NEW TRENDS ON ARCHITECTURAL LIGHTING

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Le Corbusier said about architecture that it is "the learned play, correct and magnificent of the volumes reunited under light". Both daylighting and electric lighting should be considered natural extensions of the architecture, and not just as something installed to enable people to see their task. There are few buildings in which daylight can suffice the entire lighting need, likewise there are few buildings types to which daylighting cannot make a significant contribution. The synthesis of a properly daylit space and a well-controlled artificial lighting system can produce lighting energy savings in the range of 30-70%. Why many designers are not take into consideration daylight as a primary attempt in building design? Maybe the lack of knowledge on the performance of daylighting systems and lighting control strategies, of appropriate and user friendly daylighting design tools, of evidence of the advantages of daylighting.

The avoidance of glare and protection from solar radiation are the priorities for architectural programmes, and the use of internal shading devices are not the best solution. The external shading or high-tech glasses are an integral part of design strategy being planned for and executed at the design stage of the building. When used, external shading becomes a structural element and is both visually and structurally important: visually it has an impact on the external appearance of the building and structurally it must withstand all the external pressures applied to it. One can remember two from the most representative new projects – the BRE Environmental Building and the "Valotalo" – "Light House" of the Helsinki University of Technology. The BRE's Environmental Building (1998) provides a model for offices for the 21st century. Innovative and environmentally advanced, it demonstrates the way for the future based on a platform of new low-energy targets. The energy consumption represents a 30% improvement on current best practice for an office. A Building Integrated Photovoltaic array incorporated in the Environmental Building provide non-polluting electricity directly to the building. Solar shading is provided on the south exposure using glass louvres designed and controlled electronically to cut out sun glare but allowing maximum daylight to the office space, to reduce where possible the need for electric light during the day. The "Valotalo" new building extension of the HUT Department of Electrical and Communications Engineering (2000) was specifically designed to create the optimum environment for lighting research. The objective was to apply the newest experimental technologies for the integration of artificial and natural lighting, and to validate the efficiency and peoples' acceptance of these technologies. On the surface of the south façade of the building, an integrated system of photovoltaic panels is mounted between the ground and third floors. The panel system serves also as sunshades.

Windows – through which daylight is introduced to the interior, where the light is modified and controlled, and from which the views out beyond the building are obtained – are at the heart of the matter. The natural environment aspects, the uniques qualities of daylighting make their introduction into buildings as relevant as when there was no viable alternative in artificial sources: (1) Change and variety - the direction of the light, which provides modelling to the interior, the nature of sun and sky; (2) Colour and View - the contact with the exterior beyond, such as a view through the window, an experience of the weather and the world outside, the natural colour associated with daylight which imparts reality to the interior; (3) Modelling and orientation, Sunlight effect - the mood created by the variation of light, from day to day, and time to time as affected by the weather and seasons, the dynamics of lighting. The avoidance of glare is a maximum priority for most architectural programmes. The use of internal shading is less efficient for thermal control, but is more easily managed. When used, external shading becomes a structural element and is both visually and structurally important: visually it has an impact on the external appearance of the building and structurally it must withstand all the external pressures applied to it. [Philips DEREK, 2000]

Properties of Glazing for Daylighting Applications – coordinator Dr. Marc FONTOYNONT. The goal of the EC Joule programme (1993-1995) was to propose various ways of characterizing innovative translucent and transparent window materials with respect to their luminous properties. It involved testing of materials both in the laboratory and on site. In recent years, activity

has been increasing to develop materials which have the combined properties of good optical transmission and excellent insulation against thermal losses. Today a variety of materials exist offering insulative capabilities similar to glass fibre, whilst retaining solar radiation transmission characteristics similar to double glazed units.

Human factors. Daylight guidance systems share few characteristics of either windows or electric lighting and in the absence of comprehensive knowledge on human response to these systems it is not known whether to regard emitters as electric luminaires or windows for design purposes. The fundamental question is whether daylight delivered into a room via a tube in a similar manner to a conventional luminaire is still perceived as daylight and whether the generally assumed advantages of daylight are still felt when most of the familiar properties of daylight and in some cases reference to the outside world are missing. [Dr. David CARTER, 2003]

ENERBUILD RTD Network - coordinator Dr. J. Owen LEWIS. The Research Directorate General of the European Commission has identified the field of building lighting as an area where research is needed to stimulate further developments in energy efficient technologies. Various research programmes in this field have been initiated and several are continuing. Typical lighting power densities in non-residential buildings (offices, factories, schools) range from 15 to 25 W/m^2. Modern lighting systems using high performance luminaires, T5 fluorescent tubes and electronic ballasts show that lighting power densities in these buildings can be reduced by more than 40%. Further energy savings can be readily achieved by greater use of daylighting, by reducing the length of time for which lighting is used, and through improved lighting design and appropriate use of lighting controls. "Beyond the direct development of lighting systems, lighting research benefits from the support of the European Commission in the development of tools for professionals, including lighting simulation software; protocols for on-site performance assessment; optical characterisation of materials; and the generation of climatic data adapted for the optimisation of lighting systems. Finally, we should remember that *people have always sought more light and if these demands for light are to be met without excessive energy use then ways must be found to ensure that more daylight reaches building interiors*". [Dr. Marc FONTOYNONT, Lighting Thematic Group Co-ordinator]

Solar Light Pipe, an innovative daylighting device at Morgan Lewis Building in Washington, D.C. – IALD Award 2003. 14 floors around the narrow eight-foot atrium, where a central beam of light arrived at 43 meters below the skylight. The Solar Light Pipe solution consists of a rooftop heliostat that tracks the sun and redirect it down the throat of the SLP. Inside, a cone of prismatic glass refracts the sunlight outwards where some of it images on the lycra 'sock' and is transmitted through to the atrium sidewalls and the office windows. [IALD site]

The GreenLight programme was launched in February 2000 by the European Commission, with support from the national energy agencies of 14 States (inspired by the US Green Lights programme), in the light of the Kyoto agreement to reduce CO_2 emissions. At the end of 2002, the programme was opened to the Candidates Countries, including Romania. The GreenLight programme is an on-going voluntary programme whereby private and public organisations commit to adopting energy-efficient lighting measures when (1) the cost of these measures is repaid by the associated savings and (2) lighting quality is maintained or improved. Lighting offers tremendous scope for savings. Appropriate investment would make it possible to save 30-50% of electricity. The European Commission is currently introducing a voluntary agreement with industry in this area.

A new lighting norm concerning the indoor daylight illuminants is the prove of the growing interest for daylight. CIE D65, the best outdoor daylight illuminant, seems to have much more UV content than typical lamps used in offices and for daylight as filtered through coated office windows. CIE Division 1 decided at San Diego to establish a Reportership: R1-34 "Indoor daylight", with the following Terms of Reference: "To investigate the need for an indoor daylight source and/or illuminant", coordinated by Prof. Janos SCHANDA.

A recent study of Daylighting and Human Performance in a Californian school district showed that elementary school students progresses 26% faster in reading and 20% faster in maths in classrooms with the most overall daylighting, compared to students in rooms with least daylight. There are believed to be a number of potential mechanisms that may have been responsible for the positive association between daylight and improved performance of students: (1) improved visibility due to higher illumination levels and/or better lighting quality; (2) mental stimulation from natural lighting; (3) improved mood, behaviour or well-being created by natural lighting. Light has a proven biological effect, whether one is talking about daylight or artificial lighting. Daylight makes a difference, not only in helping buildings become energy efficient, but also to help students learn more effectively. [ASHRAE Journal]

Daylight is free. But the glazing or remote lighting systems using daylight and penetrating the whole building space with natural light could be very expensive and, sometimes, a bit unusual for people.