



Planning restoration of a historical landscape: A case study for integrating a sustainable street lighting system with conservation of historical values

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ABSTRACT

Issues relating to the illumination of historical minor centers have taken on increasing significance in debates on urban rehabilitation. Interventions must ensure balance with the surrounding environment whilst implementing high-efficiency, energy-environment systems, and enhance architectural structures. The research presented in this paper aims to identify appropriate strategies and effective criteria for lighting design in historical centers. The methodology developed is based on transcalar analysis and has been applied to a village in the Abruzzo Region (Italy). The methodology involved surveys carried out in the urban context together with up-to-date and detailed analyses aimed at highlighting the criticalities and potentialities of the village in the case study. This allowed the elaboration of intervention strategies applied to two different areas: one within the historical nucleus of the village and the other in a peripheral area. This research has contributed to enriching the current debate on so-called “inland areas”, including developing new ways to benefit from the special characteristics of these areas and implementing more sustainable action.

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1. Introduction

Optimization of infrastructure systems using standard methodology is not necessarily successful in cities. In fact, an analysis of optimization processes shows interesting results for new methods and techniques of construction, tested in different sectors (construction, transport, energy), but these are not always functional or efficient within a system-oriented approach (Bunning, 2014; Cucchiella et al., 2013; Childers et al., 2014; Cucchiella and D'Adamo, 2015; Studer, 2014). The objectives are often sectorial and do not produce the exponential effect of a system-oriented approach. Some cities are now struggling to provide adequate responses to the diversified demand of increasingly specialized services and to adapt their systems to new requirements such as accessibility, usability and energy efficiency (Agrawal et al., 2014;

Yang, 2013; Verdeil, 2013; Cucchiella et al., 2012; Chiaroni et al., 2014; Bigotte et al., 2014).

Some authors have reported interesting results with LED street lighting in German municipalities (Polzin et al., 2016), others have investigated factors that may have played a significant role in the successful adoption of light-emitting diode-based lighting in Malaysia (Khorasanizadeh et al., 2016).

Furthermore, urban decay and the difficulty in adapting obsolete structures and buildings to conform to today's needs present further complications (Fazia, 2012; Korppoo and Korobova, 2012; van Doorn, 2013), and the situation becomes even more complex when the design intervention concerns historical villages, where invasive or high-impact actions must be limited and constraints exist in terms of limitations of space and height differences. As Swensen stated “Fragmented planning renders consideration to the reciprocity which exists between the historic fabric, the townscape and the natural environment difficult” (Swensen, 2012). Interventions in historical villages are also hindered by the fact that, the technical documentation is often missing, maintenance operations are only performed in the event an emergency and the actual

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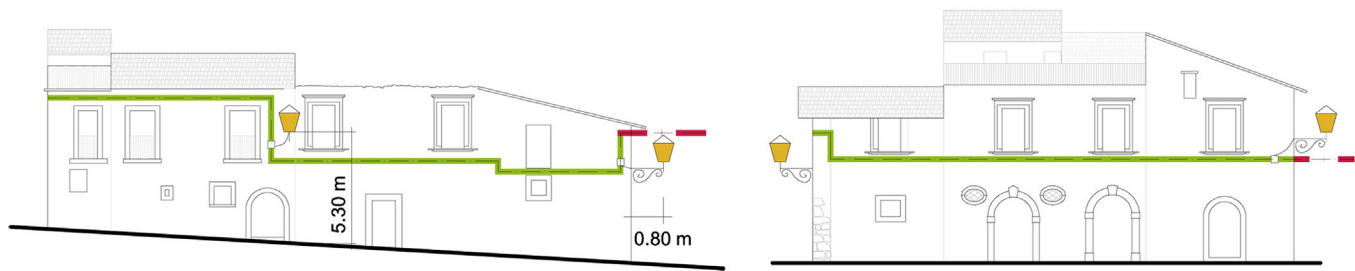


Fig. 1. Power lines of Santa Maria del Ponte (Aq). Electricity lines are mostly overhead and often coexist in vicinity to other distribution lines. These “foreign elements” cause an incorrect perception of the façades. In addition, cable and conductor junctions and wire rope joints are often installed haphazardly along the facades of the buildings.

condition of the subsoil of the village often depends on the historical memory of the few people who still live there (Moussa and Mahmoud, 2017). Many of these minor centers are now in a state of decay (Edensor, 2012; Gabrys, 2014). However, the region has witnessed a renewed interest in the historical centers of the Abruzzo region as a result of their number, their historical, architectural, environmental value as well as their importance to local economies (Verdeil, 2013; Secchi, 1984; Craggs et al., 2013; Wu, 2014).

Furthermore, the need to rebuild the buildings damaged by an earthquake in 2009 in central Italy has provided the 73 municipalities affected an opportunity to support the reconstruction and the optimization of infrastructures and networks through the introduction of innovative technologies to ensure comfort and safety to contemporary users in the open spaces (Harada, 2000). Interestingly, one of the most important factors that ensures comfort and safety is lighting and this is the focus of this research paper.

2. State of the art

Generally, only the functional aspects of the liveability of outdoor spaces, defined by technical regulations are taken into consideration when addressing city illumination. However this is a great loss, as illumination, when used knowledgeably and effectively, allows us to enjoy not only what surrounds us, but also the space and elements that constitute a city; to perceive the materials that compose it and to look and enjoy the urban area from a different perspective (Fig. 1).

The theme of street lighting design has not yet been defined fully and is often overlooked despite it being an important tool that can be used to enhance the urban night scene and promote its usability (Edensor, 2012; Cai et al., 2013). Indeed lighting, if properly designed, can contribute to the historical and aesthetic development of a city and to the readjustment of urban spaces as well as urban regeneration. It is an element capable of recreating recognizable images of the urban fabric and therefore can be used to restore the shape of the city with the perception of the elements that represent it. Urban settings can be remodeled to complete daytime perceptions acquired superficially during the rush of everyday life. In fact, lighting can be used to configure a night-time reality, totally independent of the daily one, yet complementary to it.

An analysis of the lighting in Italian cities reveals that, in most cases, light is only considered a functional or technical element and its potential to allow the city to regain an identity during the night is often ignored (Bisegna et al., 2010; Kumar, 2013).

Another element that is often overlooked is light pollution which negatively affects the image of our cities. It occurs when the light emitted by the lamps is poorly designed, generally facing

upwards Fig. 2. This condition causes environmental damage (loss of orientation for animals, alteration of circadian rhythms in humans), cultural damage (disappearance of the starry sky) and economic damage (waste of electricity for areas that do not require lighting).

The ancient centre of the village is illuminated by lanterns anchored to the facades of buildings by means of 80-cm long brackets, usually placed at an average height of about 5 m. The distribution of the lighting fixtures is fairly uniform, but the head lamp is not compliant with legal standards (UNI 10819). In fact, light is emitted above the angle 0° – 180° . Furthermore, the light source is a mercury vapor type. The good colour rendering of these lamps is neutralized by poor efficiency.

There are no national reference regulations regarding street lighting in Italy. Each Italian region has its own guidelines, which in most cases only refer to the importance of limiting light pollution, with no special reference to street lighting design (Bisegna et al., 2010). In Abruzzo, for example, the reference legislation is Regional Law n. 12 of 2005, published in the Bura N°. 15 of 18.03.2005 which local planning must refer to. However, very few of the numerous villages scattered across the Province of L'Aquila have adopted the guidelines set down and technical documentation is often missing or not appropriate.

3. Methodology

Artificial illumination cannot be considered a mere support to vision nor a guarantee of fictitious safety. It should confer a night-time identity to urban morphology, redefining space through its immateriality. Indeed, artificial illumination allows another vision of the built environment. The weaving of the construction systems, the plastic effects of the façade elements, the special characteristics of the materials used and their appearance and colors are the product of the incidence of light on the matter. They are influenced by the variation of intensity and temperature from dawn to sunset, by the daily and seasonal weather conditions, clouds, mist and fog. All this produces an identifiable concept of landscape and place. Therefore artificial illumination should not be an undertaken with the scope of achieving a homogenous standardization as this would rob urban contexts of their differing historical heritage.

Furthermore, artificial light should be seen as an important means of transmitting knowledge of the urban context; an autonomous and articulated, architectural language and an essential feature of urban rehabilitation. Illumination gives planners the opportunity to create a new night vision of an urban area that enhances its characteristics and promotes urban security without harming the environment. When designing street lighting, be it

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