OPERATIONAL APPROACHES FOR RECONSTRUCTION IN URBAN CONTEXTS

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Abstract. Urban landscapes embody the relation between continuity and transformation. Architectural projects must actively engage with pre-existing structures to bridge different historic layers along with the enhancement of monumental heritage, thereby facilitating the ongoing evolution of society. Within this conceptual framework, the paper interrogates the spatial domain of urban reconstruction, specifically examining the role of ruins when operating on the recovery of physically perceptible forms and elements of the city. The study focuses on ruins resulting from "anthropic" aggression, such as war or terrorism, where total destruction replaces poetic aesthetics with the raw evidence of trauma. The paper will discuss two different operational approaches in urban context: reconstruction as reintegration of a monument in a living and active urban environment and reconstruction as safeguard of ruins and surviving traces, treated as narrative monument. These paradigmatic approaches will be tested along with the discussion of two cases occurred in Verona, Italy, after WWII: reconstruction of Ponte Pietra and the recomposition of the surviving facade of St. Sebastian church. Through common analysis tools and a coherent narration, the paper identifies and investigates two model of interventions for reconstruction which aim at recomposing a complete architectural form, reaching a community-aligned result.

Keywords: Verona, Ruins, Memory, World-War II;

Introduction

A renewed awareness on loss of architecture and civic environments shapes the latest role of reconstruction. When tackling the complete understanding of cities and urban landscapes, reconstruction reveals what such contexts offer in terms of value, memory, perception, and knowledge. These fields constitute vivid resources which, although originated from heterogeneous principles at different times, have taken on precise character and morphology. In particular the need for such cultural permanence is felt vivid when compared to destruction brought into urban contexts by war-related attacks and events. The search for a sense of continuity and formal identity may be achieved by the work of reconstruction when dealing with the specificities of urban contexts, such as the presence of dense fabrics and open-air relation spaces, along with the co-existence of a built palimpsest. Despite such conceptual complexity, the paper aims at framing the topic within the spatial domain of the urban context. First a discussion on the main issues related to reconstruction in urban context will tackle the impact of such kind of project in a contexts characterised by the necessity and the will to remain active for its crucial role in actualize the sense of community and common living within the public environment that may be affected by war-related events which led to the loss of form; in such debate the paper will then focus on the results of reconstruction occurred in Verona, Italy, at the end of World-War II. Verona is a prime example of the widespread destruction occurred throughout Italy after the war. Due to its strategic geographical position, which remained important until the end of the conflict, the city was attacked and bombed by both Allied and German forces, with the most destructive attack occurring on the last day of the war. The depth of the destruction that affected the city and its urban fabric led to a reconstruction process aimed at restoring a coherent urban landscape that respected the existing fabric. From this perspective, the discussion of the Verona case is timely in the debate on how to intervene in the urban fabric, which cannot be reduced to simple musealisation or scientific delimitation but must be part of a broader process of cultural and civic reactivation.

Reconstruction framed within post-war event recovery

The sense of displacement caused by the interruption of experience can be averted by interventions guided by a full awareness of the environment made of symbols of culture and characterised by continuity in time and space. The project must recognise and elaborate the central role of pre-existences in order to maintain historical and spatial links and contribute to the construction (and re-creation) of culture over time. The balance of architecture between the will of the spirit and the necessity of nature, in a dimension in which the tension between the upward-tending soul and the downward-tending gravity are equivalent, is broken when a building falls into ruin, resolving the environment in favour of nature (Simmel, 2006). Ruins are poetic objects, their presence in the architectural landscape is now a widely accepted and investigated. Despite static appearance and traumatic origins, ruins are the result of external and extraneous actions that make architecture, on the one hand, intangible, while, on the other, tenacious in its will to resist erasure. Ruin represents the extreme outcome of a construction that, due to a slow process of abandonment or a sudden destructive action, can no longer be brought back to its original unity. Far from being the result of a simple disintegration or a useless accumulation of rubble, it highlights creative power of form (Ercolino, 2006). The main distinction between ruins and rubble may be traced back to temporal and formal issues. In fact although both are the result of architecture's loss of form, rubbles accumulate in recent history, whereas ruins emerge from the past. Even if both ruins and rubbles are surviving traces and document of an event, the former are endowed with a remembrance will so that the first hypothesis of intervention is not removal; nonetheless ruins are a trace of relationship, acquired and maintained within a given context. Ruins are simultaneously part of a pre-existing form and, at the moment of its discovery, part of something unknown. Such fragments appear as an accumulation of layers of memory, indeed ruins embody specific collective will and a shared social history. Consequently, reconstructive solutions must be declined on a case-by-case basis, depending not only on the state of the ruin but also on the context of intervention and the purpose of use. Societies create mental images of themselves and perpetuate their identity through generations, developing a system of remembrance within the presence of symbolic forms. When this system fails, due to changed conditions of natural or anthropic origin, whether voluntary or involuntary,

human actions aim to restore what has been altered or destroyed to a state as equal or similar as possible to the previous one. Reconstruction should be considered as an integral part of the architectural process by virtue of a paradigm shift in our understanding of time and the value component of architecture.

Reconstruction in urban context

Among the different possible contexts of interventions, reconstruction in urban environments intervenes on the physically form of the city, both in the dimension of buildings and monumental fabrics both in the spaces of relation between these built elements. The permanence of both dimensions is necessary to guarantee the civic value of the city, not only through the old/new relationship, but also through the full/empty relationship. Reconstruction of ruins in urban contexts are characterised by some precise connotations. First, architectural traces are rarely reduced to their minimal appearance since the object of reconstructive intervention is part of a continuously active environment; nonetheless, because of their insertion within a "socially active" context, ruins of the urban context may also derive from voluntary acts of anthropic aggression (e.g. war related attacks) that leave the asset in a state of almost total destruction. In this condition the vision of ruins loses the poetic and evocative component of an archaeological or naturalistic site and may be brought back to a precise moment in history which may later become the starting reference moment for reconstruction. Reconstruction within the built fabric of the city deals with its organically composed and defined parts that increase the plural sense of the city itself where a dialogue is therefore established between precise architectural objects that conserve a high degree of autonomy due to their original historical matrix. The physical and social conservation of the historical centres is recognized as desirable models of collective life; therefore the conception of urban space as the primary organising element of the urban morphology leads to the awareness that history of the city delivers precise facts, which permit to engage immediate and precise actions in the reconstruction of urban elements such street, squares, and districts;

Some phenomena of architecture may be seen as relevant urban facts which are identified with monuments and find reasons to persist in the city, concerning the value they acquire by their impact on history and memory.

At this juncture, reconstruction projects intervene transversally dealing also with the trauma of post-war regenerative processes, characterised by human tragedy, loss of community, population displacement and loss of roots and traditional culture. Along with the restoration of the architectural form, an attempt is made to remedy the same traumatic event; the formal objective will be as close as possible to the state of architecture before the loss of form with the desire to erase the trauma, to heal a wound in the urban landscape and to reconstruct an architectural image that is part of the collective consciousness of a given context.

Verona

The city of Verona, Italy, exemplifies an urban and architectural asset in which the coherence of the urban image and the persistence of a single, deliberate formal composition remain clearly discernible. Verona offers a privileged field for historical and urban inquiry, where the shaping of identity is both expressed and safeguarded through the definition and preservation of form. The perception of an urban unity finds here a favourable and stimulating ground for verification, since successive layers of intervention have guided the configuration of urban and monumental forms, positioned between the ancient layout and the evolving definition of the modern image of the city, across its urban, peri-urban and territorial dimensions. The discussion of Verona's monumental panorama centres particularly on the significant moment of rupture brought about by the end of World War II and the subsequent years of post-war reconstruction, addressing the examination of two major rebuilding sites, each proposing a distinct approach to restoring the city's monumental image. Verona's image is the ultimate outcome of a process that shaped a monumental and urban palimpsest crossing various phases of construction, deconstruction and reconstruction, mediated by differing approaches to interventions within the built environment. In the frame of post-war reconstruction Verona regained the full system of life and relationships among its inhabitants within the urban space, beyond the simple notion of the city as a mere collection of buildings and walls, and closer to the social and cultural environment defined as the "landscape", in which the architectural presence, though heterogeneous in its historical, geographical and formal traits, remains identifiable and is connected to both its context and its users through a recognised artistic, social, emotional or aesthetic value.

Ponte Pietra

The construction of Ponte Pietra, first stone-built monument, marked the expansions of the original settlement of Verona, when the first inhabitants moved from the top of St. Peter's hill towards the plain below. The bridge's strategic placement and, by extension, the foundational layout of Verona, depended heavily on the Adige River's trajectory and breadth. At this specific juncture, the riverbanks reach their narrowest proximity, and the flow remains consistently calm, a combination that enabled the establishment of vital port and docking infrastructure. Following three distinct evolutionary phases, the bridge entered the 20th century as a five-arched structure, spanning 92.80 metres in length and 7.20 metres in width (Gazzola, 1963, 125). Such structure combined the left abutment from the Roman period with the right abutment the adjacent arch and the fourth pier from the Scaliger period. Finally, the Venetian period introduced the two intermediate arches and the third pier, which a decorative circular roundel now surmounts. After the last outrageous attack by the retreating Nazi forces on April 24, 1945, Verona confronted the destruction of the entire complex of bridges crossing the Adige River. The mined charges did not spare Ponte Pietra, of which only remained the abutment and part of the first and second piers, a few masonry courses of the third pier, the fourth pier and arch, and medieval head tower, located on the left bank. The reconstruction was immediately considered necessary, not only for the functional reasons in crossing the river but also to recompose the entire urban landscape in its most ancient part and return identity and dignity to citizenship. The plan consisted of some consecutive phases: the recovery and study of surviving materials; the definition of the entire design project according to the consistency of suitable elements; the organisation for different logistic ne-

cessities such as restoration phases and new constructive ones; and finally the execution which started on February 4, 1957 (Gazzola, 1963, 148) with the laying of the foundation stone for the reconstruction of the first pier. The first survey and identification allowed a selection followed by detailed reports resuming measurements, characteristics, state of preservation and photographic documentation of the entire panorama of the surviving elements. Superintendent Piero Gazzola's programme for reconstruction aimed at reconstructing the bridge "as much as possible" as it was; in its general principles, the plan compared the formal difference between the state of the bridge before and after the explosion, thus the work was to be interpreted as the recomposition of a topographical, architectural and landscape element essential to the panorama of Verona (Gazzola, 1963, 132) and the programme of works thus aimed at full restoration in volume, line and colour (Figure 1). Given the technical-operational complexity of an intervention with ancient material on such a heterogeneously composed and articulated structure, Piero Gazzola proposed an integral reconstruction, maintaining the formal configuration which belonged to the city image. The greatest commitment of the project, beyond static issues, was to maintain the strict measure on which the compositional values of the bridge as an environmental monument were based. For the reconstruction of the Roman part, the strict scientific criterion of anastylosis was used in order to achieve a reconstruction as faithful as possible to the original. Architects and craft workers used iron rods and clamps, fixed with molten lead, whose chemical-physical composition was adapted to that recognised in other ancient metal elements. First and second arches were then recomposed in a short time, between February 26 and March 10, 1958. A total of 529 original blocks and 279 specially quarried blocks were used for the Roman part, while for the Scaliger and Venetian arches, were selected bricks from the ruins of other city palaces, recovering them identical in shape and colour, and reconstructed with modern masonry, while the stone parts were reopened from quarries that had been closed (Di Lieto et al., 2008, 101).

In this case the reconstruction refuted any prior philological criteria, referring as first stance to the spatial and formal frames of intervention. The overall reconstruction process in fact followed the almost total destruction of the church of St. Sebastian and the reconstruction of the surviving neoclassical façade on the unfinished church of St. Nicolò. The need to safeguard the monument within the urban layout offended by the war leads to invention and adoption of formal solutions that imposed a paradigm shift: it may be considered as an invented façade. The architectural elements were transported and recomposed to protect the facies of the destructed church of St. Sebastian adapted to the unfinished Baroque building of St. Nicolò church. The two churches underwent two separate building processes: the first settlement, overlooking the route of the Roman city's cardo maximus, was founded as an oratory in the 10th century and later enlarged in the Romanesque style. The construction of the first church of St. Sebastian began in 1577, then resumed by Girolamo Dal Pozzo in 1656 and finished only in the first half of the 19th century (Borelli, 1980, 420). The neo-classical marble façade, completed according to a design by Giuseppe Barbieri, was characterised by fluted Ionic half-columns bordered at the top by a grandiose tympanum, completing the façade according to a strict classical symmetry. In close distance, within the historic centre, in 1627, the Clerics Regular of the Theatines order began construction of the church of St. Nicolò (Brugnoli et al. 1980, 237), designed as one of the few cases of Baroque ecclesiastical architecture in Verona. After work interruption in 1683, the church was finally consecrated in 1697 (Brugnoli et al. 1980, 242). The church of St. Sebastian suffered serious damages after bombing of January 4, 1945, that led to the destruction of the entire complex with the exception of the bell tower and the neoclassical façade. Even if the reconstruction of the entire church had been recognised as historically fictitious and not necessary from an urban planning point of view, the recovery of the surviving façade in all its marble and architectural elements was not negotiable. The ultimate decision then was to recompose the façade of St. Sebastian on another building with a similar function and architectural volume: the church of St. Nicolò, which remained unbuilt and was proportionally suitable, also taking into account that, in front of the church of St. Nicolò the urban development plan envisaged the opening of a vast square and the recomposition of the important elements of the façade of St. Sebastian would have enhanced the monumentality of the sacred building (Vecchiato, 2006) (Figure 2, Figure 3). The work programme, outlined in 1951, divided the operations into the two sites of St. Sebastian and St. Nicolò. First operations dealt with the dismantling process while monitoring any further movement of the ruined structures. Later the focus moved towards St. Nicolò site, which underwent works of excavation of soil and masonry at the central part of the façade, in order to host a new foundation. Once the appropriate foundations had been laid, the actual assembly of the façade started with the arrangement of all the parts, and then continuing with the positioning of the marble facing, supplemented in the missing parts with new stone and concrete elements.

Meaning of a study on urban regenerative reconstruction processes

Reconstruction in urban context after traumatic events deals with a high emotional value, symbolically compensating for the suffered damages, while consolidating the equilibrium in the monumental environment, as true symbiosis of innumerable elements. Reconstruction in Verona was therefore immediately set up a reconstruction of the founding elements of the city. The recovery of the vitality related to the compromised environment required the reconquest of the image of the monuments as they appeared before their destruction. Architects and craft workers translated a deep respect for historical value into a reconstruction that strictly mirrors the original form: post-traumatic recovery restored a monument to a state almost identical to its appearance before it was damaged. The rapidity with which the form is lost leads to a project that, just as quickly, finds its true reference in the formal state of which direct experience has been preserved. Reconstruction project in urban contexts centres on built heritage as a pluralistic assembly of values across multiple scales. By leveraging knowledge generated within local communities, prior study phases identify the material historical layers essential for shaping meaningful future projects. Analysing various reconstructive approaches within a shared spatial context, along with a rigorous evaluation of complex data, establishes a rich cognitive framework that fosters innovative design methodologies.

Amidst growing environmental, social, and economic pressures, architects working on built endangered heritage must develop design strategies that interpret urban complexity while simultaneously safeguarding identity and enhancing adaptability.

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Figures.

Figure 1 – Recomposition of the entire urban landscape, photo by Pietro Brunazzi.
Figure 2 – Details of neoclassical facade, photo by Pietro Brunazzi.
Figure 3 – Co-existence of the reconstructed facade and existing fabric, photo by Pietro Brunazzi.

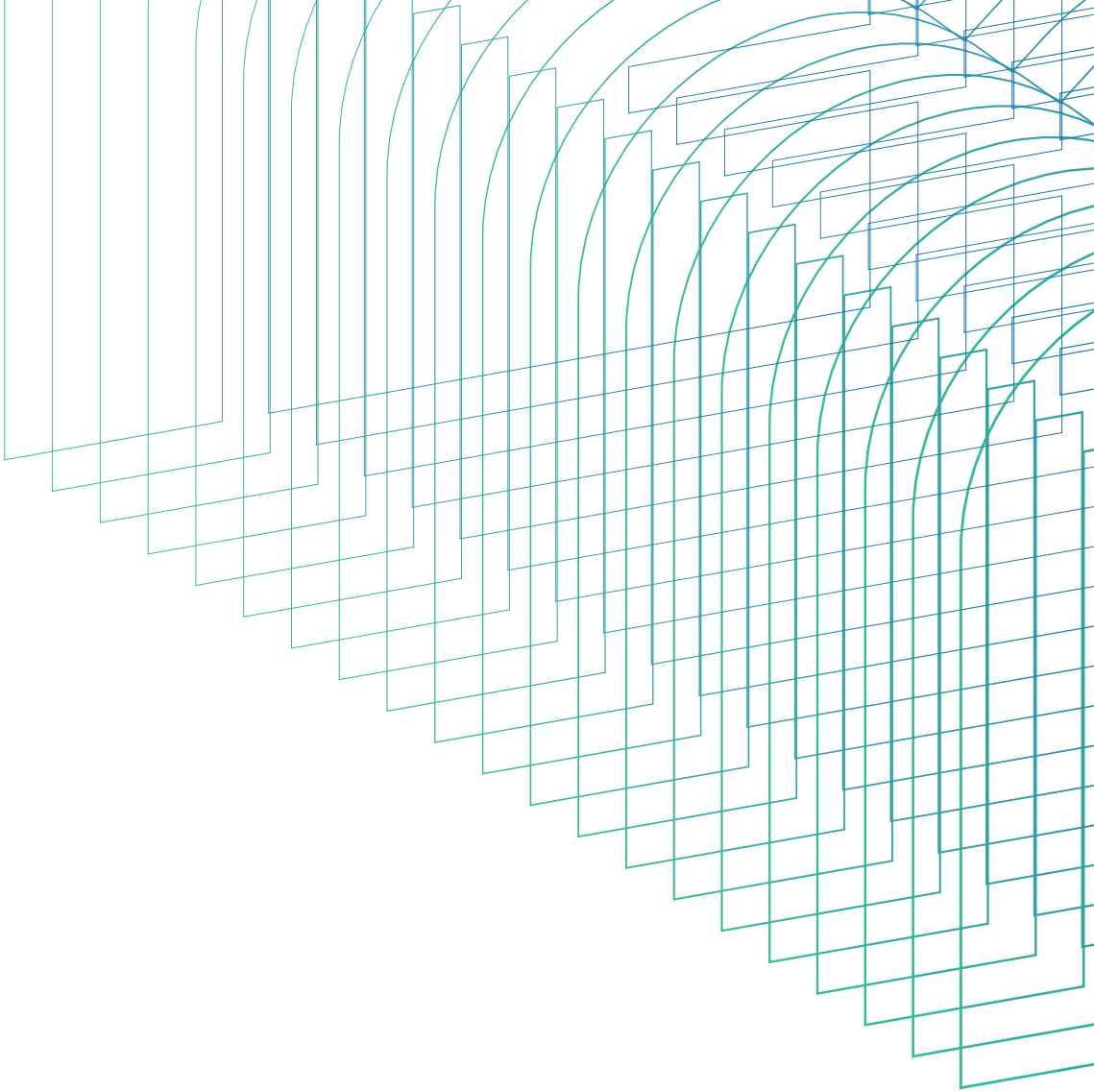


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LOW CARBON CLAY-BASED PLASTER FOR EARTHEN BUILDING CONSERVATION

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Abstract. Earthen heritage represents a cultural and environmental resource of considerable significance, particularly in regional contexts such as Piedmont, Italy, where numerous vernacular buildings using traditional materials are still preserved. However, the fragility of these structures and the limited availability of technical knowledge constitute significant challenges for their active conservation and valorisation. At the same time, the need for decarbonization in the construction sector calls for a reconsideration of traditional materials and techniques in response to current environmental challenges.

This study is part of a research project conducted by Politecnico di Torino that aims at investigating the potential of earthen plasters for both the conservation of built heritage and new building applications. Several plaster formulations were experimentally tested and some of them were enriched with corn cob due to its insulating properties and regional availability. The paper focuses on the environmental impacts of six plasters assessed through a Life Cycle Assessment (LCA), considering modules A1–A3 (cradle-to-gate) from raw material extraction to the packaging of the final product. Direct data were combined with secondary data from Environmental Product Declarations (EPDs) and literature.

The results shows that plasters containing hydrated lime exhibit the highest Global Warming Potential (GWP), while clay-based formulations have significantly lower impacts. Plasters stabilized with gypsum present intermediate GWP values and demonstrate the best environmental performance when considering both sustainability and potential mechanical improvements. Corn cob inclusion increases GWP but may enhance thermal performance, offering potential benefits during the building use phase in terms of energy efficiency and comfort.

These findings highlight that combining agriculture by-products such as corn cob and clay allows traditional construction techniques to be reinterpreted through a circular economy perspective, strengthening the link between innovation, local identity, and sustainability.

Keywords: earthen heritage, plaster, corn cob, LCA, local materials, clay.

Earthen heritage and environmental sustainability. Widely spread in many countries all over the world (in 2023, 167 out of 1157 cultural properties inscribed in the World Heritage List have earth structures), earth constructions represent not only a thousand-year tradition, but above all, constitute a testimony of knowledge, skills, habits of the peasant civilizations. In the early Eighties, one third of the world population was estimated to live in earthen buildings. More recently the United Nations statistics, taking into account urban and rural settlements even of new realization, underline that this datum is under evaluated and it is more correct to assume an amount of about 50% (Guillaud, 2008). Unfortunately, the progressive abandonment of earth construction techniques and the loss of connections with modern civilization have led to the deterioration of lots of earthen heritage.

Since the beginning of the seventies of the XX century, the spread of a renewed interest in earth buildings (thanks also to initiatives of organizations such as ICOMOS, which in 1972 organized the Premier Colloque International sur la Conservation des Monuments en Briques crues) promoted the rediscovery of this valuable architectural heritage by encouraging the study of methodologies aimed at fostering its protection and ensuring its conservation over time. As for the Italian territory, the desire to define concrete actions aimed at safeguarding this heritage was manifested by both researchers and public authorities through the development of investigation campaign, the organization of meetings and conferences, and the issue of regional laws, such as 17/1997 in Abruzzo and 2/2006 in Piedmont (Bertagnini et al., 1999; Mattone, 2010; Bollini, 2008; Fratini et al. 2020). Highlighting the value of this heritage, actions were carried out to promote its conservation and enhancement and to actualize knowledge and construction techniques in a perspective of economic-cultural sustainability and environmental compatibility.

Earthen heritage represents a cultural, architectural and environmental resource of considerable significance. Unfortunately, earthen buildings are often abandoned because considered unhealthy and unstable, but, above all, because incompatible with the concept of modernity which people aspires to. The lack of maintenance, the execution of inappropriate interventions together with the fragility of these structures and the limited availability of technical knowledge constitute significant issues for their active conservation and valorization. The earthen heritage is a cultural testimony of the past but also a source of knowledge and valuable know-how for a new sustainable architecture.

The protection of the built heritage, transfer of knowledge concerning material and construction techniques and development of preventive conservation intervention are fundamental actions for the safeguard of the earthen culture. The preservation of historical earthen buildings, but also the relaunch of the use of earth in contemporary architecture implies the development of components and appropriate intervention techniques in order to minimize and, if possible, prevent any alteration which may compromise them over time. Although specific measures were and are still adopted to ensure its effective protection against weathering (such as stone foundations or roofs particularly jutting out), constant maintenance is required and the adoption of protective layers is needed.

It is a widespread practice to apply plasters in order to guarantee protection of earthen structures. Today, as well as in the past, different types of plaster are used: earthen plasters, not very long lasting and therefore needing frequent maintenance interventions, lime plasters or cement plasters, more durable but not compatible with the earthen walls [9]. In the last few years, tests have been carried out in order to identify suitable