

Urban fabric, construction types and the art of city-building.

Approaches and methods for post-earthquake reconstruction plans.

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ABSTRACT

This paper focuses on describing the contents of Reconstruction Plans for the historical centres of Villa Sant'Angelo and Fossa as urban projects. In spite of the specificity of the two cases presented - different from each other in terms of starting condition, the level and extent of damage and the intrinsic qualities of the urban fabric - it emphasizes the methodology defined and used for the formation of management tools for post earthquake reconstruction.

The plan decisions derive from in-depth analysis and research carried out on both these centres aimed at defining intervention categories and guidelines for reconstruction and for preserving the local

characteristics of buildings with measures and solutions integrated with the history of the damaged cities.

Based on the identification of the main characteristics of the local built environment, the plans for Villa Sant'Angelo and Fossa define projects where transformations and even different types of development are possible; these are derived, in any case, from that same built identity continuing its themes.

1. PRE-EARTHQUAKE CONDITION AND STATE OF DAMAGE¹

Like most historical towns in the Aterno valley, Villa Sant'Angelo and Fossa were in a state of large scale abandonment, before the earthquake of 2009, due to the attraction of the region's capital city as a place of residence offering living standards different from those characterizing housing in historic centres.

This situation of population decrease in both cases did not cause emotional detachment as was evidenced by the continuation of several activities which saw the participation of a large number of people.

In Fossa, the reduced number of residents in the historic centre has probably allowed the preservation of the integrity of the built environment that still characterizes the city centre and its surroundings. In Villa Sant'Angelo - where alterations due to recent interventions are widespread - a rebirth of the economy had begun just before the earthquake, related to the attraction of the historic centre and the quality of the surrounding environment and partly to seasonal tourism in nearby mountain districts (Figures 1-2).

1 The experience on Reconstruction Plan of Villa Sant'Angelo and Fossa historic centres hit by 2009 earthquake carries out by collaboration among the Municipalities and the University of Catania. The Working Group, coordinated by C. Carocci, is composed by C. Circo, M. Costa, L.A. Scuderi, C. Mangiameli, A. Scudero. A. dal Bo', A. Caiello, M. Giuffrè, S. Giuffrida, M.R. Vitale. Urban Design consultant is F. Andreani.



Figure 1 – Villa Sant'Angelo, aerial view of the historic centre after the earthquake



Figure 2 – Fossa, view of the historic centre from the valley

2.1 SEISMIS DAMAGE IN VILLA SANT'ANGELO

The severe damage caused by the earthquake of 6 April 2009 was concentrated in the central areas where collapses involved large parts of built-up area, resulting in a situation of heavy loss of large parts of the building fabric. Systematic documentation of the damage and a virtual reconstruction of the urban fabric in its pre-earthquake condition have been carried out - from the immediate aftermath of the earthquake with the idea of verifying the possibility of rebuilding the centre while confirming its urban form and its construction history.

With this aim, a plan to clear away rubble, based on the possibility of preserving what had not been destroyed by the natural event, was set up as the first operational tool at the end of 2009 (Carocci 2011a).

The investigations carried out during the preparation of this plan and more detailed analyses of some sample blocks have permitted the creation of an exhaustive and systematic database of information on damage conditions defined at the level of building blocks (Carocci et Al. 2010). (Figures 3-4).

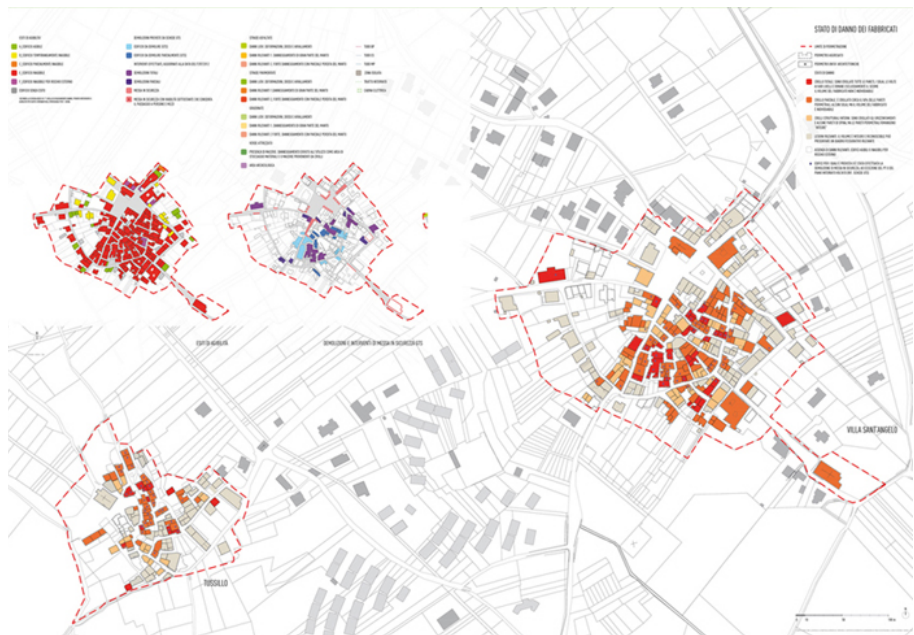


Figure 3 – Villa Sant'Angelo, damage condition maps

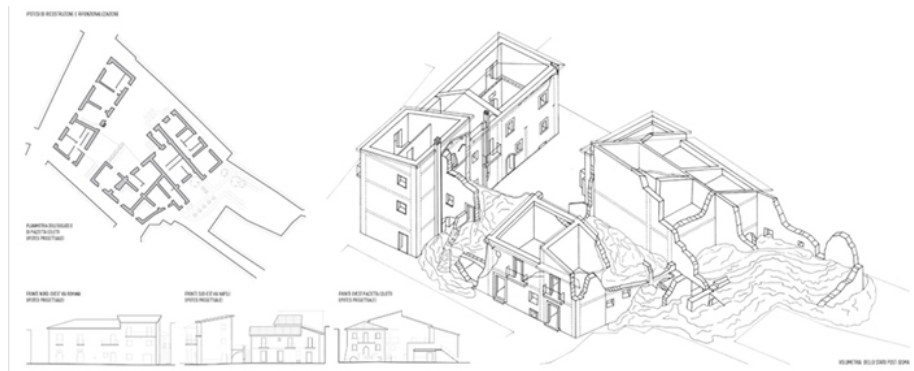


Figure 4 – Villa Sant'Angelo, a block's damage condition

2.2 SEISMIC DAMAGE IN FOSSA

Despite the fact that the historical centre in Fossa was affected less severely than in other neighbouring towns - probably due to compactness of the bedrock on which it is built and to the quality of the construction technique characterizing its buildings - the damage was spread to most of the urban fabric and a landslide originating from the side of Mount Circolo - overlooking the town - has made the whole historical centre inaccessible.

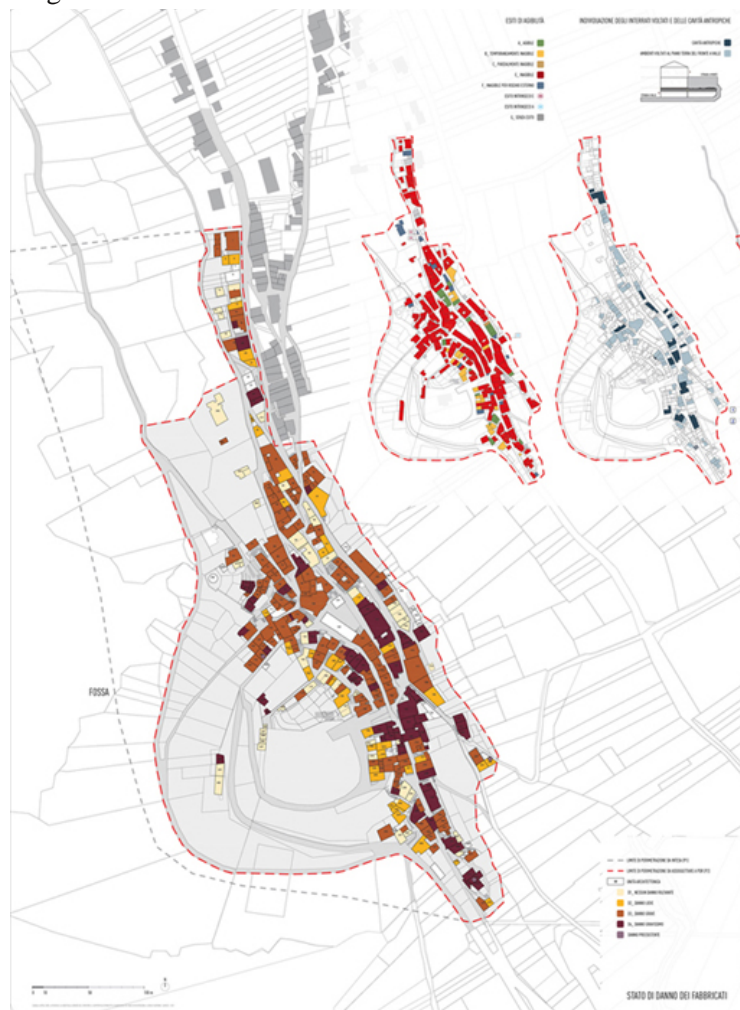


Figure 5 – Fossa, damage condition maps

Unlike Villa Sant'Angelo, here collapses were sporadic and limited to few buildings, but the crack patterns and damage mechanisms activated by the action of the earthquake are widely scattered in the urban fabric and have led to a damage condition that necessarily requires coordinated and integrated action. That picture must be considered against the backdrop of the importance of the centre in terms of historic and environmental built heritage and architectural features with buildings of considerable importance (e.g. the fortified castle, the church and square of Santa Maria Assunta and the peripheral church of Santa Maria ad Cryptas) (Figures 5-6).

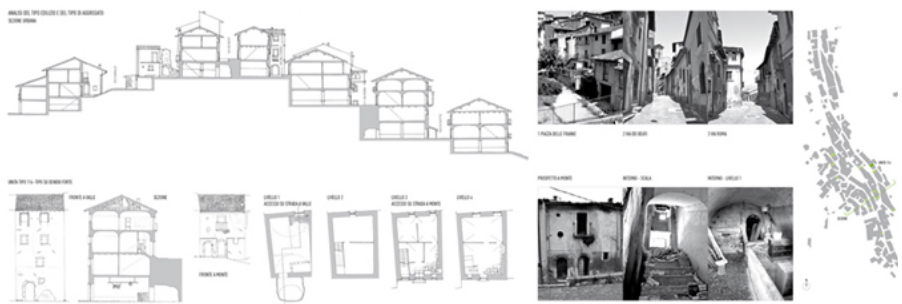


Figure 6 – Fossa, urban and architectural analyses

3. KNOWLEDGE FOR THE PROJECT

The survey phase, preliminary to the preparation of the plan – in spite of the different character affecting the two historic centres object of the planning (concerning the level and extent of the seismic damage, configuration of urban fabric and state of conservation and utilization) – was carried out in pursuit of a detailed knowledge of the built-up area, obtained through investigations performed at different scales and, in particular, aimed at obtaining information about the built-up heritage and public and private open spaces (Carocci 2011b).

Preliminary observations were conducted on blocks of the urban fabric with the aim of identifying those most appropriate for the execution of in-depth analysis and to define the scale of the units for the intervention plan.

3.1 THE BUILT-UP PROPERTY

In the phase preliminary to the preparation of the plan a series of thematic surveys were carried out for all of the two centres; firstly attention was directed to the definition and identification of Architectural Units, as sub-units of the blocks that, as indicated by the reconstruction law, constitute the basis for the design of the reconstruction project. This first analytical investigation allowed subsequent analysis on the basis of a single system of reference that connects the survey phase to that of plan preparation. The collection of data concerning buildings' height and on-site observations were associated with the analysis of building types and their combinations in the urban fabric, documenting configurations, features, and highlighting incongruous alterations.

In the case of Villa Sant'Angelo, with reference to collapsed areas, the size and shape of the buildings had to be hypothesized where there was a lack of documentation of their condition prior to the earthquake (photographic images and maps).

The collected data about the buildings' use and location of the principal houses was also the subject of specific investigation, supported by information collected through the acquisition of statements by the owners. At the scale of the elements composing the building, the structural arrangement and groupings were observed, emphasizing positive features and weaknesses of local construction techniques (Figure 7).



Figure 7 – Villa Sant'Angelo, masonry works analysis

The architecture and exterior finish were analysed with a focus on the state of the façades.

In the case of Fossa, a systematic analysis of the local construction lexicon has allowed the identification of the centre's evolutionary process and its seismic history through examination and mapping of anti-seismic devices and pre-modern repair interventions (spurs, scarp walls, chains and hoops) (Figure 8).

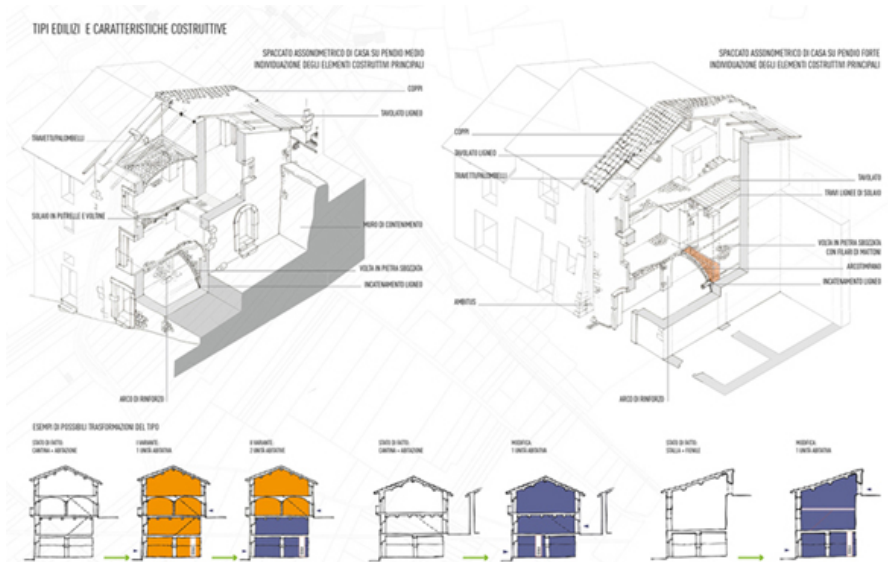


Figure 8 – Fossa, building types and buildings' construction analysis

3.2 PUBLIC AND PRIVATE OPEN SPACES

The analysis of open spaces and their relationship with the buildings, both in their public form (squares and streets) and in the semi-private and private expression (alleyways and inner courtyards) was carried out with the same systematic approach dedicated to buildings, through a survey of their layouts and their characteristic patterns, determined by the natural constraints and the urban nodes constituted by squares and particular buildings.

Also the study devoted to un-built areas underlines the quality and character of the centres and allows us to recognize the particular spatial dimensions that will be confirmed and preserved in their consolidated configuration, or

in some cases changed, in the plan.

Through the redesign of characteristic elements, such as slopes, tiers and ramps, the general arrangement of the public space was identified with its materials, structural patterns and its condition of preservation or damage.

Since public spaces accommodate network services of public utility, they are likely to be affected by large-scale interventions relating to the provision or re-supply of those network services. This situation on the one hand allows us to suggest their re-design while, on the other, stressing the need for an effective documentation of the established character of those spaces.

All these analyses highlighted strengths and weaknesses – some of which were inherent in the urban form and others that introduced by the earthquake - which are the basis for design of the plan.

3.3 PROJECT-AIMED ANALYSIS: AGGREGATES AND ARCHITECTURAL UNITS

The systematic examination of the built environment allowed the achievement of two operational results of great interest to the plan.

First is the division of the urban fabric into sub-areas (this is a procedure explicitly required by the law) derived specifically from the actual state of the built-up area as interpreted following the comparison between information collected at different scales of analysis (from urban analyses, to those concerning blocks' layout, construction techniques and damage) (Figure 9).

The second result is the definition of Architectural Units, resulting from direct and systematic observation of the buildings of Villa Sant'Angelo and Fossa by highlighting the unity of external façades and the subsequent identification on the base of Land Register maps and on-site surveys.

The division of the built-up areas into Architectural Units, defined as sub-parts of the blocks, allowed the elaboration of both analysis maps (which illustrate the present damaged condition) and design maps of the Reconstruction Plan using the same basic unit.

In that way the Architectural Units define a common ground that binds analysis to project and plan and provide greater specificity in the assignment of categories of intervention on the built-up.



Figure 9 – Villa Sant'Angelo, aggregates' identification and definition criteria

4. PLAN CHOICES

Even though from an early stage of plan preparation the community of Villa Sant'Angelo and Fossa wished to reconstruct their centres as they were, preserving their own identity and even if analysis work was deep and extensive, accurate and comprehensive, the design phase of the plan was not at all obvious and predictable but was full of new observations and unexpected implications.

Perhaps the first step in design that allowed the formulation of predictions about the reconstruction was to recognize a match between the identity of a building and its material form as masonry work.

This first identity was expressed in the plan by establishing the correspondence of Structural Units (as defined by law) with Architectural Units, the latter instead defined by the Reconstruction Plan on the basis of typological and material studies².

2 It is opinion of the authors of this paper that the definition of Structural Unit as defined in the Italian

The decision to make the equivalence between Structural Unit and Architectural Unit helped to preserve – in a structural reading marked by the block's dimension - the size of the units and that of the whole formed by these units.

The unit defined by the Architectural Unit is recognized as a significant record (masonry, material, structural and typological) which determined the face of the city before the earthquake. The choice to put the Unit at the core of the plan aims to reaffirm its role in the new face of the city in continuity with its history.

4.1 VILLA SANT'ANGELO

The desire to preserve the still recognizable character and values of the urban landscape and the historical built-up area is the central priority in the planning choices and it directs the plan's objectives, aimed at the redevelopment and the improvement of living quality and safety of the built heritage.

The main criterion behind Villa Sant'Angelo Plan is, therefore, the preservation of the identity of the historic urban fabric and by doing so to promote the preservation of routes and urban spaces that characterize the established urban structure.

This criterion has been observed in relation to damage conditions and the possibility to identify surviving built-up portions that will be preserved and will provide a starting point for the reconstruction and consolidation of the urban fabric (Carocci et Al. 2012) (Figure 10).

4.1.1 Interventions on existing buildings

The Reconstruction Plan promotes the preservation, redevelopment and re-use of surviving parts and elements, through instructions about modes of intervention and operations for the preservation of structures and decorative elements.

Technical Norms for Constructions (Decreto del Ministero delle Infrastrutture e dei Trasporti del 14/01/2008) does not suffice to describe the historical, typological and architectural characters of the urban fabric; it is for this reason that, working on the plans of Fossa and Villa Sant'Angelo, the definition of Architectural Unit was formulated as the result of the in-depth analysis of the urban centers.

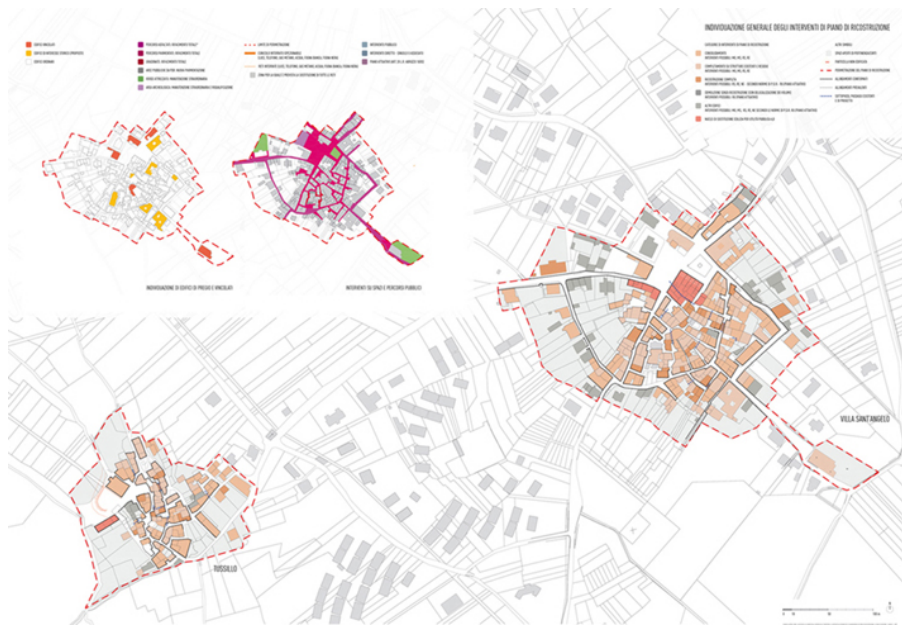


Figure 10 – Villa Sant'Angelo, urban plan

One among the many instructions for operational contents defines that surviving portions and elements will, as a rule, be preserved, restored and strengthened in order to form the starting point for the reconstruction and consolidation of the urban fabric.

In accordance with the conditions resulting from earthquake damage, the categories of intervention in the Reconstruction Plan - strengthening, completion and reconstruction - have been assigned to each one of the Architectural Units.

Categories of intervention, with regard to both urban planning and construction, were tailored on the present damage condition in order to establish the value of reconstruction in terms of quality, location and urban image of each building.

It should be noted that consolidation and completion are categories also defined at level of built structures, emphasizing the presence of important primary elements – such as stone vaults for ground floors and basements - and establishing the repair and/or the reconstruction with masonry techniques for the restoration and completion of the pre-existing building.

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4.1.2 Interventions on public spaces

Besides the definition of Architectural Units, other general characteristics have influenced the reconstruction of Villa Sant'Angelo, resulting from the reading of the route alignments and from a realistic and effective forecast of inevitable transformations that will be produced by the reconstruction.

Layouts as described in the plan were divided into “obligatory” and “predominant” introducing a distinction between those determining the obligatory permanence of the pre-existing urban arrangement and those on which relative changes are possible, whose partially different reconstruction will not affect the historic urban form.

Choices expressed in the plan are aimed at reducing removal interventions and minimize demolition without reconstruction; when present, are closely related to necessary upgrade and redesign of public routes and spaces and should be seen within a logic of urban restoration aimed at the reintroduction of small open spaces (nowadays obstructed by the addition of recent buildings) carefully calibrated on the existing urban fabric.

The creation of new small squares – which derive from the collapsed

buildings and are comparable, in position and size, to open areas and courtyards of the ancient urban fabric – is regarded as a reconfiguration of the original urban fabric which defined the form of the town of Villa Sant'Angelo. The urban plan defines - under the category of "Reconstruction" assigned in any case only to few Architectural Units - the redefinition of some open spaces located inside the blocks which were already existing before recent obstructions.

Furthermore, the Plan specifies a series of actions aimed at the reorganization of the system of routes, public spaces and strategic buildings for the prevention of seismic risk. Specifically, connections between different areas and access to different parts of the settlement are taken into account in the definition of a system of escape routes and first emergency measures.

4.1.3 The cores of building replacement

If the main focus of the plan was the reconstruction of the traditional and historical identity, recognizing its uniqueness as a tool allows us to address several issues of renewal in response to those "urban" topics that every city shows and which are, everywhere, the matter of the art of the city.

These issues might be: a long-designed road but never realized; the solution of a peculiar accessibility problem; the definition of a public space unresolved for long time.

Following the demands of the local community, the plan for Villa Sant'Angelo has introduced a replacement intervention on a block in the city's central square; the specific block was affected by severe damage and it was decided to introduce a new public building in order to renew civic social life in the newly rebuilt city.

A series of new units for uses such as office and retail, in line with the standards of businesses in the neighbourhood, is to be developed as part of a new complex rebuilt within the original layout and sized to the pre-existing ones.

4.2 FOSSA

At the core of the choices in the Reconstruction Plan of Fossa are its urban landscape and the preservation of character and value of its historical

buildings, which in this specific case are intact, recognizable, and can be effectively used as a tool to start a new era for the city centre.

With the establishment of repair and seismic improvement building sites covering the whole of the damaged urban fabric, the Reconstruction Plan assumes total responsibility for the preservation of urban history and architecture in Fossa and, for this reason, the provisions of the plan are aimed at the possibility of improving living standards in the historical centre while identifying transformations compatible with the identity of the town as part of the natural environment.

4.2.1 Interventions on existing buildings

Although the damage characterizing the historical village of Fossa does not require operations of total reconstruction, buildings in the urban fabric will be subject to detailed and specific work of reconstruction.

In that context, it is unthinkable that the extensive work of consolidation on Architectural Units might occur without an improvement in housing conditions and that the large investment of resources managed by the Reconstruction Plan will not lead to a renewal of quality of residential units that have remained (from the volumetric point of view) substantially intact. For that reason the plan rules and suggests forms of building transformations compatible with the observed historical types, paying attention to the identity of the urban fabric.

The two basic intervention categories for Fossa, “Restoration” and “Recovery”, allow at different degrees, a rational modification of the primary structural elements with respect to the actual conditions, in accordance with the level of present damage and therefore of relative consolidation.

Introducing the possibility of rethinking residential units - allowing, for example, both horizontal and vertical mergers of volumes - the plan aims to an urban rebirth through possible housing redevelopment linked with the newly found appeal of the historical centre (Figure 11).

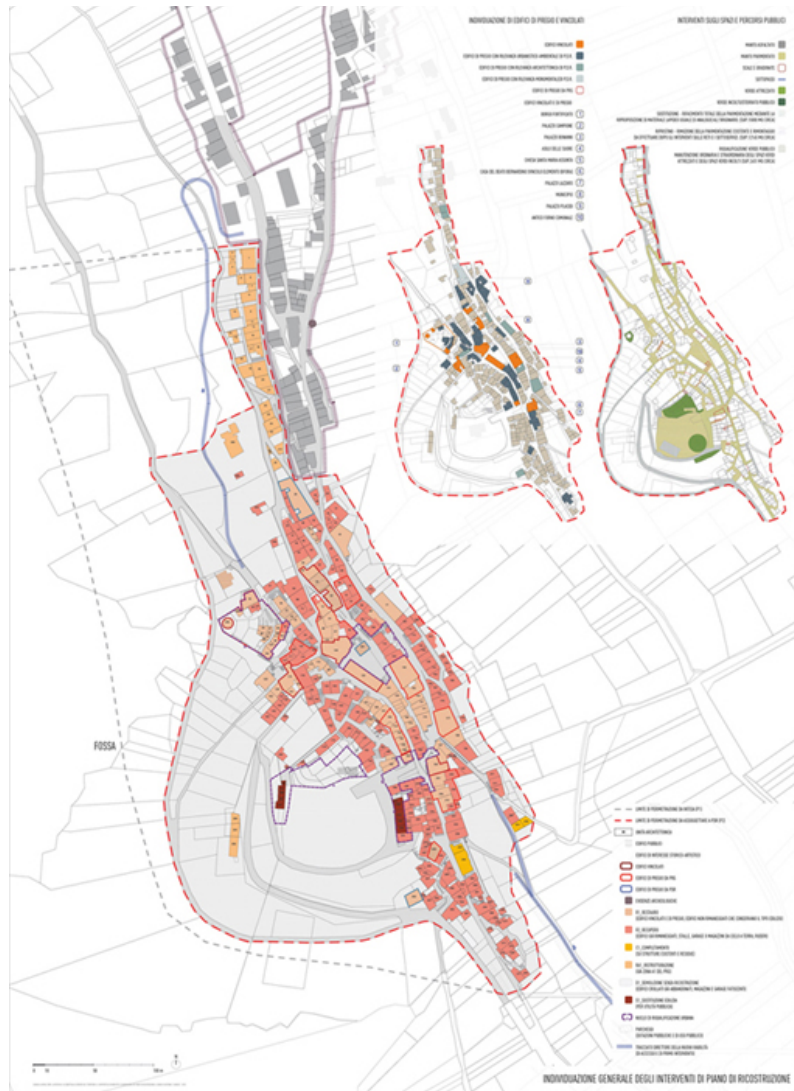


Figure 11 – Fossa, urban plan

4.2.2 The cores of urban renewal as an opportunity to rethink public spaces

The predominantly conservative core of the Reconstruction Plan of Fossa is accompanied by strategies aimed at the improvement of the town that

translate, in practice, into the identification of a few “Cores of Urban Renewal”, for which it defines the restoration and redevelopment of public spaces, the improvement of access routes and safe areas and a new provision of public services or facilities of public interest.

In these areas, combining built areas and open spaces of significant interest, the plan defines the possibility of introducing new public uses and improvement operations of access roads, such as new parking and services. Among these areas the plan includes the fortified castle and the magnificent Piazza Belvedere for which some transformations are defined (Figure 12).

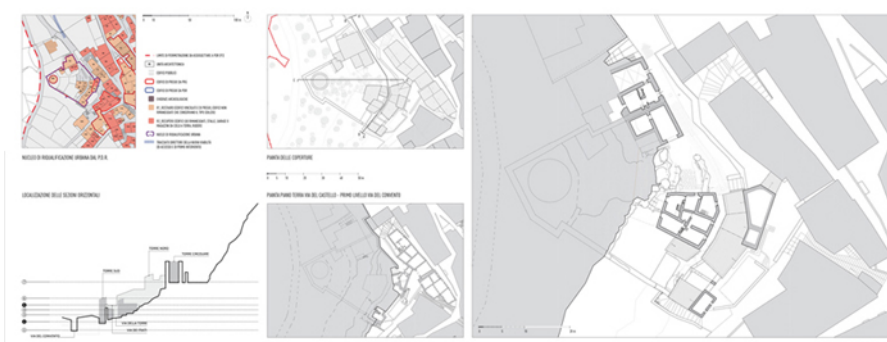


Figure 12 – Fossa, Castle's core of urban renewal

5. SOME REMARKS

Following these short descriptions of the work carried out on the reconstruction plans of Villa Sant'Angelo and Fossa some concluding remarks may be attempted.

The in-depth work of study and research of the material identity is in the tradition of the better Italian school of urban analysis, in particular with the analysis of evolutionary processes of the urban fabric pioneered by Gianfranco Caniggia (D'Amato Guerrieri-Strappa 2003) and the experiments conducted by Antonino Giuffrè (Giuffrè 2010) on the behaviour of masonry fabric and their construction and structural qualities (Caniggia 1979, 2006 and Giuffrè 1989).

The road taken by our research following the work of those masters suggests two new themes for the analysis of the urban fabric and urban space.

The first one is to take into account the role assumed, in the definition of the urban identity, by issues and qualities that often escape the definition of typological unit, by ideas and rules that we can refer to as the matter of the “art of the city”³.

In city-forming, together with the concept of “house” historically stated and the typological process, another well-defined idea was at work; it possessed rules and clearly established geometric qualities and directed the formation of the peculiarities of the urban fabric.

The idea of practicing a principle of conformity not only on Architectural Units but also on the urban whole, which derives from the study of the city in the Renaissance, has been introduced in these Reconstruction Plans through norms regarding the respect of obligatory and predominant alignments and through the suggestion of the relevant nodes constituting the historical identity of the urban arrangement.

The second topic that can be found in the Reconstruction Plans of Villa Sant'Angelo and Fossa is that, in the process of analysis of typological aspects, the prevalence of a theme has to be identified in order to isolate a feature more capable than others of preserving the identity of form and architecture.

That theme is the structural identity, or construction identity to use a more general and non-sectorial term. The identity of an urban fabric can be preserved recognizing, first and foremost, its primary construction qualities; by employing masonry techniques it is possible to establish and rediscover, even in a reconstruction process, those elements constituting a town's identity (masonry walls, vaulted floors, wooden roofs and architectural elements) and which - also nowadays - the use of masonry construction systems allows us to realize.

The Reconstruction Plans drawn up by this school are far from a frozen vision of urban history, which identifies architectural images and restates them in different construction systems, resulting in the poor quality of buildings common to many post-earthquake reconstruction scenarios and to

3 The “Art of the City” may be defined as the whole of the rules and formal and geometric strategies that regulate the process of construction of public spaces, an institutional function that, throughout history, has always been part of any civic set of rules. See: E. Re, *Maestri di strada*, Archive of the R. Società Romana di Storia Patria, vol XLIII, Roma 1920; M. Tafuri, *Ricerca del rinascimento*, Torino 1992.

many 'context-aware' buildings constructed inside many a historical centre (Andreani 2005).

By deciding to maintain the integrity of the existing masonry construction system, the plans of Villa Sant'Angelo and Fossa define living Architectural Units, where transformations and even different types of distribution are possible, and derived, in any case, from that same construction identity from which they derive and bear the traces.

In conclusion, even in the case of total reconstruction or with the introduction of staircases, elevators and new facilities, but preserving the identity of the primary elements, even - in short - meeting the ever-changing requirements of urban life, it is possible to preserve character and identity of places and the important legacy that history hands down to us.

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