

The survey for the conservation and restoration of historical towns, in contexts affected by seismic events

Il rilievo per il restauro dei tessuti storici, in contesti colpiti da eventi sismici

The timeless news of seismic events that hit the center of Italy made it possible and, to a certain extent, required a reflection on the contribution that our area can give to the preservation of heritage and to the protection of historical identity, but also to the security of our historical settlements.

The editorial reviews some fundamental themes for a wider view on the issue of protecting our heritage by presenting the most current instruments and methodologies for documenting and representing the historic constructions, reaching an overview of the main topics covered in the selected contributions, grouped together ideally in two distinct categories: the first, for field-applied studies in post-earthquake reconstruction, and the second, for studies concerning prevention activities.

L'infausta attualità degli eventi sismici che hanno colpito il centro Italia ha reso possibile e, in una certa misura, necessaria una riflessione sul contributo che la nostra area può dare alla conservazione del Patrimonio e alla tutela dell'identità storica, ma anche alla sicurezza dei nostri insediamenti storici.

L'editoriale ripercorre alcuni temi fondanti per una visione ampia sul problema della tutela del nostro Patrimonio, presentando gli strumenti e le metodologie più attuali per la documentazione e la rappresentazione del costruito storico, giungendo a una elencazione delle principali tematiche trattate nei contributi selezionati, raggruppati idealmente in due grandi categorie: la prima, per gli studi riguardanti attività sul campo nella ricostruzione post-sisma, e la seconda, per gli studi riguardanti attività di prevenzione.



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EDITORIAL

On the light of recent seismic events that have affected so extensive areas of Italy, the title of this issue of the magazine *Disegnarecon*, is “the survey for the conservation and restoration of historical towns, in contexts affected by seismic events”. The aim is to offer the opportunity for scientifically accurate reflections about the important theme of the heritage conservation, the protection of historical identity and the safety of historic settlements.

Italy, like most of the Mediterranean countries, is a high-seismic risk area. From North to South mainly following the Apennine ridge cyclic or frequent earthquakes strongly damage entire geographic areas, endangering the lives of hundreds of people. Today, on the basis of the studies already carried out and under development, the frequency and intensity of the earthquakes are likely to be determined with some degree of accuracy. The question deals with the possibility to forecast where a strong earthquake will occur limiting the margins of time to about a decade.

Based on these considerations, it is increasingly essential to carry out studies and preventive interventions that allow urban areas, especially ancient towns in high-seismic risk zones, to “resist” the seismic events by limiting as much as possible damages to things and people. In this view, the historical analysis of settlements, documented through archive and mapping apparatus, can reveal how seismic events rarely led to the abandonment of areas or dwellings. Much more important is the effect of seismic events on typological transformations and changes in constructive techniques. Thus, a substantial “permanence” of urban structures, corresponds to a generalized reorganization of building units. At the same time, the studies need to develop the problem of seismic vulnerability of historic centres and, in particular, the road paths crossing them, by providing work protocols that allow the analysis of the criticality of these urban tissues.

In order to preserve and maintain the Heritage of the Italian historical centres in high-seismic risk areas, we need to know and study thoroughly the Cultural Heritage that has been handed down to us and what we are called upon to intervene. In 1972 the Central Office of our Ministry carried out the publication of the rules for the drafting of the records of urban historic centres

for the Catalogue and the Documentation of Cultural Heritage. It was established that:

*“analysis and filing represent the first essential moment. The knowledge of cultural property is indispensable both in order to put in place a precautionary defence action and to foresee a series of technical standards to be included in urban planning instruments whose main task is to harmonize the urgent needs of a reality in continuous development with the fundamental requirements of preserving the cultural patrimony of our civilization”*¹

The analysis and mapping of the architecture of the buildings cannot be ignored by the technical survey and the graphic / info graphic documentation.

The problem of a not-superficial knowledge of the urban fabric of our historical town centers, through the analysis of all its components, seems to be the most important aspect. The interest is not only directed towards the single building but also, and most of all, to the organization of the interconnected spaces of the settlement structures; we have to analyse functional relationships and even structural connections between each one of the individual building units.

Without having the claim and critically explore the long ambitious debate on the subject of heritage conservation and risk prevention, we believe it is worth pointing out what are the key aspects of the problem. In this issue of the magazine our purpose is to talk about methodological modifications, past or prefigurative for the future, obviously underlying the point of view of the detection and documentation of the state of the fact and the history of the historical heritage.

Recognizing and filing the existing Urban Heritage of historical interest, in a given territory, is therefore one of the main activities, the fundamental preliminary step for identifying correct intervention strategies; it constitutes the basic knowledge that aligns and guides the subsequent operational phases of the interventions to be realized. It is necessary to have the correct knowledge of the quantitative data, forms and volumes, the organization of the functions of the real estate of an historic centre protected at any level, as well as the knowledge of all its individual buildings or archi-

¹ Ministero della Pubblica Istruzione. Direzione generale delle Antichità e Belle Arti, Ufficio Centrale per il Catalogo, Norme per la redazione delle schede dei centri storici urbani, Roma 1972, p. I.

tures and of their relatives evolutionary dynamics. The act of critical survey, the graphic representation of the analysed phenomena, together with the analysis of historical and documentary sources, is a compulsory step in the operations that tend to identify procedures and methods of study. The documentation and transmission of values is very important for the purpose of preservation of the Heritage and the planning of interventions, in order to preserve the vitality itself of these urban areas.

The upgrading of an urban area, of great or small historical value, substantially involves three stages of preventive analysis: the digital survey on the urban scale of the historic centre, the mapping of the buildings, also realized through a historical-documentary research on the urban fabrics, and an adequate analysis of historical construction techniques that shows any defects or advantages that the buildings have had. In the realization of a master plan, determining the gradation of the categories of restoration and retraining of buildings that make up the urban areas under consideration, the assessments of the stability and vulnerability of the buildings structures will be taken into account in order to meet the safety conditions.

The integrated survey project is planned and organized into stages, with different levels of detail, also based on urgent needs, for example, to forecast the first actions of intervention. It's getting evident the efficiency of the use of digital survey techniques, such as the use of laser scanners and / or detection systems, and even more expeditious, such as Laser Scanner Mobile and low-altitude photogrammetry systems (Drone type). These technologies can produce highly reliable maps, cartographies and models, complemented by georeferencing systems and GIS-based data formats, and digital representations (as BIM) or applications for the use of virtual reality.

In this context, as to the the acquisition of digital documentation, it is important to emphasize the importance of the achievement of shared criteria for the certification of data obtained with these technologies and the fact that they establish and, above all, follow methodological working protocols that ensure adequate criteria of reliability database. Another important topic is the ability to keep digital data and maintain databases that we have made. Preserving the digital image of a monument, or a city, and of Heritage in general, is to-

day one of the main challenges. The three-dimensional database (in the form of cloud points, model, etc.), depending on the degree of reliability, provides a sort of “double” of the same threatened natural or anthropic monument that can at least preserve the image of the Heritage under the form of Digital (or Virtual) Heritage. The use of the technologies described above will also provide an effective database for the future monitoring of the building complexes and historic centres, also in relation to risk protection.

From this point of view, in the course of analysis, we start from the identification of the aggregates in which the urban fabric is subdivided, also highlighting the mechanics of the disasters which not only compromise individual buildings but also the interactions, at a structural level, with the real estate neighbours. Analysis of the façade fronts (in-line buildings, porticoes, etc.) and reading of disasters (injuries and deformations) also allow to evaluate the various issues of buildings facing the roadway. The knowledge of the history of buildings and the urban fabric provides data to obtain information on the various evolutionary phases, structural patterns and main mechanism of disruption. Finally, the analysis of individual buildings allows to predict from what type of deterioration a property can be affected, what type of damage can receive and / or cause, and to schedule the priorities and to time the interventions on public areas and private buildings of strategic importance.

It is evident that two complex disciplines - such as those of architectural survey and architectural restoration -, are in strong relation in order to fully understand the nature of the buildings and their context. Today's survey methodologies allow us a relative speed for the survey campaign and the data collection, but subsequent computer data processing, if it'll be not accompanied by a careful surveillance campaign that allows empathy with the building, will only provide not completely exhaustive information metrics without acquiring an adequate knowledge level. The need of a direct contact with the building is even more evident if the analysis is structured in terms of structural survey and diagnostic survey of the degradation. All these stages of the study are the result of the reader's ability to read and understand the artefact and the damages it suffers. “The architectural survey distinguishes the true connoisseurs from those who remain on the sur-

face of knowledge, even though educated”: these are words of Piero Sanpaolesi . These idea, even in the “digital age”, is the correct philosophy of work.

In this issue of the magazine, devoted to the technical survey for the restoration of historical fabrics in contexts affected by seismic events, we intend to collect a set of contributions according to these two main themes:

- experiences of post-earthquake analysis and documentation of historical centers, implemented after calamitous events in order to assess the damage, draft reconstruction plans or any planning activity for the conservation or recovery and redevelopment of damaged areas.
- experiences of analysis and documentation aimed at the prevention or reduction of seismic risk in areas highly exposed to the repetition of calamitous events.

By going into more details, the presented experiences relating to a building aggregate or an entire historic center are based on the detection of a significant portion of ancient fabric, where the single building is never isolated from the context it is included in and whose is part. Often, the model of the block, aggregate or historical center, drawn through two-dimensional and three-dimensional digital elaborations, is representative of the level of knowledge that it is possible to reach from the architectural, morphological, typological, figurative, geometric, proportional, metric and historical analysis under constructive equipment, architectural damage, structural damage and degradation point of view.

As to this last point, today the digital survey offers the opportunity to realize three-dimensional databases: in the future they could represent an important heritage, with basic documents for the preservation of historic centers and small settlements which are the richness of our country. We could take the opportunity to transform urban survey campaigns into an important occasion for preserving the image of urban tissues with the purpose to make our cultural heritage accessible also in terms of Digital Museum.

The essays we have selected for the first issue illustrate and document specific field-experiences conducted in areas affected by earthquakes, going beyond an exclusively theoretical-methodological approach.

The article “A survey campaign aimed at the recovery of an old Abruzzo town hit by the earthquake in 2009” documents the study carried out by the University “G. D’Annunzio “in Pescara, in some of the fifty-seven urban centers affected by the earthquake of L’Aquila in 2009. The documentation for the “reconstruction plans”, conducted by a team of the Faculty of Architecture, of the medieval town of Brittoli, in the Gran Sasso foothills, has highlighted the immense damage to real estate assets. This essay illustrates the results of this survey and the graphic restitution of the real estate property of this small center and, in relation to the Technical Specifications provided by the Abruzzo Regional Government, an intervention program for post-earthquake reconstruction has been established. Similarly, we find it in the contribution “*Survey and Design: an interdisciplinary model for post-earthquake reconstruction in smaller historical centers*”, where theoretical research, though not strictly actual, but of paradigmatic- methodological value, documents an integrated process ranging from post-earthquake reconnaissance survey campaign to a complex pilot project. The main result is the development of a wide-ranging methodological proposal that involved different professionalisms ranging from the direct and indirect design to three-dimensional modelling, from the architectural design to urban design, for the control of maintenance processes to legal competencies for planning the Reconstruction Plans.

A greater amount of contributions has been selected for the second theme: they concern with the experience of preventing or reducing seismic risk.

In the article “*Survey of buildings, elaboration of urban level maps and establishment of multilateral databases in order to know the seismic vulnerability of historic centers, thanks to Survey and Representation disciplines*” the “Santorre di Santarosa Square” in Savigliano (Cuneo province) is detected. Here we understand how urban survey is not only an occasion for the presentation of good levels of analysis and knowledge of the buildings, but also a fundamental scientific tool to make highly comprehensive level of cognitive analysis, aimed to enlarge the relationship between different levels of knowledge.

In the contribution “*The designed’ memory*” you can find the morphological re-reading of a medieval square in the urban fabric of Aversa, described in a work

that is considered as an emblem of critical analysis. This is intended to highlight the fundamental role of critical documentation of the state of affairs within an informative and cognitive model for the integrated management of projects of restoration, restructuring or reconstruction, in the unfortunately case that natural disasters have destroyed or damaged the sites.

After the recent seismic events in Central Italy, the cultural debate about the preservation of minor historical centers has been re-opened: in fact, for their original urban composition, minor historical centers are considered to be in all respects Heritage items to protect and preserve.

This is the same theme of the contribution “*HT_BIM: Parametric Modelling for Risk Analysis in Historical Centers*”: here, new paths, including methodological approaches, are experimented with the purpose of building models for the management of these complex urban realities, attempting to dominate the heterogeneity of data concerning the individual building units, the structural aggregates and the entire urban area. In recent years, BIM’s parametric systems have made an interesting contribution even to the surveys of Heritage, and the purpose of this work is to develop a Historical Town Building Information Modelling (HT_BIM) system. Through this program, you analyse the architectural characters, the out-of-plane kinematics of the buildings’ structures, the surface degradation due to wind and sunshine phenomena, in a system that is able to handle the characteristics of all the architectural components of urban fabric and to define the possible risks related to the static conditions of the buildings and the degradation phenomena.

The research presented in the article entitled “*Fra Capo S. Alessio and Capo Scaletta: urban surveys*” aims to identify some objective data useful to effectively, but concretely, circumscribe the quality, the form and the nature of the places to prevent risks due to urban and construction planning, in particular, in the case of earthquake. This study started in 2012 with the survey of the village of Mandanici, located on the Messina Straits on the slopes of the East Peloritani; actually, it also includes the urban surveys of Forza D’Agrò, Ali, Fiumedinisi and Itala.

Similar considerations we find in the contribution “*Via Giostra Vecchia: architecture and urban areas in the ancient center of Cosenza*”. Starting from the study on

this important street in the historic center of Cosenza it takes the opportunity to analyse the town, considering both single buildings with their technical, constructive, formal and geometric characters, and the urban spaces the same buildings combine with. The work underlines how urban space and architectures both represent the real “material” of the city. Public (and semi-public) space is not “anything else” from the buildings, but is rather an essential part of the city, that finds both functional and recognition reasons in the urban voids, shapes and materials.

Also the contribution “*The Importance for the Conservation and Valorisation of Rural Villages in Central Sicily: Borgo Pietro Lupo’s Case Study in Mineo*” highlights the important role played by the survey in view of preventing or reducing the seismic risk in areas exposed to the repetition of calamitous events. The essay, through the case study of “Borgo Pietro Lupo” in Mineo, (Catania province) proposes a pilot project for the re-use, functional and structural adaptation of the center, based on a rigid protocol of analysis and documentation aimed to the prevention and reduction of seismic risk. Through the analysis of a real case we want to highlight the function of technical survey as a tool of scientific reflection aimed at the Heritage’s conservation and protection.

In the article “*Poppi historical center: urban analysis for seismic risk assessment*”, we study the problem of historic centers in high seismic risk areas, such as the valleys of the Tosco-Romagnolo Apennines through the issues of their documentation, conservation and security. The work has three main themes: the realization of a reliable urban scale survey, the documentation of the current state of the building units, and finally the identification of critical elements within the building fabric. The theme of security is addressed by developing a non-invasive laser scanner survey of the road front view in order to identify possible wall deformations and an accurate examination of the porches arcade structures, a feature of the historic center of Poppi, exploiting the potential offered from the laser scanner 3D pad.

Finally, the article “*Florence: urban planning and seismic vulnerability*” has the aim to develop historical city analysis methods that allow to understand the fragility of both single building units and large urban areas. Through the tools of the survey and accurate

filing of the buildings, the risks arising from the overlapping of ancient construction techniques, anthropic problems and geological localization are documented. It’s possible to realize thematic maps that can identify the different levels of structural degradation related to the different priorities of intervention. These analyses also allow us, as an add value, to identify the safest paths to be used in case of seismic events by the population and rescue vehicles.