

# Really solving energy and light pollution issues in urban environments

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## 0. Short summary of the paper (abstract)

The basis for the study was the master plan of the OMA architecture associates (“*Office for Metropolitan Architecture*”-Rem Koolhaas-NL) for the old dockyards of the Ghent harbour near Ghent-Dampoort railway station.

The earlier realised city light master plan designed by the “*Atelier Roland Jéol*” has been meticulously evaluated by means of a survey and extended to be implemented into the new OMA site.

Photometric and colorimetric measurements are carried out to characterise the visual climate.

RELUX [9] simulation and visualisation software has been used in the lighting design process of this former industrial site which has been partially dismantled.

Particular elements of public spaces are then chosen to be worked out in detail such as a road, a river and a riverbank, large and high industrial premises (e.g. a concrete factory redestinated as a theatre tower). These are treated as a typology in solving other cases.

## 1. Objectives

The conclusions of this research are to be read as an evaluation and a judgement of the realised light master plan of the city of Ghent designed by the “*Atelier Roland Jéol*”. Then, these conclusions are to be projected to the OMA site at Ghent-Dampoort and in particular applied to typical spots as a road, a river, a riverbank, a former concrete factory.

## 2. Research Strategy

### 2.1. Preliminary Research

This phase consists of drawing the light plan in the frame of the urbanistical master plan; the study of existing light master plans of Ghent, Herentals, Tienen and Tournai (B); the study of the lighting design criteria for public lighting (in general) and for the urban environment (in particular); composing a photographical report of the realised and the non-realised parts of the Ghent light master plan.

### 2.2. Research - first part

This deals with the proper city centre of Ghent and its light master plan.

In a first stage the technical aspect has been treated by means of measurements of illuminances (vertical and horizontal), of luminances from a considerable number of well-chosen points of view and of objects with typical surfaces; and of measurements of colorimetric properties of light sources and surfaces with a spectroradiometer.

In a second stage the aesthetical aspect has been treated. Visual comfort is characterised with the help of a so-called *visual comfort index* here and chosen subjective, decorative options are criticised.

In a third stage the social aspect has been worked out. An inquiry has been carried out amongst inhabitants, people passing by and tourists of Ghent to determine the visual impressions of the (illuminated) outdoor scenery.

Lighting scenarios are realised with computer based simulation and visualisation software programmes like Relux (where the geometrical input out of AutoCAD has been linked with Relux through ReluxCAD). Three-dimensional illuminances as the semi-cylindrical illuminance at face height are calculated on the basis of measured horizontal illuminances at ground level and vertical illuminances at face level (according to a regular measuring grid); these measurements are then transformed into nominal values of light fluxes and intensities.

### **2.3. Research - second part**

This concerns the OMA site at Ghent-Dampoort.

Firstly the data of the OMA light master plan are tested for what concerns the visual impact (aesthetically) and simulated by means of Relux Professional version 2006 software. This is complemented by a photographic study.

Secondly and finally, modifications of the OMA light master plan are formulated.

### **3. Discussion**

The questionnaire presented contained elements as :

- what is the general impression of the lighting of the public room and of its congeniality (open question);
- what is the feeling of personal security (in terms of where there is a higher degree of threat – see Picture 3 and Picture 4);
- in what way are borders of the footpath detectable and recognisable (e.g. Picture 2);
- how are details of the road pavement visible (like obstacles);
- is recognition of pedestrians and of their intentions feasible;
- are the buildings and other outdoor elements clearly visible at night (in terms of architectural details and in terms of colour rendering – see Picture 5 and Picture 6); is the applied nighttime lighting upgrading the outdoor architecture (Picture 6);

The evaluation was carried out on basis of presented photographs and of the real outdoor environment. Obviously the inquiry is subdivided into three themes : safety; aesthetics and beauty; general issues.

### **4. Conclusion**

An optimum has been found in restricting light pollution (with the calculated contribution of direct and indirect,reflected components), in creating an attractive visual scenery and in minimising energy consumption.

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*Picture 1 : The “Dutch Theatre” building illuminated consistent with the Ghent light master plan*



*Picture 2*



Picture 3



Picture 5



Picture 4



Picture 6