

New Technologies for the Preservation, Conservation and Enhancement of Verona's UNESCO Heritage: The Walls

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Abstract

The Veronese fortified site, a UNESCO heritage site, has in recent years been the subject of important digital documentation, unique in the Verona area. The research was an opportunity to verify a process whose technological developments in the field of heritage documentation have offered significant opportunities for the survey of architecture both in the metric data acquisition phase and in representation and dissemination. The study is part of the research project "*Verona Fortificata*", born in 2015 thanks to the collaboration between the Universities of Florence and Pavia and the Municipality of Verona. The aim is to focus on what has been obtained from a sort of "resulting product" of the classical survey and the consequent possibility of its use to provide preliminary but essential data for the Municipality's assessment of the actual Buffer Zone of the UNESCO site, of the visual impact of both the monument and the extraneous elements that are nevertheless part of the context.

Keywords

Digital-survey, Fortifications, Walls, UNESCO, Verona.

Development of the Veronese territorial scenario between history and geography

Monumental works that form a repertoire of almost two thousand years of the history of fortification art are still visible in Verona's urban space. Contrary to what happened in most major cities in Italy and Europe, where the city walls made way for ring roads or to allow for the expansion into new quarters, in the Scaligera city the historical characteristic of a compact nucleus delimited by precise boundaries was not lost. Even today, the remains of the Roman city, the perimeter of the Scaligera walled city, the bastion structure of the Venetian fortress, and the grandiose layout of the Habsburg stronghold, the cornerstone of the Quadrilateral, remain imposing. The city walls, in their final layout, are over 9 kilometres long and occupy almost 100 hectares with their works: towers, washers, bastions, moats, embankments. The Veronese defence system is an imposing complex consisting of various elements arranged in the hills and plains around the city of Verona, constituting not only an extraordinary typological catalogue of military architecture and its development but also an urban apparatus and landscape that is practically unique in the world. This stratified defence system constitutes one of the cornerstones on which the UNESCO declaration of the city is based, expressing an international historical and cultural significance waiting to be fully rediscovered and enhanced. It should be noted that despite being Heritage since the beginning of the new millennium, due to mismanagement, it is still largely unknown to most

of the Veronese. In the past, fortifications have represented, together with the Adige River, fundamental elements, conditioning and being conditioned by the development of the city in the five main historical phases¹ of the fortified system. They are elements of the city's DNA, of its historical stratification, due to the particular geographical position of the Scaliger capital: a median territorial crossroads between the western plains and the Alpine connections, with the river acting as a natural defence. Here geometries and distances are recognisable signs and are part of a territorial design in which Verona's fortifications are elements of identity: "they are defensive works that have immense properties. They represent an important component for redesigning the landscape and fruition, if appropriately oriented" as described by urban planner P. Galuzzi, a professor at La Sapienza University in Rome.

In the 1990s, local associations and Legambiente began cleaning, protecting and raising awareness of this material and intangible treasure; specific studies, research and proposals followed. Since 2012, a valorisation agreement has been in force for the transfer to the municipality of large parts of the magisterial walls and other assets of the fortified system. Only 5 % of the assets have been transferred due to a number of issues involving abuse and private use. Between 2018 and 2019 a memorandum of understanding was signed with the Agenzia del Demanio (State Property Agency) to promote the recovery of a series of public properties, testimonies of the city's defence system. Recently, the document Verona 2030 - Diffused urban regeneration, urban and environmental redevelopment contemporary uses, which envisages a cycle of transformations with Variant 29 to the Plan of Interventions. Within these processes, an agreement between the Municipality and the University aimed at awakening the complex situation was inserted in 2016.

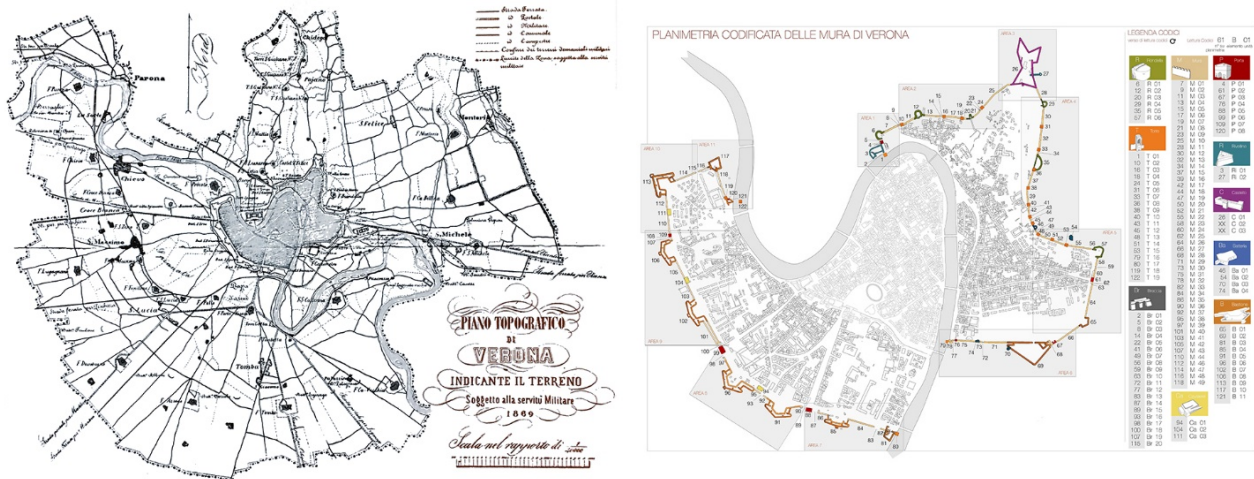


Fig. 1 On the left the Topographical Plan of Verona showing the land subject to military servitude in 1869. On the right the codified plan of the walls of Verona carried out for the survey project.

The survey as a tool for understanding Verona's walls.

Through a close collaboration between the University of Florence and the University of Pavia, in May 2016, in agreement with the Municipality of Verona, an important research project was launched, for the first time in the Verona area, involving the cataloguing of the entire fortification complex of the city of Verona for its digital mapping and knowledge². Starting with the TLS survey of Porta Palio, a monument of known Sanmichelian

origin, other sites of equal value were also involved, such as Porta Nuova, for which a careful study was developed, in collaboration³ with students from Shanghai University and the Department of Civil Engineering and Architecture of the University of Pavia, to manage data and a detailed picture of the monument's condition, highlighting any critical issues in view of possible restoration. This was followed by Porta Vescovo and Porta San Zeno, where a three-dimensional regeneration project was launched for the virtual fruition of the complex for the purpose of dissemination, but also for the purpose of a registry useful to technicians for the study, analysis and conservation of the monument's architectural, structural and masonry heritage.

Lastly, a survey project was developed for the sections of the walls to the east and west of Fort San Felice in order to census and collect cognitive elements of certain portions of the wall system, which is composed of a variety of typological categories (archaeological, functional and historical), not only the curtain walls, but also forts, barracks, turrets and powder magazines. Specifically, the consultancy with the Universities of Florence and Pavia focused on proposing not only a simple, albeit very important, documentary survey activity, but also devising a broader concept for the use of this data, through the design of a dedicated site where all scientific and notional information could be accessed in digital form, the creation of a three-dimensional database that could not only explicate the landscape relations between the various architectural complexes and the surrounding area, but also serve as a useful support for the development of management, planning and study tools for subsequent recovery and redevelopment work connected to the various monuments of the walls that are currently in a state of decay or abandonment. This material can therefore serve as a guideline, useful for the preservation and enhancement of the city walls, to be applied in an overall vision, as well as directing events and initiatives involving these spaces to activities that are in line with the sense and identity of the monument.

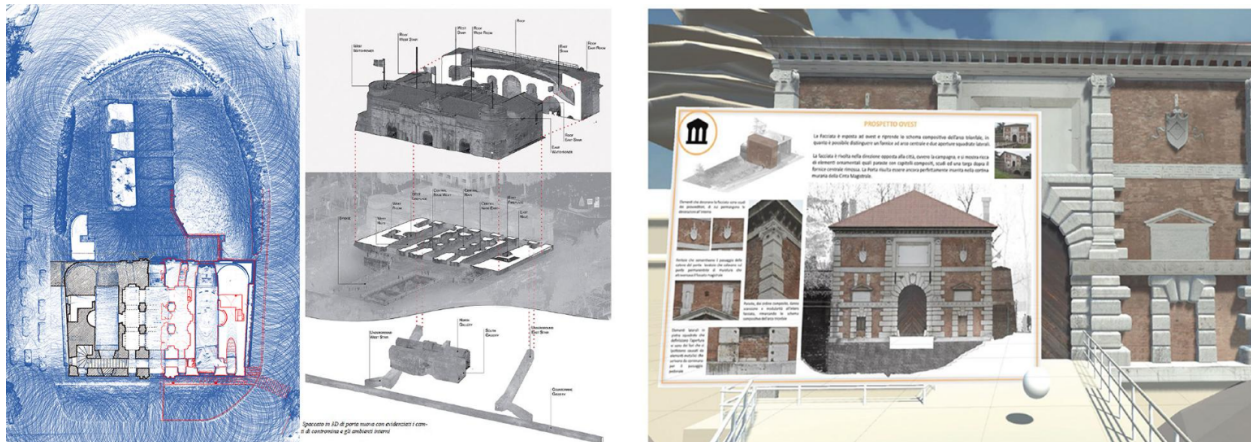


Fig. 2 Left: the superimposition of a survey using TLS and SLAM. In the centre the 3D cutaway of Porta Nuova. Right: Virtual Tour development of the survey project carried out on Porta San Zeno

Hypothetical evaluation for a 3D system of the Buffer Zone in Verona

The Veronese context, today more than in the past, needs a long-range view of what its walls, which crown the scenic front, may be in the coming decades. After a careful study of the Verona area, it became evident that the urban part, on the right bank of the Adige River, is the most 'vulnerable' in our days from the point of view of a criterion of constraints for future constructions, since within it, between the bends of the river, there are numerous criticalities in the current Buffer Zone, from the point of view of scenic protection, as it is structured

today. In fact, over the years, the Veronese enclosure has been surrounded by asphalt and cement, which have made the current Buffer Zone a zone of mobile traffic on four wheels rather than a buffer zone, where smog and the desertification of the area from activities of rest, relaxation, as occurs outside the Lucchese enclosure⁴, has degraded, over time, this extensive 10 km perimeter. Public gardens are sparse, not always safe, and alternate with sports centres, which visually 'clutter' the walls behind them, and concrete squares, which have become unattended car parks. As a result of these problems, it is clear that the current buffer zone is not therefore created with a homogeneity of intent. In particular, it should be considered that the study carried out for the creation of the current buffer zone was approached bi-dimensionally, without questioning all those features, mostly vertical, that, as in the case of Florence⁵, may compromise the scenic view of the heritage to be preserved, represented in our case study by the Veronese city walls, the perimeter of the Core Zone. With the aid of the experimental survey methodology, given by the SLAM technology, together with what has been obtained from the aerial photogrammetric surveys, by means of UAV instrumentation, it has been possible to use the data obtained also in an urban planning function in order to investigate all those environmental and qualitative characteristics of the surrounding area immediately close to the walls. All these data can therefore be used with a well-studied system and organised in a coherent manner with a documentation structure that can provide preliminary but essential information for the evaluation by the Municipality, as well as the Administration, of the current Buffer Zone according to the concepts of visual impact of the monument, of the elements that are extraneous to it but are part of the context, impact of the vegetation and above all of the maintenance or cultivation criteria, if there are cultivated areas. Our work is therefore structured with model cards that report the essential data, environmental sections of the critical or areas of interest, thus giving the opportunity to see in 3D what is urbanistically seen in 2D. The specific map obtained from this file was superimposed on the current Buffer Zone drawn up in 2015 by the Municipality of Verona website, determining, where a difference appeared, the causes that led to that representation. The different environmental sections obtained in fact report the current state of the usability of the walls, giving the possibility to manage the heights of the buildings, deciding a useful distance and establishing a 3D criterion corresponding to the visual height towards and from the walls. The development

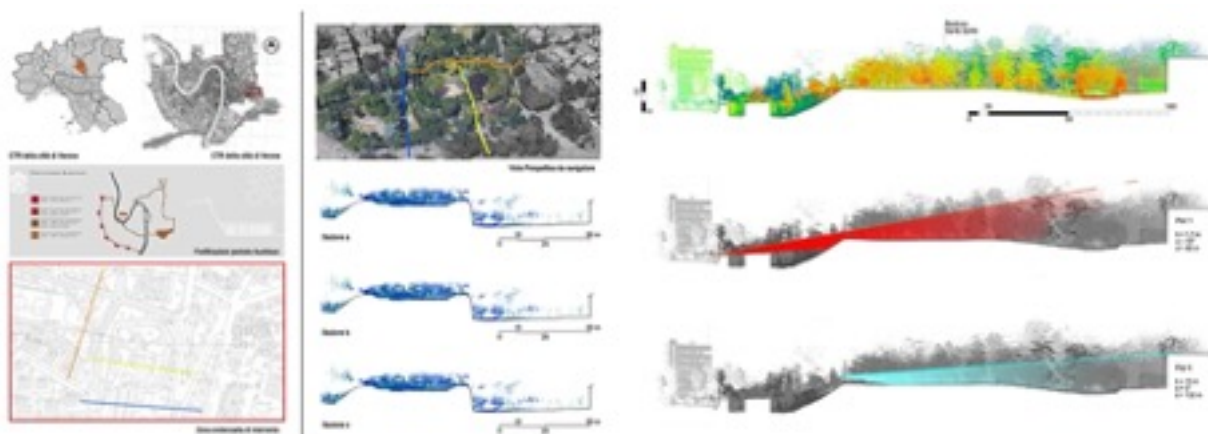


Fig.3 Model sheet of the study in three dimensions with detail (left) of the cones of vision to and from the walls

of this research, therefore, intends to be the realisation of a hypothesis of intervention to complement and control the one currently in force, in order to better manage a common good such as that represented by the walls of Verona, an exceptional symbol of the concept of the fortified city, which has developed in several characteristic stages of European history. Recalling what is one of the tasks of the UNESCO Management Plan and that is to study the correctness of the Buffer zone, with part of the results of this research, we are now in a position to hypothesise a valid positioning of the Buffer zone, which will be a useful contribution, in order to consider the right criteria that must be followed by applying a Ruskinian diktat according to which it is the power of memory and remembrance, inherent in the historic city, that is the reason for our Heritage.

Research perspectives

The careful operation of surveying and the consequent operation of synthesis, proper to the phases of restitution of metric and qualitative data and of the character of the place, must therefore tend, through opportune elaborations, to the definition of the qualities proper to the urban image of a given context. Within this framework, the close correlation between survey moment, cognitive moment and recovery programme is evident. The main idea of the project is the possibility of investigating and recognising all the characteristics going to make up the urban image of the walls and fortifications of Verona and the set of relations that exist between the individual elements of the fortified complex, gates, ramparts, walls, buildings and the urban context surrounding them, also in perspective of new interventions. The creation of extensive documentation of the UNESCO monument by means of an accurate survey system also constitutes the basis for the realisation of an extremely useful scientific investigation to support the public administration in the integration and adaptation of the current regulatory apparatus for the adequate conservation, coherent development and possible valorisation of a specific historical centre such as that of Verona. Therefore, the programme for the recovery and exploitation of the historical settlements envisages the production of a preliminary phase of analysis and census for the creation of a database for the specific knowledge of the value of the artefacts with a view to their conservation and appropriate use. The multidisciplinary approach that has characterised the work made possible to develop a path of research and innovation, a methodology that can be replicated in contexts and

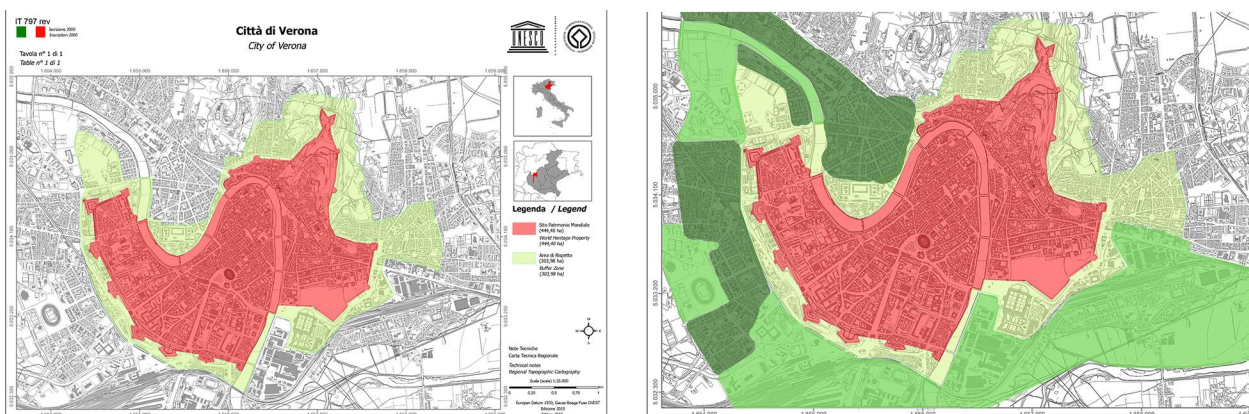


Fig.4 On the left the current Buffer Zone, on the right the hypothesis developed after careful study.

places other than those in which it has been experimented, becoming a fundamental point for research on historic fortified centres in general and with advanced tips on the themes of landscape protection that are part of the Heritage. Giving value to the characteristics of local architecture and carefully studying, cataloguing and preserving these testimonies of the past means making organised and well-structured information relating to different historical moments accessible in order to highlight their specific value in the urban context of the place: critically organising and disseminating knowledge provides visitors, historians as well as technicians, but also inhabitants and regular visitors to the city streets, with a consolidated picture of the historical value not only of each single artefact or monument but of the entire urban and social fabric of the entire capital of Verona. A particular output of the project was the processing of the 3D point cloud of survey data that provided the opportunity for evaluations of the space, the monumental parts of the fortification, and the environmental and built context constituting the space in which the artifacts of historical interest currently live and are enjoyed. These records can be organized coherently through a documentation structure that can provide preliminary but essential data for the evaluation and monitoring of the current UNESCO site buffer zone. In particular, it is possible to structure a system for monitoring the visual impact of the monument and any changes that could further impair the visual usability of the large complex of fortifications. By adopting this type of instrument, flanked by a cogent regulation by municipal urban planning instruments and protection regulations, it would be possible to carry out the planning for the redevelopment of certain critical areas as well as to prevent or possibly mitigate the effect of the new introduction of elements extraneous to the monument especially in the context of its now-historic context. The impact of the entire set of green areas surrounding and coexisting with the fortified perimeter and which are now part of its context could also be more appropriately evaluated, and above all, the criteria of maintenance and new planting of these areas could be optimized in relation to the possible improvement of the usability of these areas, contextually to the control of the visual impact on the established image of the Veronese wall circuit.

¹ From Roman times, through the Communal, Scaliger and Venetian periods and ending under Austrian rule.

² In February 2017, the General Assembly of the Beni Italiani Patrimonio UNESCO association was held in Verona, where it was reaffirmed that Verona, at least for now, does not run the risk of 'rejection', a fate that could actually be different if actions are not pursued to conserve, promote and enhance this heritage, but on the contrary, actions are implemented that run counter to these principles, risking losing the UNESCO title, as has happened in other European situations, such as Dresden.

³ International Workshop on Survey and Analysis for Restoration 'Digital Documentation for the Study of the Defensive System of Porta Nuova'.

⁴ Cfr. PIETRO BECHERINI, *Le mura di Verona. Il rilievo digitale per la tutela e valorizzazione del Patrimonio UNESCO*, 2019, pp. 252-260.

⁵ Cfr. MARCO BINI, CAROLINA CAPITANO, CARLO FRANCINI, *Buffer Zone, l'area di rispetto per il sito UNESCO Centro Storico di Firenze*. DIDA - Dipartimento di Architettura. 2015. pp 23-76.