



POLITECNICO
DI TORINO

Honors thesis

COURSE OF
ARCHITECTURE FOR THE SUSTAINABILITY DESIGN

Abstract

**Conservation and technological innovation
of historical luminaires of Turin**

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February 2018

Nowadays, the increasing awareness of issues concerning sustainability like energy consumption, light pollution and the environmental impact of lighting systems has brought to a massive use of LED systems in public lighting.

Turin's territory is characterized by the presence of historical luminaires that spread in the 20s and 30s of the 20th century and whose particular design is consolidated in the day and night view of particular symbolic places of the city.

Aim of the present work, written with the support of the Street Lighting section of IREN Energia S.p.A., is to investigate the aspects of the technological adaptation of these historical luminaires in order to combine the limitation of energy consumption and environmental impact with the respect for the aesthetic characteristics of the devices as well as for the urban context they belong to.

The study of the history of Turin's street lighting makes it possible to understand the evolution of the way of generating light and how its function was conceived, which led to the development of the above-mentioned devices. Thereafter the distinctive features of the different types of historical lighting fixture, identified with the catalogue reported in the Municipal Lighting Regulation Plan (PRIC), is examined. Their technical and formal characteristics, as well as their link with the urban area, is analysed with a focus on the changes made over the years in order to make the current system more efficient thanks to the availability of more and more technologically advanced solutions.

The focus is therefore on the main aspects of the technological upgrading of these types of lighting fixture, with particular regard to the perception of their design in relation to the urban environment, to the performance of the different technological solutions as well as to their energy assessment.

Starting from this analysis and from the study of the LED conversion interventions already carried out on some types of historical luminaires of Turin, it has been possible to develop the LED conversion project of the "Impero" historical luminaries in Carlo Emanuele II square. This fixture has a diffuse distribution of the luminous flux which results in a not-optimal performance as regards street lighting, but, at the same time, it allows to illuminate the verticality of the surrounding buildings. The critical issues related to the lighting system currently in use have been identified and 4 different solutions to improve the lighting performance have been developed and compared to guarantee the requirements and limiting light pollution, to respect the provisions of the relevant legislation. The approach is based on obtaining a considerable energy efficiency while respecting the original design of the historical luminaires and of the surrounding urban environment. Therefore the evaluation and comparison of the proposed solutions are made on the basis of their impact on the perception of the urban environment, in line with the lighting requirements for users'safety and in consideration of energy consumption. The results show that it is possible to improve the performance of the historical luminaires and save energy at the same time, and the relative consequences on the view of the context. The particular influence on the perception of the verticality of the buildings around the square emerges from the analysis of the facade of the Santa Croce church, built in 1718 on a project by the court architect Filippo Juvarra, featuring a less widespread distribution of light due to the limitation of the luminous flux emitted upwards by the lighting fixture in question, with a

lowering of the minimum luminance levels compared to the present status. These results show the need to integrate the lighting system of the square with dedicated solutions to highlight the surrounding monuments.

The situation offers the opportunity to develop lighting projects devised for specific urban functions and characteristics, oriented towards the coexistence of dedicated solutions that complement each other. As a consequence, new implications in terms of performance and energy saving will follow, which will make possible to apply specific and differentiated management systems to allow the optimization of energy consumption related to public lighting systems, with an eye on the quality of lighting and the usability and enhancement of the urban context.
