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Lighting strategy for Norwich Research Park Enterprise Centre

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Briefing Paper 07

Lighting design philosophy

This brief outlines the low carbon lighting strategy for Norwich Research Park Enterprise Centre at the University of East Anglia (UEA). As lighting contributes between 20-40% energy consumption of the completed building, the design of the NRP Enterprise Centre's lighting scheme focuses on the total power consumption and lighting energy efficiency as its prime directive. In order to achieve this, the following principles will be employed:

- **Utilise available daylight as the prime source of light**

This will ensure the most comfortable and psychologically beneficial environment for the user while reducing the energy consumption of the artificial lighting. Utilising daylight also means that the quantity of light fittings can be reduced and hence reducing the amount of energy consumed as well.

- **Task focused lighting**

Focusing light to the task only, allows for a strong visual contrast between areas, aiding navigation and giving character to the space. This also means that the environments become clearly defined for their purpose whilst being sympathetic and complimentary to the architectural form. Using light in this way also removes the need for higher illuminance levels across a whole space and hence reducing the wattage of the lighting scheme. In addition to that, the overall lighting levels are reduced whilst required light levels for the dedicated task are maintained.

- **Intelligent lighting controls**

Intelligent Lighting controls will be effective throughout the whole building. The way it's being utilised will be determined by how each space is used within the NRP Enterprise Centre. To help reduce energy usage, presence and absence detection will be incorporated in each space to ensure that lighting is not activated when the space is unoccupied. Whilst control will be automatic to minimise energy, simple intuitive human interfaces will also be available to give building user a degree of control over their environment. It is hoped that if people feel they have control over their environment, they will tolerate lower light levels. Alongside this day lighting strategy, dimming will allow for general artificial lighting to only come on once the illuminance levels in the room are below what is required to perform the task. Wall switching and integrated furniture switches will allow partitioned areas with task lighting to be controlled independently. In open areas, task lighting will be controlled via daylight dimming and presence detection.

- **Lamp colour temperature**

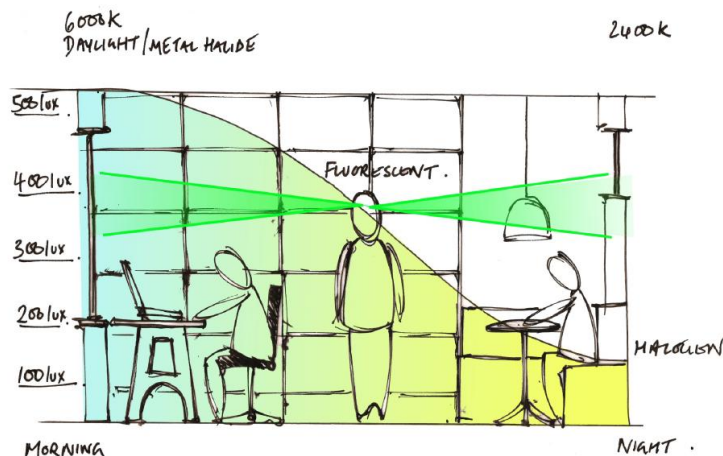


Figure 1 Ratio of illuminance between morning and evening (picture courtesy of Colin Ball from BDP)

Giving focus to the lamp temperature means that artificial light will mimic daylight throughout the day, allowing the artificial lighting to appear neutral to the space. This also plays a key part in how building user reacts to lighting. Daylight is considered as 'cool white'. It ranges between 4000k to 6500k and generally the preferred colour that is associated with work activity and concentration. Evenings and relaxation activity on the other hand, are associated with warm white colour temperature of 2700k. Allowing for this difference in temperature will make clear distinctions between areas of work and rest, as well as day and night. These subtle changes to the spaces work with the user's

natural reactions to light (circadian rhythm) and help encourage focus and relaxation at appropriate times of the day.

Figure 1 above shows the ratio of illuminance between morning and evening and the comparison of colour temperature throughout the day compared to natural light. It also shows how the positioning of the light should be similar to that of the sun. The main source of lighting in the day, when the sun is higher in the sky, should come from above the eye line, alternately when the sun begins to set, artificial lighting should be below the eye line to aid relaxation.

- **Reflectance factors**

Reflectance can have a significant effect on the luminance levels measured on the working and task planes due to the amount of light reflected onto this surface. A decrease in the surface reflectance will decrease the average luminance measured throughout the room. Where reflectances are known, these are incorporated within the calculations. Otherwise the standard values as per below have been used:

- Floors 20%
- Walls 50%
- Ceilings 70%
- Glazing 6%

Colours also play an important role in the effect of reflectance and glare. The most notable colour to have the most obvious effect is dark colour which due to a reflectance as low as 6%, increases the visual contrast between itself and its surrounding colours.

Lighting Energy Distribution for NRP Enterprise Centre



Figure 2 Daytime lighting energy distribution (Picture courtesy of Colin Ball from BDP)

Within NRP Enterprise Centre, each floor plate has been defined according to three to four typical criteria. These typical criteria will be superseded within each individual room according to task requirements. Daytime illuminance as shown on Figure 2 above will use the illuminance provided from daylight ingress to reduce the level of artificial light required during hours of daylight. This will allow for reduced energy consumption across the majority of the site.

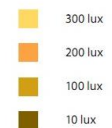
Key Plan



Figure 3 Evening lighting energy distribution (Picture courtesy of Colin Ball from BDP)

The evening illuminance strategy will make a transition from daytime artificial to artificial lighting requirement for the entire space. With the addition of PIR, energy consumption through lighting will still remain low as building usage begins to depreciate through the evening. Using EN BS 12464:1, the illuminance levels will only be increased to the levels shown on the task area required allowing for reduced lighting in room circulation and a comfortable working environment. In areas where furniture layouts are flexible, the level of lighting shown is required for the entire space. Particular attention will be made to managing transitions between adjacent spaces, as well as the transition from the exterior. An illuminance and control strategy has been developed as part of this report. Step changes in illuminance between adjacent spaces have been selected to aid visual adaptation when moving through the spaces.

Key Plan



Conclusion

The lighting strategy proposals for NRP Enterprise Centre include a strategic analysis of the Lighting Scheme fitting types, special feature spaces and typical room types. Although each room has a distinct user requirement, care has been taken within each space to unify the overall look of the entire scheme to ensure design continuity. It has also been designed to utilise available daylight as the prime source of light where possible and utilise absence detection, photocells and daylight dimming for the artificial systems. The lighting systems are designed with centralised control system linked to the BMS. To ensure minimum energy consumption, the localised task lighting to desks and work areas are only installed within large spaces and luminaires will be located where possible in relation to the windows and building structure (where appropriate) on the soffit.

Funding and business support for East of England SMEs

As a condition of this funding, the Centre for the Built Environment (a Centre that draws upon a cluster of expertise within and outside UEA and is responsible for delivery of ERDF outputs and, through Adapt Commercial, the provision of low carbon consultancy services) will provide free business support. This support will be delivered through a series of bespoke CPD accredited seminars, webinars and other support showcasing the design, build and post-occupancy of the building. As part of the ERDF funding, SMEs in the East of England are eligible for up to 12 hours support free of charge. Non SMEs will be charged £30 plus VAT per half day session.

The seminars are CPD accredited and suitable for architects, contractors, planners, M & E consultants and other built environment professionals. The seminars will be delivered by a combination of professionals working on the Exemplar Low Carbon Building, other built environment specialists and CBE consultants and will have a maximum capacity of 15 people per session. Events include topics such as Passivhaus, BREEAM, Sustainable Urban Drainage System (SUDS), Building Information Modelling (BIM), Ventilation and many more. For our latest events, please visit our website: www.adaptcbe.co.uk/CBE/events.



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