

## **Integrated Methodologies for the Analysis and Conservation of the Old Bar (Montenegro): the Case Study of Doge's Palace**

**Antonella Versaci**

Faculty of Engineering and Architecture, University of Enna "Kore"  
Cittadella Universitaria, Enna, Italy  
antonella.versaci@unikore.it

**Alessio Cardaci**

Department of Engineering – University of Bergamo  
Viale Marconi 5, Dalmine, Italy  
alessio.cardaci@unibg.it

### **ABSTRACT**

The old town of Bar in Montenegro, a Byzantine settlement rebuilt on the remains of a more ancient town destroyed in the 3<sup>rd</sup> century during the Roman invasion of Dalmatia, ruled between 1443 and 1571 from the city of Venice and then by the Turks until 1878 is, today, a little over an abandoned village but, at the same time, an extraordinary monument from the past to protect and enhance.

Traces of its most glorious past are still recognizable in the ruins and artifacts of daily life become known following recent archaeological excavations. Stari Bar is a site unique, a sort of miracle that fortunately survived the ravages of time and negligence of the men. However, it now runs the risk of being overwhelmed by a frenzy of "intervention" that leaves little room for reflection and that can produce errors, which cannot be remedied in the future. Rather than rebuild a fake medieval city or give way to immobility, risking that the culture of ruin prevail, it is necessary to pursue activities of knowledge, study and promotion allowing local communities (as well as those further afield) to re-appropriate the memory of those architectural and urban spaces, triggering new ideas for their possible regeneration.

In this framework, this paper presents the case study of the "Doge's Palace", analyzing this important monument in depth knowledge, in order to formulate a proposal for its conservation and valorisation. The experience here reported responds to the initial phase of a more ambitious project aiming at producing a three-dimensional "picture" of the site in its current state: a representation made both through the documentation of the town's most relevant parts and the use of virtual tours and 3D modelling. This activity intends to support the nomination proposal submitted by Montenegro in 2010 to include Stari Bar in UNESCO's World Heritage List.

**KEYWORDS:** cultural heritage, conservation, valorisation, integrated survey, 3D documentation

### **1 THE OLD TOWN OF BAR: AN EXCEPTIONAL ARCHAEOLOGICAL TESTIMONY TO THE HISTORICAL ANTIQUITY**

Montenegro is characterized by a rich architectural and archaeological heritage; several cultures have left behind traces of their existence there. Located in a territory that straddles the East and West civilizations, the Montenegrin heritage is permeated by very diverse historico-artistic influences and is of exceptional quality.

Among the most interesting elements, sticks out the city of Stari Bar, also called Antibari. One of the largest fortified archaeological sites in the globe, it spread over a rocky hill inaccessible on three faces, placed at the foot of Rumija Mountain. Five kilometers inland from the modern port of Bar, the ancient town is placed at an intermediate level between the Bay of Kotor and the estuary of the river Bojana, along which major Hellenistic-Roman settlements were built. This privileged location and the bearing of a source of drinking water, established it as an important point of junction between the coast and Adriatic commercial trades, and the internal areas of Serbia and Balkans.

Its origins are still unsettled, although the tradition dates back them to the Illyrian world with a continuation in the Hellenistic-Roman period. However, only in the 10<sup>th</sup> century, documentary sources more reliable refer to a town named Antibareos. In the following century, a site with similar name was mentioned as relevant to the territories of the Byzantine thema of Drač (Duracium). Episcopal seat since 1089, the town became first part of Serbia (1183) and then was conquered by Venice (1443). The period of Venetian rule significantly changed the urban and architectural fabric of the city, widely giving it its current appearance. In 1571, the town passed to the Ottomans, who had it until 1878. The scene of a siege in 1877, it was finally reclaimed by Montenegro from the Turks (after the locals bombed the aqueduct into the town and cut off the water supply) and mostly abandoned by the community (Mijovic and Kovacevic, 1975; Markovic and Vujicic, 1997; Gelichi and Gustin, 2005).

In the mid-50s of the last century, the Serbian architect Đurđe Bošković - to whom we owe the first map of the city and its main buildings – carried out studies aimed at the recovery of the town. Published in 1962, this research still stands for a milestone in the knowledge and understanding of the Old Bar. Through innovative methodological approaches, Bošković brought to light the history of this forgotten Montenegrinian town and produced an analytical and comprehensive analysis of its material structures (Bošković, 1962). The Federal Institute for the Protection of Historical Monuments undertaken some activities to protect and restore the citadel, and then enabling people to visit it.

Unfortunately, in 1979 a violent earthquake ravaged the (at that time) Socialist Republic of Montenegro. The seismic activity not only killed almost a hundred people and injured a thousand; it also destroyed a large number of buildings, school premises and scientific and technological research establishments, put major industrial complexes out of action and severely damaged the glorious Montenegrin cultural heritage. In the Old Bar, several structures collapsed, including a vast wall section, which came off in one single block (UNESCO, 1984).

However, the earthquake gave new impetus to research, re-evaluation and renewal of the cultural heritage. Immediately after the tragic event, a considerable movement of solidarity developed in the other Yugoslav republics, in many foreign countries and in the international organizations. At the invitation of the Federal Government, Amadou-Mahtar M'Bow, the Director-General of UNESCO, went to the scene

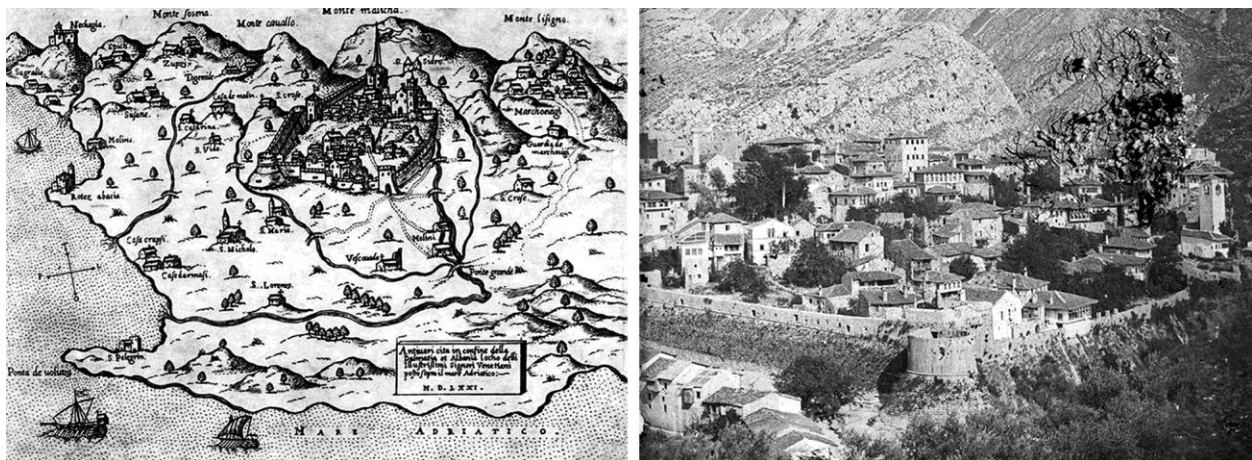


Figure 1: Stari Bar in a historical plan (1571) and in a picture of P. Marubi (1868)

of the disaster some days later on the quake. Following a mission to the devastated zone, three UNESCO experts indicated what the priority needs were and the possibilities of international aid. Significant material and technical assistance was received from the former Socialist Federal Republic of Yugoslavia and abroad, enabling restoration of a significant part of the architectural heritage, using new methods and technologies (Pickard, 2008).

Concerning Stari Bar, in particular, a huge restoration program was done by the archaeologist Omer Peročević. It aimed at re-evaluating the city through its opening to the public in an organized way, transforming the fortress into a center for cultural/artistic production and aggregation, restoring environments for residential use (in a more or less acceptable way), creating an open air theatre and providing space for art exhibitions. The project did not achieve all the desired results, but bequeathed many buildings completely restored or rebuilt, the establishment of a small Antiquarium at the entrance of the walled city and the opportunity to visit the city in its entirety.

Extensive archaeological researches and training activities in the area were held out by mixed teams of researchers Italians, Slovenes and Montenegrins from 2004 and then from 2007 only Italians and Montenegrins. They have offered significant new insights into the descent and development of the site, as well as secured a certain town's vitality.

In more recent years, Montenegrin archaeologists have carried out a program of recovery of the entire settlement, which led to a series of restoration/reconstruction of several monumental buildings in the upper part of the town. These activities - even directed at transforming Stari Bar in a suitable site for promoting cultural tourism - represented a unique opportunity for the knowledge of the buildings history and of the architectural culture of those territories, particularly in the age of Venice.

Yet another drafted and fully implemented project included infrastructural works on the road running from the main gate to St. George's Cathedral: "this clearly shows the unambiguous interest in rehabilitation of certain structures and in reestablishing corresponding functions of the same, all in line with the programs relative to their purpose" (UNESCO, 2010). The electrical supply network enabled the installation of public lighting, the illumination of certain monuments and communications. Thanks to the regular investments and technical maintenance related to the cleaning of vegetation, the upper portion of the town is accessible to public.

Today, the city, enclosed within the ramparts constructed by the Venetians in the 15<sup>th</sup> and 16<sup>th</sup> centuries, is an open-air museum: rich in charm and cultural interest but yet far from being a well-formed and protected site. It still maintains the imposing repaired structures of the aqueduct, the ruins of the Cathedral of St. George and the church of S. Nicholas (destroyed by dust explosions in 1881 and 1912). A Romanesque chapel was built in the Venetian fortifications, while a large palace in the western part of the city - traditionally identified as the Archbishop's Palace - has been recently restored (also by carrying out significant reconstructions) and is waiting for a new use. Despite three centuries of occupation, the Turks have left relatively few marks on the urban fabric, the most notable of which is a 17<sup>th</sup>-century hammam.

Houses, shops and restaurants have appeared around the old fortifications and official figures show it has a population of almost two thousand people. However, the original town will never be inhabited again and the present heritage safeguarding strategies do not correspond to the needs that a cultural monument, included in the Central Registry of Protected Cultural Monuments of Montenegro as of first category, deserves (European Commission-Council of Europe, 2008).

Moreover, the lower, southern part of the town with the suburban rampart has not been treated and it is rather dilapidated. Ample vegetation endangers the remains of the architecture and makes them almost invisible.

## **2 THE DOGE'S PALACE: A REPORT ON RESEARCH ACTIVITIES UNDERTAKEN**

In this area, along a slope that follows the natural contour of the hill, from east to west towards the Venetian walls, stand still distinguishable the vestiges of the Doge's Palace, so named after an erroneous translation of the original name from Serbian (the correct version should be "the prince's palace"). A politically and economically important family, at least at the local level, in all probability inhabited the

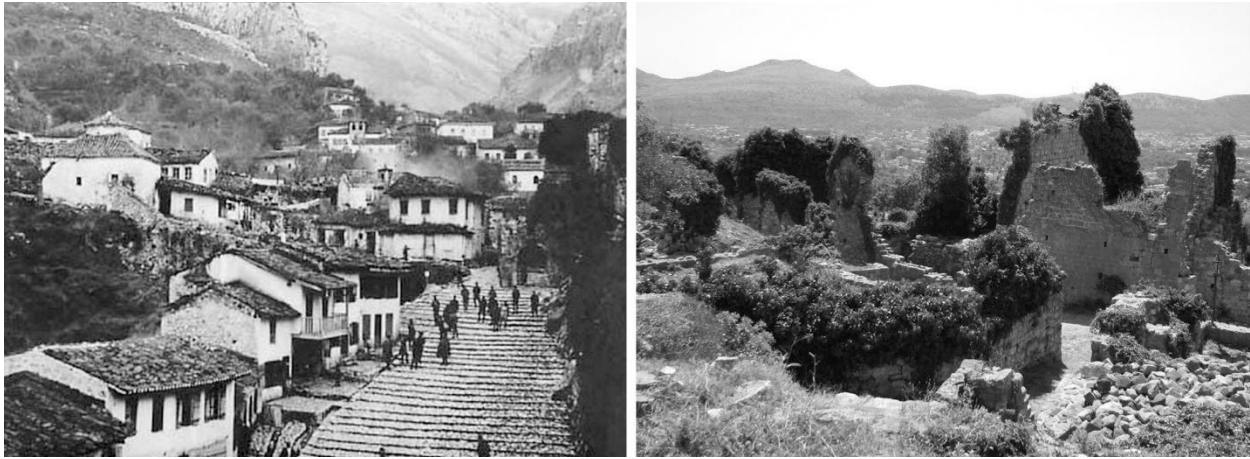


Figure 2: The street around the fortress (1910) and the town the earthquake (1979)

building. The ruins give an idea of the last configuration of the building, consisting of six adjacent rooms connected to each other (Leardi, 2013).

According to Bošković, the edifice called “grand palais seigneurial formé de deux parties rattachées l’une à l’autre” is characterized by a high degree of stratigraphic complexity, the result of countless construction phases as well as of widespread and substantial interventions restoration carried out during the second half of the 20<sup>th</sup> century (Bošković, 1962). The researcher dwelt extensively on it and published several floor plans, sections, and photographs that constitute today a very useful database on the state of the building before the earthquake of 1979 and of the subsequent restoration works that have greatly compromised his structures’ legibility. Another particularly eloquent testimony are some historical images including a view of the 1860 Italo-Albanian photographer Pijetro Marubi, in which the building still appears in good condition.

The palace was also investigated during the first archaeological mission in Stari Bar carried out by the University Ca' Foscari of Venice, then continued during the campaigns from 2007 to 2012, which allowed to acquire significant new data on its intricate evolutionary process. However, the partial preservation of the outer walls and the total absence of shell and interior stairs, made particularly complex the stratigraphic analysis of the building and the reconstruction of the related sequences of construction. Considerable uncertainties remain in relation to the exact ground plan and function of some environments, especially for the earlier periods, because some of their parts (even large), are lost or have been replaced by masonry relating to subsequent periods (Leardi, 2013).

More recently, to better understand the events that have affected this multifaceted architectural artifact, a team from the Italian Universities of Enna and Bergamo, directed by the authors of this work, conducted an in-depth and multi-scale survey (from the whole town to the most interesting and in-danger blocks and buildings), by combining traditional techniques for metric and material-pathological recognition with the most innovative laser scanning activities. This program aimed at improving the knowledge of the town: a preliminary and indispensable process for the formulation of a proposal for its conservation and enhancement. This paper reports, by way of example, the experience carried out on one of the most fascinating and in distress building: the so-called Doge’s Palace.

### 3 SURVEY ACTIVITIES: METHODOLOGY, APPROACH AND FINALITIES

The specific characteristics of the Doge's Palace - an architectural object not particularly complex, but full of irregularities - has suggested using laser scanning technology as the basic methodology for the survey’s activities of this building, even if by integrating it with the direct survey. The possibility of using an instrument with small size and relatively lightweight (only 5 kg) allowed to operate in a completely non-invasive way and considerably reducing acquisition time.



Figure 3: Laser scanning activities on the Doge's Palace

This approach was chosen because laser scanning technology allows surveying following a “global” approach that reflects the needs of knowledge from two different but converging approaches: the one of conservator and that of the archaeologist. The first needs to acquire data on the monument in its entirety that should be also metrically correct and translatable into plans, sections and axonometric views. The purpose is “to bring to light from a masonry wall, often incomprehensible at first sight, an exceptional series of documents, all of guaranteed authenticity”. So ensuring “that intimate and total knowledge of the monument useful to study in depth the consistency, noting characteristics and particularities (alignments, wall thickness diversities, discontinuities, variations - even infinitesimal - in the wall surface) that would otherwise escape. Peculiarities that are always indicative of some artistic, historical and chronological or even simply constructive thorny point that should not be underestimated and that, however, must be solved” (Carbonara, 2012). The survey provides, therefore, the restorer with the opportunity to understand and express relationships between the parts of the building, allowing a quick reading and a comparative overview of the study object, and to better evaluate degradation phenomena, and analyze the crack pattern, representing them on a precision sport.

The archaeologist, however, is more interested in the recognition and dating of individual parts of the building (possible even through schematic plans often illustrative of the true geometry and/or rectified photographs on which to recognize and indicate the stratigraphic units) allowing to retrace the succession of construction phases. In the archaeological analysis, the idea of architecture as a spatial organism is rather limited because, traditionally, the planimetric vision of buried stratification appears more enhanced than the verticality and above all the three-dimensionality of a building as a whole. A very common approach from which it is necessary to break away because “the floor plan often receives an unbalanced attention compared to other forms of graphic representation. It is not treated only as a form of graphical documentation, usually a horizontal section just above the floor. The floor plan has become a mental category that tends to monopolize the attention of scholars, perhaps because the archaeologist is trained on the excavation of demolished structures, of which only the foundations often survive, and where the plan is the only form of graphical documentation possible”(Brandt, 2012). Laser scanning survey, as well as to ensure the completeness and detail of information “both in plan and elevation”, requires an approach to the monument through considerations made on the point cloud, and then on the volume as a whole.

The high acquisition speed and greater accuracy of measurement of new instruments allow greater precision in the survey (particularly if compared to traditional methods). A more accurate survey can also explain constructive irregularities of the building, which cannot always be considered the "degradation" of project idea due to the imprecision of construction yard. The process of rectification, often performed in the graphical representation of structures - that are in fact devoid (or almost entirely) of straight walls or strict symmetries (due to a need for simplification of measurement activity and to the influence of the operator in subjectively interpreting the geometry of the monument) - is, in effect, misleading.

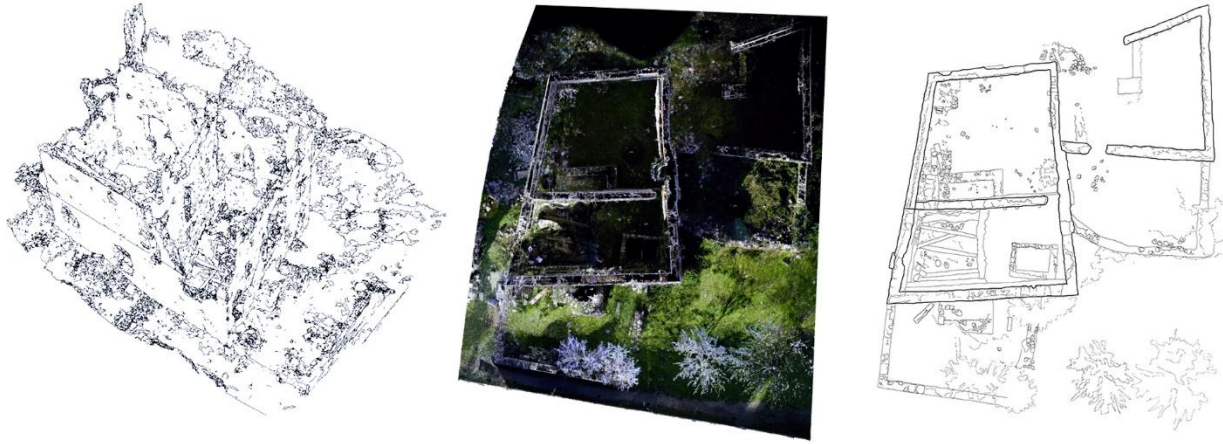


Figure 4: Axonometric view, ortophoto and 2D drawing (plan) obtained following laser scanning

The laser scanning offers, when used to survey arrhythmical and intermittent architecture, an undeniable ease in drawing orthographic projections allowing to valorise the irregularity, both in plans or cross-sections and volumetric representation: an opportunity certainly not marginal or worse, to be discarded, but rather a feature that must be grasped and appreciated. In addition, the ability to overlay transparent sections (horizontal and verticals, exteriors and interiors) allows functional interpretations of the building and construction-technical considerations hardly highlighted by a traditional survey.

The point cloud is, also, an immense database that can freely be investigated, according to new research paths and even a posteriori. Such a data set can be seen an irreplaceable ally for the researcher, archaeologist or restorer, as it allows performing, on the 3D model obtained, the virtual analysis of the detected object in terms of volumes, sizes and weights, and centers of gravity, making comparisons between different files of the same object obtained from measurements far apart in time, verifying the state of conservation of the property and still monitoring the possible future damage due to external agents. Finally, it permits the full documentation of the relationship between storage buried and aboveground structures, a weak aspect of archaeological practice. Based on these assumptions, 3D scans were performed with the instrumentation Faro Focus 3D and aligned thanks to recording networks created by means of checkerboard paper targets. The small space between each station - always less than 5 meters to secure the optimal automatic detection of objects at the chosen laser scanner solution - i.e. 1/4 of the maximum one and a quality of 4x - has resulted in a very dense final point cloud with limited occluded areas. During every scan were acquired approximately 43.000.000 points at times slightly higher than 9

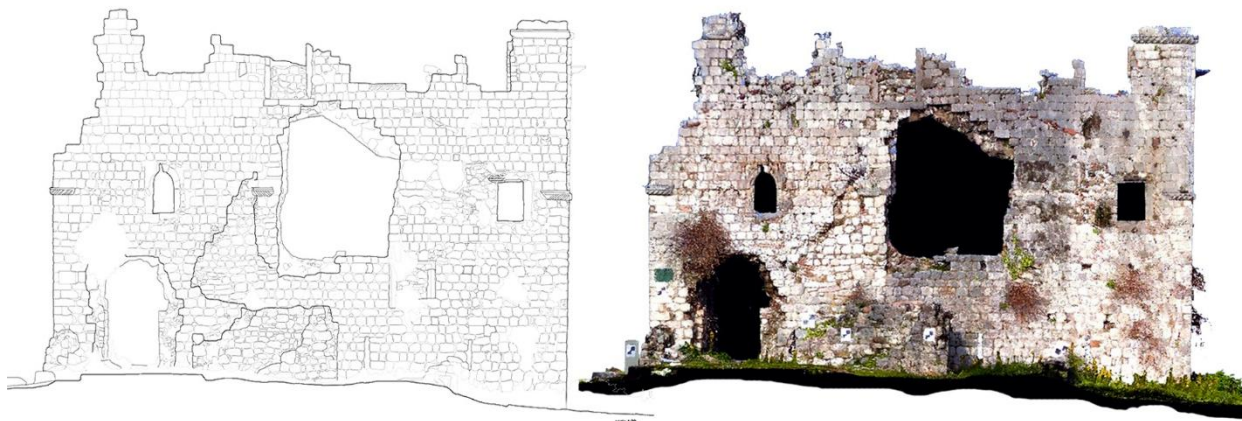


Figure 5: The main façade of the Palazzo del Doge (CAD drawing and ortophoto)

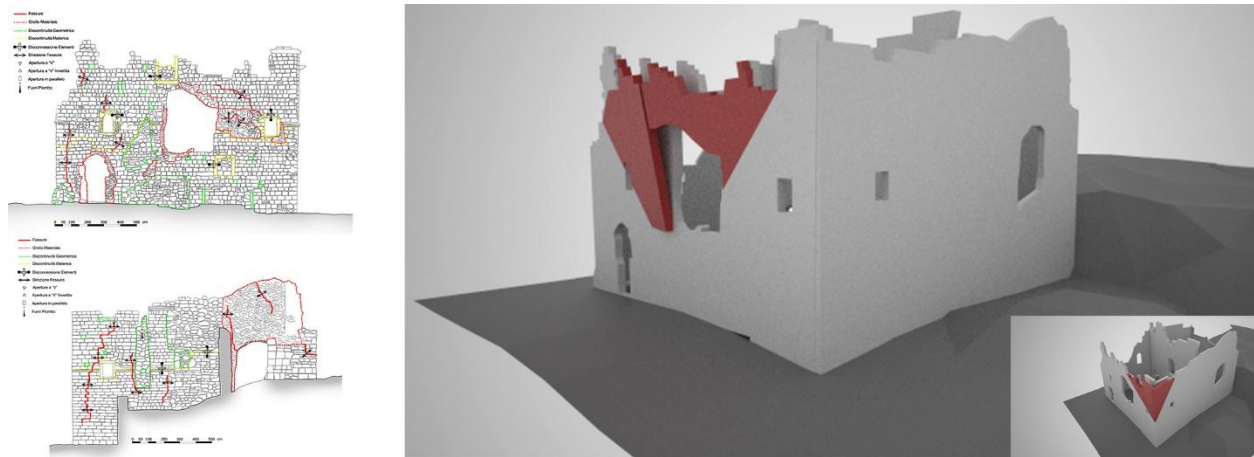


Figure 6: Structural analysis and crack pattern

minutes (including color data).

The subsequent operational phases allowed to obtain textured 3D models from which high-resolution orthophotos (at the nominal tolerance for vectorial representations of 1:50), necessary for the rendering of top and plan views, elevations, longitudinal and transversal sections to describe the structure as a whole and all of its structural components, were obtained. The orthographic projections produced were subsequently "reworked" in accordance with established practices of 2D graphics in order to get images allowing a more clear and defined reading of degradation phenomena (and in general of the status quo of the building) while not altering the veracity of colors, materials and geometry.

The 3D model and the 2D views were used to undertake an extensive analysis of the construction (masonry techniques, especially) phases. The virtual reconstruction of the exact building's morphology and the in situ investigations have permitted to carry out laboratory tests in order to analyze the static and dynamic behavior of the building and to propose a strengthening intervention.

#### 4 CONCLUSION

This experience intends to highlight how much remains to study about this amazing site. Almost 50 years later Bošković, in September 2013, an updated and highly accurate planimetric view has been finally produced by the authors of this work, at the request of the University Ca' Foscari of Venice. If a lot has been done in terms of archaeological excavations, only recently, even thanks to international cooperation, new studies have been undertaken, at urban and architectural level. In a multidisciplinary perspective and from the general to the particular, Stari Bar is being investigated, with the aim to set/improve the necessary safeguarding, risk assessment/mitigation and enhancement plans.

Properties submitted on the Tentative List of UNESCO in 2010, the Old Town of Bar actually needs the establishment of a complete and exhaustive management strategy based on a long run vision and on a virtuous integration between conservation and valorisation, which today seems missing. Much architecture is still ruined (about 600). Not only there is a great risk dependent on natural factors but also an agreed and clear solution on the revitalization of Old Bar and its future purpose still does not exist.

Yet this sleepy town, "constitutes an exceptional archaeological testimony to the historical antiquity of the town and its architectural values, as well as a specific example of relocating the life from inside the town walls to the seashore" (UNESCO, 2010) and for this reason needs to be safeguarded and enhanced. There is no doubt that such a program would guarantee the transmission of this important legacy of the past to future generations; a correct knowledge, appreciation and enjoyment of the public could also lead to the development of the entire region.

## 5 ACKNOWLEDGEMENTS

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