, employed wholly or partly for the purposes of advertisement, announcement or direction, and (without prejudice to the preceding provisions of this definition), includes any hoarding or similar structure used, designed, or adapted for use and anything else principally used, or designed, adapted for the display of advertisements, and references to the display of advertisements, shall be construed accordingly.

Note:

1. A range of modern devices for outdoor are within this definition. These include rotating poster panels, advertisements displayed on permanently fixed blinds.
2. The definition excludes anything employed as a memorial, or railway signal.

Amenity: This includes aural and visual amenity. The visual amenity includes general characteristics of the locality including features of historical, architectural, cultural, townscape, landscape or similar interest.

Illuminated Advertisement: An advertisement which is designed or adapted to be illuminated by artificial lighting, directly or by reflection, and which is so illuminated (whether continuously or from time to time).

Business Premises: Any building or part of a building normally used for the purpose of any professional, commercial or industrial undertaking, or for providing services to members of the public, or of any association and includes a public restaurant, licensed premises and a place of public entertainment. It excludes the following:

- A building designed for use as one or more separate dwellings. This is unless
  - It has been used in each of the 10 preceding years for the purpose of any professional, commercial, or industrial undertaking, or for providing services to members of the public, or any association, or
  - It has been adapted for such purpose by the construction of a shop front, or the making of a material alteration of a similar kind to its external appearance.
- A building used as an institution of a religious, educational, cultural, recreational, or medical or similar character.
- Any forecourt or other land forming part of the curtilage of a building.
- Any fence, wall or similar screen or structure, unless it forms part of the fabric of a building.

Colour Temperature: Expressed in 'Kelvin', is a measurement unit for the colour of light that is illuminating the subject. The higher the colour temperature, the bluer it is, and the lower the colour temperature, the redder it is.

Digital Display: A digital display is a uniform structure composed of components that emit light. These components may be able to change intensity and colour, and may be addressed individually and controlled together. The components are sufficiently close together and are furnished with appropriate control such that they may be resolved by the human eye to display a recognisable image and/or alphanumeric text. These images may be static or change dynamically. If changed dynamically, then these images can be read as video or film.

Digital Facades: Digital facades comprise of a number of discrete luminaires located and spaced apart on a building façade or structure, and are intended to form a digital display where the intended observer may be a hundred or more metres distance away.

Environmental Zones: A classification of the ambient brightness of the environment experienced at night-time on a scale of E0 (darkest) through to E4 (city centre / brightest).

Halo Illumination: Illumination of the background of the text of the advertisement, where the light source cannot be viewed directly from any angle.

Lasers, Search Lights, Beams of Light, Projected Illuminated Advertisements: Under the Advertisement Regulations, all illuminated advertisements projected onto buildings, landscapes and into the sky, require express consent.

Light Source: A device that produces light or serves as a source of illumination, the smallest physical component that can be removed from a containing product / luminaire, without physically damaging the containing product / luminaire.

Light Trespass: The term light trespass has been used in the past and should no longer be referenced. Trespass is to physically encroach on land, which light can't do, so the term nuisance or spill light should always be used.

Local Planning Authority (LPA): The authority with local jurisdiction in determining an application for the display of advertisements. This may include a district council, a national park, the Department of Environment in Northern Ireland and the Council of the Isles of Scilly and similar authorities.

Luminous intensity: (of a source, in a given direction) Unit: cd

Night-time: The time between evening and morning; the time of darkness, in light terms the time between when task lighting needs to switch on or off due to the change in ambient lighting levels, to provide the required level of task lighting.

Nuisance: A nuisance can be defined in general terms as an action (or sometimes a failure to act), on the part of a defendant, which is not otherwise authorised, and which causes an interference with the claimant's reasonable enjoyment of his land, or to use a slightly different formulation, which unduly interferes with the claimant's enjoyment of his land. As Lord Wright said in *Sedleigh-Denfield v O'Callaghan* [1940] AC 880, 903, "a useful test is perhaps what is reasonable according to the ordinary usages of mankind living in society, or more correctly in a particular society."

Obtrusive Light: Light which, because of the quantitative, directional or spectral attributes in a given context, gives rise to annoyance, discomfort, distraction, or a reduction in the ability to see essential information; this can include but not be limited

to spill light, source intensity, disability and discomfort glare and flicker, as well as skyglow.

Observer: An observer is a person who may be the intended audience for the illuminated advertisement installation, or may be someone to whom it is a source of obtrusive light. Observers may be located within premises, be pedestrians, cyclists, drivers and passengers of motor vehicles, trains, trams, and / or buses.

Premises: A house or building, together with its land and outbuildings, occupied by a business or person.

Retail Park: A group of 3 or more retail stores, at least one of which has a minimum internal floor area of 1,000 square metres and which:

- are set apart from existing shopping centres but within an existing, or proposed urban area.
- sell primarily goods other than food.
- share one or more communal car parks.

Appendix 1 Model conditions

The following are offered as 'Particulars of Decision' model conditions for the approval of all illuminated digital displays. It should be noted that the model conditions may not be suitable in every case, and depend ultimately on the location and other applicable planning circumstances.

Consent to display advertisements

Notice of approval

Town and Country Planning Act 1990

Town and Country Planning (Control of Advertisements) (England) Regulations 2007.

Particulars of Decision

The ..... Council hereby gives notice in pursuance of the above-mentioned Regulations that Consent Has Been Granted for the display of the advertisement material referred to in Part 1 hereof in accordance with the application and plan(s) submitted, subject to compliance with the following condition(s):

1. The consent now granted is limited to a period of five years from the date hereof.

   Reason: To accord with Schedule 2 of the Town and Country Planning (Control of Advertisements) (England) Regulations 2007.

2. The development shall be undertaken in strict accordance with the approved documents for this Advertisement Consent which comprise:

   Documents to be listed

   Reason: To define the permission and for the avoidance of doubt and in the interest of proper planning procedures.

3. Any advertisement displayed, and any site used for the display of advertisements, shall be maintained in a condition that does not impair the visual amenity of the site.

   Reason: To accord with Schedule 2 of the Town and Country Planning (Control of Advertisements) (England) Regulations 2007.

4. Any structure or hoarding erected or used principally for the purpose of displaying advertisements shall be maintained in a condition that does not endanger the public.

   Reason: To accord with Schedule 2 of the Town and Country Planning (Control of Advertisements) (England) Regulations 2007.

5. Where an advertisement is required under these Regulations to be removed, the site shall be left in a condition that does not endanger the public or impair visual amenity.

   Reason: To accord with Schedule 2 of the Town and Country Planning (Control of Advertisements) (England) Regulations 2007.

6. No advertisement is to be displayed without the permission of the owner of the site or any other person with an interest in the site entitled to grant permission.

   Reason: To accord with Schedule 2 of the Town and Country Planning (Control of Advertisements) (England) Regulations 2007.

7. No advertisement shall be sited or displayed so as to:
   a) Endanger persons using any highway, railway, waterway, dock, harbour or aerodrome (civil or military).
   b) Obscure, or hinder the ready interpretation of, any traffic sign, railway signal, or aid to navigation by water or air.
   c) Hinder the operation of any device used for the purpose of security, or surveillance, or for measuring the speed of any vehicle.

   Reason: To accord with Schedule 2 of the Town and Country Planning (Control of Advertisements) (England) Regulations 2007.

8. There shall be no moving images, animation, video or full motion images displayed unless otherwise permitted by this consent.

   Reason: In the interests of amenity and in order to retain effective planning control.

9. In the hours of darkness, the advertisement display luminance shall be no greater than the recommended maximum night time luminance value set out in Table 10.4 within the Institution of Lighting Professionals - Professional Lighting Guide (PLG 05) 'Brightness of Illuminated Advertisements including Digital Displays' (or its equivalent in a replacement guide) in cd/m^2. The environmental zone to be agreed with the Local Planning Authority.

   Reason: In the interests of amenity, public safety and in order to retain effective planning control.

10. In daylight hours, the advertisement display luminance shall be controlled in order to reflect ambient light conditions (to ensure it is neither too bright or too dull), and shall at all times be no greater than the recommended maximum daytime luminance values set out in Table 10.5 within the Institution of Lighting Professionals - Professional Lighting Guide (PLG 05) 'Brightness of Illuminated Advertisements including Digital Displays' (or its equivalent in a replacement guide) in cd/m^2.

    Reason: In the interests of amenity, public safety and in order to retain effective planning control.

11. Unless otherwise permitted, the minimum display time for each advertisement shall be 10 seconds and the advertisement shall not include any features which would result in interactive messages / advertisements being displayed.

    Reason: In the interests of amenity, public safety and in order to retain effective planning control.

12. The interval between successive advertisements shall be no greater than 1 second and the complete display shall change without effect. The display to include a mechanism to default to a blank or black screen in the event of malfunction, or if the advertisement is not in use.

    Reason: In the interests of amenity, public safety and in order to retain effective planning control.

13. No images displayed shall resemble official road traffic signs, traffic lights or traffic matrix signs.

    Reason: In the interests of amenity and in order to retain effective planning control.

Appendix 2 Approximate method to calculate illuminance at point facing a sign

14.1 It is possible to estimate the illuminance at a point due to an illuminated advertisement by treating the advertisement as a single light source and using the inverse square law. This approach is best when the advertisement is a long distance from the point being illuminated. As most illuminated advertisements provide a diffuse light in all directions, the method is a reasonable approximation if the point being illuminated is more than twice the maximum dimension from the advertisement. In most cases this is taken as the diagonal of the advertisement rectangle.

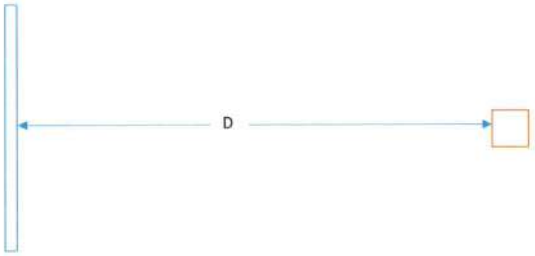
14.2 The diagonal (d) may be calculated from the length (L) and width (W) using the following formula:

$$d = \sqrt{L^2 + W^2}$$

14.3 Procedure

- Check the 2 to 1 ratio holds
- Calculate the intensity of the sign by multiplying the area by the luminance
- Calculate the illuminance by dividing the intensity by the distance squared
- Correct the results using cosines of the angles involved if the sign and point receiving the light are not facing each other.

14.4 Examples



14.5 In this example the sign and the surface being illuminated are facing each other. The sign has length 4m and width 3m, the distance between the sign and point being illuminated (D) is 12m. The luminance of the sign is 400 cd/m^2

14.6 First check that the distance D is greater than maximum dimension of the sign (d).

$$d = \sqrt{L^2 + W^2} = \sqrt{4^2 + 3^2} = \sqrt{16 + 9} = 5$$

As D is more than twice d the method may be used.

14.7 The intensity (I) of the sign is the length multiplied by the width multiplied by the luminance, in this case 4 x 3 x 400, 4800 cd. The next step is to use the inverse square law to calculate the illuminance (E).

$$E = \frac{I}{D^2} = \frac{4800}{12^2} = 33.3\ lx$$



14.8 In this example the sign does not face the point being illuminated and angle φ, between the normal to the normal of the sign, and the line joining the centre of the sign to the point being illuminated is 15°. All other parameters in the calculation are the same as in the example above so the illuminance is given by

$$E = \frac{Icos(\phi)}{D^2} = \frac{4800 \times \cos(\phi)}{12^2} = \frac{4800 \times 0.9659}{144} = 32.2\ lx$$

14.9 In the few cases where the distance from the illuminated advertisement to the observer is less that 2d then assessment has to be undertaken on site.

Appendix 3 Further reading

Impact of artificial light on fauna and flora

Pérez Vega, C.; Zielinska-Dabkowska, K.M.; Schroer, S.; Jechow, A.; Hölker, F. A Systematic Review for Establishing Relevant Environmental Parameters for Urban Lighting: Translating Research into Practice. *Sustainability* **2022**, *14*, 1107. https://doi.org/10.3390/su14031107

Institution of Lighting Professionals
Regent House, Regent Place,
Rugby, CV21 2PN
T: 01788 576492
E: info@theilp.org.uk
www.theilp.org.uk