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Encouraging walking

Public space lighting for pedestrians

The series of "Encouraging walking" factsheets seeks to promote this mode of travel, which is good for both people's health and the environment, by providing simple information to local authorities and public space developers.

Often considered essential for urban motorised transport, public space lighting is still often perceived as road traffic equipment intended to illuminate the road, without giving specific consideration to adjoining pedestrian routes. By making night-time travel safer, more pleasant and more attractive, lighting all components of the public space helps to extend daytime activities, or create new ones, and improve comfortable use of the public space at night, while respecting environmental considerations. The comfort derived from lighting can even prove to be essential during the autumn and winter periods when days are shorter, and peak times for pedestrian travel come about when it is dark.

Factsheet no. 07 – December 2020

Collection | **Connaissances**

The challenges inherent in lighting pedestrian routes

The development of walking is greatly influenced by the quality of the pedestrian routes available. This is even more so at night, when lighting serves to mitigate the hindrances of darkness, which may otherwise further undermine the "walkability" of certain places. Here, the quality of the lighting is decisive for the pedestrian's choice in terms of whether to continue walking or to use some other means of transport considered to be safer.

In fact, public lighting covers multiple aspects that tie in with the purposes which the designer intends of it: lighting the public space to make it safer and more accessible, creating a given atmosphere by specifically illuminating certain objects or buildings, or for certain events such as Christmas illuminations.

Source: Cerema

Christmas illuminations change the way places and objects are perceived

Ensuring that places are safe through suitable lighting

Night-time tends to be perceived as the period from 10 pm to 5 am, or thereabouts. However, in winter, the amount of daylight is much shorter. When the days are shortest, daylight starts at around 8 am and ends at around 5 pm. In these conditions, if the public space is not lit, rush hour mobility for pedestrians and cyclists takes place when it is already – or still – dark. A Cerema study provides an analysis of night-time urban pedestrian accidents based on the BAAC road traffic accident and injury report database for the period 2010-2014.

The night-time factor is identified between October and February in terms of:

- the number of pedestrian accidents;
- the rate of pedestrian accidents;
- pedestrian mortality.

For their safety, the road's various users must be guaranteed visibility of and by one another, and the possibility of seeing obstacles and dangers. The pedestrian is clearly the most vulnerable user category.

Lighting serves to limit the consequences of friction between pedestrians and motor traffic by improving the possibility of anticipating and seeing vulnerable users.

Maintaining the accessibility of spaces at night

The objective of the law of 11 February 2005 is to ensure accessibility across the entire chain of travel. The quality of this accessibility depends on the visibility conditions provided to the user in the public space. The answer to the question "should the public space be lit or not" clearly becomes essential.

Without actually imposing any obligation to provide lighting, the order of 15 January 2007 sets recommendations concerning the quality of use and of the services provided for all concerning the lighting of routes and public spaces.

Source: Cerema

Pedestrians can instantly identify the pathways thanks to a carefully chosen combination of lighting and ground materials

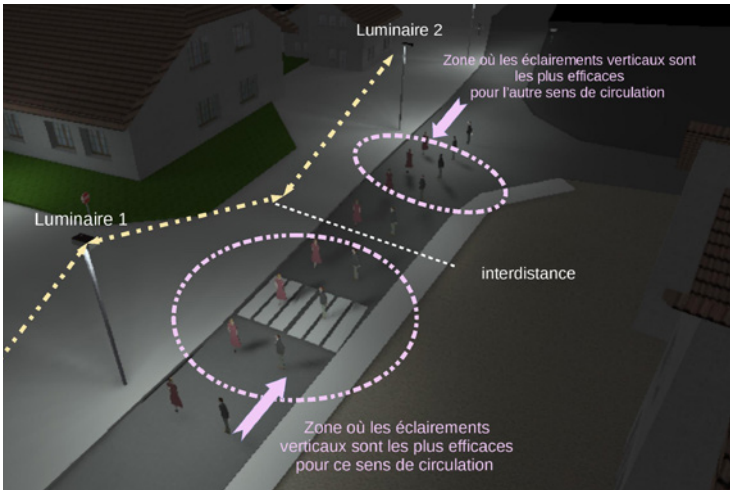
Pedestrian crossing lighting

In 2016, 27% of the pedestrians killed lost their lives while on a pedestrian crossing, and 28% of the pedestrians killed lost their lives at night. (Source ONISR)

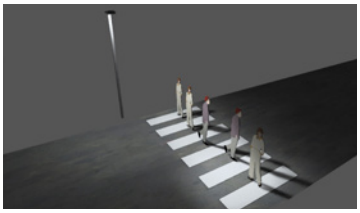
Source: Cerema

To protect crossings, specific lighting may be legitimate. Accordingly, local authorities have installed various types of equipment, since there is currently no national legal doctrine. Nevertheless, the law of 2005 for the consideration of persons with reduced mobility imposes certain constraints on the installation of urban furniture (particularly in terms of contrast performance) and on lighting levels. Recommendations are given in the various guides published by the competent institutional bodies (*AFE* [French lighting association], *Syndicat de l'éclairage* [Lighting union], etc.) and by Cerema. Lighting system standards define elements concerning the height of posts, distances between the successive lights, the choice of street light type and the distribution and direction of the light.

- The efficiency of pedestrian crossing "over-lighting" remains questionable. Lack of uniform lighting is detrimental to good visibility of the pedestrian when crossing roads, especially at the ends of the crossing. Lighting systems are mostly installed directly along the axis of pedestrian crossings. In this configuration, they do not ensure a sufficient level of lighting on the full height of the pedestrian's body to increase their visibility. They generally strongly illuminate the top of the pedestrian's head without improving visibility of the person overall. To address this problem, the lamp supports need to be offset somewhat on either side of the crossing.



Source: Cerema



View in the favourable direction

View in the unfavourable direction

- Using lighting with a different colour, or adding light mechanism "gadgets" can help to differentiate the pedestrian crossing and thus alert the driver's vigilance. However, the risk with these types of accessories is that of trivialising pedestrian crossings devoid of them, thereby lowering drivers' vigilance elsewhere. Basically, the devices used need to increase the visibility of the pedestrian crossing the road without disrupting the driver's visual perception of the scene. For this purpose, they must undergo a formal assessment in the scope of a test authorised by an order of the Delegation for Road Safety (DSR).

Generally speaking, uniform lighting with a good level of illumination remains the best guarantee for detecting a pedestrian crossing the road.

This order establishes general principles aimed at improving visibility conditions: elimination of hindrances to vision, reduction of glare, recommendations for uniform lighting of the space, and the maintaining of minimum contrast thresholds. Accordingly, good lighting must take into account the physical and mental capacities of all pedestrians.

The perception of the public space may vary significantly depending on whether materials have different luminance contrasts. This property also depends on the material's surface, which may be mat, shiny, polished, textured, dry or wet. Generally speaking, it is preferable to combine materials with a high luminance contrast. For optimal perception both by day and by night, the quality of the light sources should amplify a satisfactory colour rendering while allowing for the eventual deterioration of surface coverings' photometric characteristics over time.

Lasting stability of the lighting's quality can be achieved through new lighting system technologies, which can now adapt to daily variations in natural light and possible changes to the components in the public space.

Roadway regulations and public buildings

The "20 lux rule" to be maintained "at all points along the accessible outdoor navigation path" set out in the decree of 30 November 2007, and which amends the decree of 1 August 2006, is not applicable to the public roadway, and even less so to traffic-calming zones. Often wrongly applied on the roadway and in public spaces, this measure only refers to the accessibility of disabled persons in public buildings and facilities open to the public.

Favouring urban safety, protecting people and property

The sense of insecurity, whether valid or not, is a hindrance to night-time walking, especially for elderly persons, women, children or populations with certain mental or physical handicaps.

Lighting in traffic-calming zones

In traffic-calming zones and especially in shared spaces and pedestrian areas, the pedestrian has priority, and can move about across the entire right of way, which must benefit from a good level of illumination from façade to façade.

Reduced speed limits serve to heighten vigilance among all users, particularly the most vulnerable, i.e. pedestrians and cyclists. When the visibility conditions in the urban space deteriorate, the lighting plays a essential role, in particular to:

- identify the specific aspect of the space and detect its limits; the choice of light colours can help identify places and their "borders";
- understand how the space functions and how it is organised;
- guarantee mutual visibility of the various categories of users.

Source: Cerema

A uniform level of illumination will avoid creating dark areas or, conversely, overlit areas that could cause a certain visual discomfort for all users:

- avoid configurations that dazzle or are uncomfortable, such as lights embedded in the ground;
- ensure a good rendering of the colours and materials if they help users to understand the public space, along with the contrasts created by combinations of materials.

In addition, the lighting of the urban furniture and other equipment must help to ensure that the development is coherent with its role and with a limited speed. Developments with a good level of lighting associated with a good rendering of the colours help drivers to identify the traffic-calming zone, and thus comply with the authorised speed limits.

Good lighting gives the pedestrian a greater sense of security, in particular with respect to aggressions or deteriorations, even if it is not correlated with an objective reduction in damage to property and individuals. Furthermore, good lighting makes it easier to comprehend places and routes and to identify "risk" areas through a greater possibility of anticipation faced with potentially dangerous situations.

Reducing light emissions and energy consumption

Reducing our energy consumption and the pollution generated by lighting on nocturnal fauna and flora inevitably requires public and private lighting to be reduced, and even switched off altogether. However, pedestrian safety must continue to be guaranteed at night; having paths and routes that are lit helps with this considerably.

The Grenelle I and II acts impose environmental objectives for preventing light emissions, reducing energy consumption and reducing light emissions in order to protect the night sky. The French Environment Code sets general rules for switching off the lighting of non-residential buildings.

While these acts do not specifically apply to public lighting installations, for many local authorities they nevertheless represent a sufficient basis on which to envisage a certain modulation, or even the complete switching off, of public lighting.

New materials offers solutions for reducing the negative impacts on the flora and fauna while saving energy. LED lights, for example, use much less power for an equivalent level of light. More importantly, they can be used to vary the light's intensity, and thus adapt to nocturnal wildlife. By managing the lighting on the basis of an astronomical clock, lighting periods can be brought into line with sunrise and sunset times.

To learn more about the integration of biodiversity issues in the choice of lighting, refer to the series of factsheets entitled Planning, urbanism, biodiversity, lighting available for free download at www.cerema.fr.

"Luciole" in Lille

Aware of the impacts generated by urban light pollution on multiple nocturnal species such as bats and moths, the city of Lille has initiated a strategy for the conservation of biodiversity. From now on, at night around the Citadel, the Luciole plan will adapt the lighting to preserve the natural habits of these animals while ensuring safe travel for humans. Equipped with the latest generations of equipment, connections and remote control systems, the lighting along the pathways will increase as more pedestrians pass along. The strength and colour of the lighting will adapt to the animals' life cycles.

Promoting heritage through specific lighting

At night, perspectives and volumes can be changed by the interplay of shadows and light. This in turn offers a different perspective on façades, spires and other heritage treasures. This "highlighting" (quite literally) creates markers within the urban landscape, making these destinations attractive for night-time walkers.

Source: Cerema

Source: Cerema

Source: Ilex paysage-urbanisme

▲ This lighting underscores the building's elements of heritage – window casements, substructure – while indirectly lighting the public space. Concepts for lighting buildings and public spaces can thus be developed by lighting artists and designers.

◀ Well-lit streets and an enhanced heritage encourage night-time events and avoid uniform atmospheres. The lighting creates markers for pedestrians and promotes night-time walking.

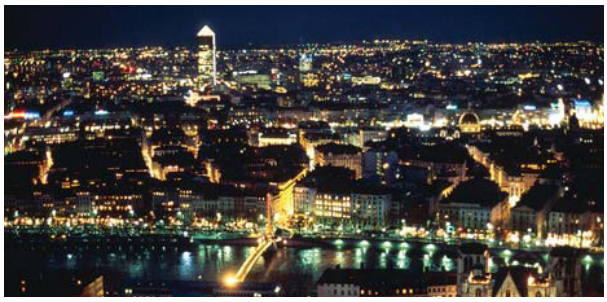
Planning public lighting: the merits of a global approach

Light plans whose scope is increasingly broad

Representing an all-important component of the public space, lighting can be managed via a so-called Light Plan, in the same way as other plans: mobility plans, bicycle urban framework plans or pedestrian plans. Many towns and cities have already undertaken this process. Via the diagnostic, this plan provides them with an overall vision of the quality of the lighting across the entire metropolitan area, and no longer merely at the scale of a given district or neighbourhood.

An ambitious light plan must not merely be a diagnostic of the existing system with the sole objective of achieving energy savings. It must be fully integrated in an overall thought process on the use of the public space and on how it is experienced by users. In order to be exhaustive, it must integrate all forms of lighting used within the urban space: public, private, advertising and possible lighting for events or architectural points of interest.

Lyon's light plan



Source: Lyon

Lyon's first light plan gave the city a strong reputation in terms of public lighting. Its Light Festival showcases the city's built and natural heritage through light, attracting ever greater numbers of visitors each year. With its ambition to "light differently", the city of Lyon has taken up a fresh challenge: upgrading its Light plan by playing on rivers, hills and main routes to highlight humans and their activities which have fashioned Lyon's history. While continuing and complementing Lyon's lighting, the city has undertaken to ensure the sustainable development of its lighting by reducing nuisance, using less energy and recycling more.

The Light Plan represents the reference document that defines the strategic orientations for the city's lighting in terms of:

- energy savings: preference to provide lighting, little or not at all;
- the nature of the lighting: pedestrian, architectural, scenic, road, residential;
- the policy concerning private lighting and lighting for advertising;
- sustainable development: the reduction of light nuisance, and consideration for plants and wildlife.

Adapting public lighting to users' needs - Saint-Malo

Source: Cerema

Diagnostic of the lighting carried out by a group of pedestrians

When it updated its lighting master plan, Saint-Malo sought to reconcile sustainable development objectives with the needs of its inhabitants and users. In the scope of a partnership with Cerema, night walks, commented routes and diverse surveys have been carried out with users to understand their needs, their expectations and how they experience the town's public space at night. These surveys were conducted in different sectors (residential, tourist, town centre) and highlighted areas in which the level of lighting could or could not be reduced, and in which conditions: specific times, colour, the desired or expected atmosphere of a given place, the transition with other adjoining areas lit differently, etc. Following these surveys, the town adapted its lighting master plan and its modulation pattern accordingly in order to adopt a reasoned, sensible approach to the lighting of its public spaces.

Along with technical recommendations such as:

- The types of space in which to provide lighting: a busy square in the heart of the town, a square in a historic setting, a square used by traffic, the forecourt of an interchange hub, a main pedestrian line, pedestrian routes along avenues or main roads, or in feeder roads, a path in a natural space, etc.
- the types of materials: "candle holder" lights, sconce lights, spot lights;
- the ranges: standard, specific, LED;
- the light's strength in line with the location;
- the lighting times: sunrise and sunset, working days, weekends.

The lighting network: a transmission medium for the connected city

Present throughout towns and cities, street lights are located within the immediate vicinity of users as well as all urban connected objects (whether already connected or intended to be in the future). Given the density of LED equipment and its remarkable technical characteristics, a new role for public lighting can be envisaged: that of a transmission medium for the future connected city, potentially leading to:

- the pooling of objects incorporated into street lights: sensors, cameras, electric recharging points, etc.;
- new local services for users, in particular through the technical potential (currently in the experimental phase) of Lifi (Light Fidelity) which uses light to transmit digital content, such as geopositioning data, guidance data and information, to the smartphones of all users of the public space.

Technical elements to guide the choice of public lighting

Regulatory and normative context to guide action

The NF EN 13201 "Éclairage Public" (Public Lighting) standard, applicable since 2005 and revised in 2015, is a voluntary standard. Once the location of a future lighting spot has been validated, this standard represents one of the tools available to determine the level of performance to be attained and maintained over time. It is based on the following two principles:

- the lighting's rationalisation with respect to the associated issues, in particular the safety of night-time travel;
- the sustainability of its performance, to be maintained throughout the service life of the installations.

Regulatory requirements: when and where to provide lighting

With regard to public lighting, the French legal framework assigns responsibility for outdoor public lighting to the mayor, by virtue of his or her policing powers (article L2212-2 of the French general local authority code). This service concerns public spaces that are intended for night-time use. There is no text that stipulates an obligation to provide lighting.

In the absence of such an obligation, it is up to the mayor to decide which space will or will not benefit from artificial lighting, depending on the uses, issues and good practices in force.

The ministerial decree of 27 December 2018 intended to reduce light nuisance now regulates lighting installations by means of technical requirements, more or less demanding in line with the geographic areas, rules on lighting temporality and the compliance of existing installations with the most severe impact.

The EN 13201 standard

The EN 13201 standard does not provide for entries by type of urban development, rather by a crossing of the entry criteria that characterise the spaces studied and the regulatory speed. This observation is particularly true for shared spaces whose operation ties in very closely with the context and development bias of the space. The intended objective via the development of this area, and the resulting mode of operation, could lead to the allocation of a reference speed of 20 km/h to a shared space with a relative balance between the various types of users, or a reference speed equivalent to that of walking for a mode of operation very similar to that of a pedestrian area. In the end, the retained group of lighting situations will thus differ in these two cases.

The all-important choice of equipment

A street light contains a number of elements: the light source and its support with its post and lantern in which the lamp is housed.

These elements all have a role to play in the installation's overall performance level:

- the street light's energy efficiency: high-performance lamps with reflectors will offer better light uniformity;
- glare: preference should be given to street lights whose lamp is not directly visible, to limit glare.

The lamps

The choice of lamp can be guided depending on whether consideration is to be given to its luminous flux, its service life, its energy performance, its potential impact on biodiversity, its environmental cost of manufacture or its capacity to create a given atmosphere in a given location. Choices may differ for:

- the colour and temperature of the light emitted, bearing in mind that the ministerial decree of 27 December 2018 limits the lighting intended for safe travel to 3,000 K, or even less in certain territories (such as national parks);
- the lamp's capacity to render colours and their contrasts via its CRI (Colour Rendering Index);
- the lamp's environmental impact, on the one hand from the light spectrum of the light emitted and its impact on the natural environment, and on the other hand from its manufacture, and the possibility of recycling its components;
- the lamp's capacity for modulation, bearing in mind that the LED technology offers a greater possibility of modulation (10 - 100%), whereas so-called luminous discharge technologies (now obsolete) such as High Pressure Sodium are much more limited and much less efficient in this respect. The LED technology can also be activated by detection, which is not possible with discharge lamps.

Source: Cerema

Embedded post-type lights and light "balls", often used for waymarking, can prove to be very dazzling for pedestrians

In terms of photometry, the street light's design must be optimised to ensure a more uniform luminous flux and avoid glare, which can be a hindrance for drivers and pedestrians alike.

The support: the post and lantern

The choice of support involves issues whose impacts are difficult to quantify based on objective criteria. This choice will often be oriented by a given environment or by more subjective matters such as:

- the aesthetic and/or architectural bias of a development. The lighting furniture can be "standard" or, on the contrary, given its specificity, can further mark the identity of an emblematic location, such as a square or forecourt;
- the nocturnal ambiance, which may be decisive for the nocturnal image of a public space. Reassuring and offering a sense of security to varying degrees, this ambiance can contribute largely to the city's night-time accessibility conditions for all pedestrians.

Source: Cerema

A single support to illuminate pedestrian paths and the road with a view to reducing the pavement's congestion

This choice will have to comply with the ministerial decree of 27 December 2018 which, among other things, limits the amount of light emitted above the horizon (ULR = Upward Light Ratio) to a maximum 4% of the total flux (in an installed situation), or even less in certain "sensitive" areas.

The number of posts, their height and their location are specific to each place within the urban space. They must always be chosen following a suitable lighting sizing study.

Simulations serve to visualise the renderings and thus avoid having alternate dark and well-lit zones, which will deteriorate the perception and comfort of users, and exacerbate the sense of insecurity often expressed by pedestrians.

Source: Cerema

Example of a "ladder effect": alternate dark and well-lit spots

A preventive maintenance policy

The expenses incurred by public lighting represent substantial amounts in a local authority's budget. This is especially the case for small rural towns which all too often still use old, energy-intensive equipment. Well managed public lighting thus becomes a significant means of reducing electrical consumption and saving money, where the disrepair of existing installations is the main cause of overconsumption.

The efficiency of lighting installations, both in terms of ensuring optimal user accessibility conditions and saving energy, hinges on a pro-active preventive maintenance policy to anticipate drops in performance and failures. This pro-active approach may result in a public lighting charter which must also give consideration to the recycling of lamps at the end of their service life, and the now prohibited use of certain types of lamp bulbs. Government policies have set up assistance financed by energy efficiency certification bodies to encourage local authorities to replace sodium or neon lamps with LED lamps, which are much more energy-efficient.

Energy assessment of public lighting (source: Ademe)

In France, the energy used by public lighting represents:

- 41% of the electricity consumption of local authorities;
- 16% of their consumption of all energies;
- 37% of their electricity bill.

Even if the average consumption for a town has fallen by 6% versus 2005, the expense incurred has remained stable due to the sharp rise in the cost of electricity.

There is a huge potential for reducing energy consumption:

- more than half of France's public lighting system is obsolete and energy-intensive: diffuser balls, mercury vapour lamps, etc.
- almost 40% of the luminaires in operation are more than twenty years old.

For a local authority, the initial investment needed to renovate its public lighting base may seem substantial, however, the authority must calculate the overall cost and take into consideration:

- the performance of the lamps, luminaires and systems it manages, as well as their deterioration over time;
- the operating, maintenance and recycling costs to ensure a continual high-quality service.

Further reading

- Series of planning, urbanism, biodiversity, lighting factsheets, Cerema, 2020
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- *Éclairer juste* (The right light), Ademe, AFE, 2010.
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- *Report on urban pedestrians at night / Analysis of accident rates / BAAC data 2010-2014*, Cerema, 2018.
- *Éclairage public sur le réseau routier national; utilisation de la norme NF EN 13201 "Éclairage Public" applicable depuis 2005* (Public lighting on the French road network; use of the NF EN 13201 "Public Lighting" standard), Certu, 2008.
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- *À la conquête de la nuit* (Conquering the night), CGEDD, rapport 2018.
- *La lumière urbaine : éclairer l'espace public* (Urban lights: lighting the public space), Narboni Roger, 1995.
- *Maintenance en éclairage extérieur (Outdoor lighting maintenance)*, Syndicat de l'éclairage, 2002
- Lausanne Light Plan, 2011
- Lyon: the new Light Plan, 2013
- Brussels Light Plan, 2017
- Ministerial decree of 27 December 2018 relative to "the prevention, reduction and limiting of light nuisances" and the amending decree of 29 May 2019
- Standards NF XP X 90-013 "nuisance lumineuse" (light nuisance)
- *Étude d'acceptabilité du schéma directeur d'éclairage de la Ville de Saint-Malo* (Acceptability study of the lighting master plan of Saint-Malo), May 2018

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