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Re-thinking Re-construction New Design Strategies for the Reconstruction after Natural Disasters. A Local Research Experience for a Global Topic

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Abstract

The paper presents the ongoing results of a design research carried out at the School of Architecture and Design ”Eduardo Vittoria” of Ascoli Piceno (SAAD) of the University of Camerino.

The specific objective of the research is to develop an innovative and replicable design methodology, and to experiment new design strategies devoted to the sustainable, compatible and innovative re-construction after natural disasters in rural areas and low-density urban systems.

The research is based on a “local-to-global” approach: it refers to Italy as a case study but it aims to achieve general results applicable in different geographical contexts.

The specific case study relates to the earthquake that in 2016/2017 affected a significant area of Central Italy and that strongly hit a large part of the so called “Italian village system”, i.e. a peculiar environmental and productive urban system that is still now in real emergency. As in most of the international reconstruction experiences, this reconstruction will certainly require a long process which, still today, is full of unknowns. The massive damage caused by this disastrous event, the constraints imposed by regulations and the need for an adaptation of the building stock to the current housing standards, exclude the possibility of applying design strategies focused on a “where it was/as it was” model. This awareness, which increases the uncertainty about the future of the ”earthquake” communities, requires an innovative approach in relation to apparently incompatible aspects: the preservation of the identity of lost places and the upgrade of building performance often explicitly required by the population and however connected to a new housing demand. In relation to worldwide territories with a high level of disaster risk, this scenario can nowadays be considered a global issue which concerns both cultural and technical aspects.

The design methodology pursued is based on a scientific approach to re-construction that focuses on a “systemic” and “design to build” approach that concerns also productive and technological aspects in relation to purposes of low-cost performance, constructive simplicity, cost-effectiveness of the interventions. This approach aims also at the introduction of lightweight building system in contexts of traditional and massive construction, according to an idea of a construction site as an “assembly point” of prefabricated parts, light and modular, with a controlled life-cycle.

Keywords: Rebuilding, low-density/high performance, lightweight building

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1. Introduction

The earthquake that affected Central Italy in 2016 severely hit a quantitatively and qualitatively considerable part of the Italian urban ”system of villages”, that is a peculiar and consolidated landscape, environmental and production system that today sees a significant part of its heritage under conditions of environmental and housing emergency.

One of the most critical elements, which makes the reconstruction reasoning particularly complex, is the state of crisis that characterized a large part of these territories even before the earthquake. The area of the crater included in the Marche region, the region most affected by the 2016 events, already presented, for example, previous and consolidated conditions of fragility: low population density; urban conformation made up of small towns in a wide territory, orographically rugged and little connected to the major urban centers; an often obsolete building patrimony, realized with traditional building systems prior to 1971 (year of the anti-seismic regulations); an asphyxiated economy mainly of agri-food and (recently) tourist. The depopulation was and is a constant phenomenon, partly due to the inadequacy of housing standards to the aspirations of the inhabitants (especially the younger) and the lack of job opportunities, with the exception of the areas with the greatest tourist vocation. As evidence of this phenomenon, the recent ’Measures for the support and development of small municipalities, as well as provisions for the redevelopment and recovery of the historical centers of the same municipalities” represent an attempt to stem a progressive process of exodus that, in areas affected by the earthquake and for the younger generation, is a temptation only partly mitigated by the roots to their territory. The awareness that the earthquake has hit an urban, geological, social and economic system already ”suffering” feeds doubts (or should feed) on how and, in some cases, on where and on whether to rebuild, but can be read also as an ”opportunity ”(sad and unwanted) to imagine new possible scenarios.

2. Looking Forward: Rethinking/Rebuilding

Aware of the cyclic nature of seismic phenomena in Italy and of the social and economic vulnerability that characterized these areas even before the earthquake but considering the ”village” as an original housing model and an equally original urban widespread system, its reconstruction is configured as a specific, ambitious topic of ”urban and environmental regeneration”. This, more than in other cases, requires courage, ability

to prefigure and an interdisciplinary approach capable of understanding the ”seismic” design in a broad meaning that goes beyond the mere, but necessary, engineering aspects. The specificity of the theme also derives from some characteristics typical of this settlement system. Among these, two in particular constitute a first reference for the prefiguration of possible scenarios:- the geomorphological and socio-productive characteristics of the areas affected by the earthquake: some towns on the fault are affected by hydro-geological instability and therefore reconstruction is excluded for them. The perimeter operations for the reconstruction plans have in fact excluded those villages that, in all probability, cannot be rebuilt in the original places and must be relocated elsewhere;

- a population rooted in the territory with nostalgic considerations on lost residential building heritage but with critical opinions on the quality of building-technology and on the inadequacy of current housing needs (many homes in recent years have been destined to tourist reception). The new housing demand (beyond the safety aspects) therefore perceives the destruction connected to the seismic event as an opportunity for a redefinition of the housing model.

These issues recall two points of strategic importance that seem to place themselves at the margins of the current institutional debate on the theme of reconstruction: the question of ”where it was/how it was”; the overcoming of the engineering approach to the theme of reconstruction. According to P. Valéry ”a tradition exists only to be unconscious and (...) cannot bear to be interrupted (...), resume, renew a tradition is a false expression” [1]. In this sense ”rebuilding where it was/how it was” sounds like a slogan dictated by emotionality rather than a real perception of reality. If it were possible, rebuilding ”where it was/how it was” would be an ineffective strategy compared to the explicit demand for an ”improvement” that cannot be resolved exclusively in the seismic safety aspects and in the recovery - even if incontrovertible - of the original landscape and environmental values. The need therefore arises to prefigure models of reconstruction that can integrate the ”conservation” instance with the need and the opportunity to update, from a functional, environmental and technological point of view, what has been lost, so that this – i.e. the home, the village, the territory - can “really be filled with new life, new choices and impulses” avoiding generating a travesty of what has been. Moreover, ”conservation (...) is always also an act of selection and choice. Otherwise the preservation of the past becomes a parody of itself ”. In this sense, the theme of reconstruction in the seismic area cannot be considered the exclusive prerogative of engineering, since it is an interdisciplinary, open and multi-level

issue. Otherwise, there would be a strong risk of producing ”seismic architecture”, a flat, uniform, morphologically banal ”anti-seismic environment” [2].

3. “Back to the Future”. Searching for New Living Models in Seismic Areas

Within the Agreement signed in 2017 between the University of Camerino and the Municipality of Arquata del Tronto, an interdisciplinary research group of the SAAD coordinated by the authors of this essay launched, in the early months of 2018, research aimed at identifying some strategies for the reconfiguration of lost villages capable of balancing the preservation of the original housing features with the need for their partial adaptation to the new housing demand.

The research refers to a methodological approach, coherent with the theoretical fundamentals and the systemic approach of the Italian scientific sector of Architectural Technology (SSD ICAR/12), focused on the study of the urban environment (not just the building) understood as a system of parts and components held together by clear and shared connection rules that find reason to be in satisfying the needs of users. The research uses a specific parameter as a constant to identify possible design variations: as part of a hypothesis of reconstruction of some lots destroyed or damaged by the earthquake, a reduction of 20% of the original volume of the building has been hypothesized. This parameter takes into account some regulatory aspects relating to the distance and height limits set by the current anti-seismic regulations and represents an opportunity for the innovative reconfiguration of residential fabrics, allowing the introduction of new spatiality, new devices, more favorable conditions for the constructability of buildings, respecting the pre-existing urban and orographic conformation. The experimental approach adopted has produced and will produce results of a holistic nature and long-term goal that in this context are considered essential in relation to the complexity of the theme. The research therefore poses intermediate objectives that cannot be, at least today, compared with the guidelines of the reconstruction policies in progress, necessarily tied to a regulatory level that has been deliberately kept in the background in order not to compromise the experimental and prefigurative nature of the work done. On the operational level, the research is divided into three phases: Split, Grid and List. The Grid and List phases have been developed according to three ’strategic’ levels of analysis: space/function, technology/construction and energy/environment.

Split - Starting from an analysis of the Municipality of Arquata del Tronto territorial system, assumed as a sample village, a layout of possible and recurrent orographic,

urban and morphological-type configurations of the settlement fabric was defined, which can be extended in general terms and in a systemic way to all the villages present in the earthquake 'crater'. Four orographic frequently repeated configurations have been indicated: ridge, slope, valley bottom and plain. For each settlement model of the original ante-earthquake urban fabric and in relation to the four orographic contexts previously identified, some planimetric configurations have been extracted as samples within a catalogue defined of "recurrent urban conformations". Those samples can be considered emblematic of some typical and recurrent (in the pre-earthquake system) urban relationship: building/street, building/square, building/landscape, building/natural environment. Extrapolated from the original context and re-proposed in an ideogrammatic scheme, these samples have been virtually set in different and plausible environmental conditions in relation to landscape views, orientation and exposure. Finally, within the singular perimeter of the chosen urban samples, the lots for the design experimentation were selected. For each single lot, the ground conformation, the shape and the volume of the original building was kept.

Grid - This phase was carried out through the analysis of the macro-recurring architectural features of residential construction in relation to the three "strategic levels": the space/functional level refers to indoor and outdoor spaces. In this level some specific spatial units have been identified, considered strategic to design a new "low-density" urban pattern. Consistent with the rules of the recent Technical Standards for constructions, the volume of the original buildings has been reduced by 20%, in order to improve the conditions of living and, at the same time, to facilitate and trigger social relations between inhabitants of the same community. Following a logic of "subtraction", some solutions have been experimented. They have been focused on: the reconfiguration of the external spaces; new functional areas of collective and public utility mainly located on the ground floor; distribution spaces accessible and open for socialization; the visual permeability between inside and outside of the building achieved through the insertion of porticoes, courtyards and open spaces in relation to possible panoramic views; the combination of a different kind of dwellings with a rational, flexible and dimensionally diversified plan in order to satisfy the possible housing demand; lighting and natural ventilation of the apartments in relation to orientation and exposure. For the technological/building level, inherent to: material, building systems, ground connection (in particular, considering the seismic performance as pre-eminent in those areas), the characteristics of the enclosure and the roofing systems, a system of high-performance solution have been considered and evaluated. In the choice of building systems some aspects have been supported, as: the use of mixed structural

systems equipped with anti-seismic devices, consisting of prefabricated frame systems, two-dimensional bearing panels and self-supporting three-dimensional cells that can be combined together; ”light” industrialized wooden and steel construction systems which can be assembled through dry and off-site techniques, hybridized with heavy reinforced concrete systems, mainly used for rigid modules in order to confer greater seismic properties and rigidity to the structures; technological systems and materials from the most innovative production sector. Finally, the energy/environmental level, on the basis of the original conditions of lighting, ventilation and energy supply, has worked on the compactness of volumes and surfaces by adopting high and low-tech technological solutions to optimize the internal comfort conditions of buildings in relation to the current regulatory standards. Plant systems were introduced in service areas and on the ground and roof floors, included environmentally sustainable passive systems such as solar greenhouses, loggias, ventilation chimneys, cloisters, ventilated enclosures, shielding devices, coating insulation systems and systems for collecting renewable energies.

List - The epilogue of this activity, developed both through traditional (models) and advanced digital (BIM) tools, is the assembly of a catalogue of design solutions that, starting from the invariant of the volumetric reduction, implement some possible variations to the urban and building typologies analyzed. The project results achieved to date are still disomogeneous in relation to constructive and normative feasibility but represent a first result that demonstrates how the reconstruction of those villages, in the same or different places, can foresee, compatibly with the original features of the building, a complete functional, technological and environmental requalification. The catalogue defines to date a first set of project addresses divided into three strategic levels.

Spatial-functional - Starting from the requirements of the anti-seismic regulations (that requires regular indoor spaces), different solutions have been tested. Based on Alejandro Aravena’s ”Elemental” model, they are based on two construction phases: basic housing spaces construction and completion/customization by users (with mezzanines and other devices). This strategy, together with the search for diversification of the housing offer (accommodation with different sizes and qualities), moves from the need for housing flexibility, a paradigm that responds well to the duplicity of local demand oriented both to personal residence and to tourist use. And still, the reduction of densification has given the possibility to introduce a new system of open spaces, subordinated to the main road: small squares, private courts, greenhouses, passages can represent a strategy of relieving the often-narrow open spaces and, at the same

time, an opportunity to create intermediate locations (public/private, open/closed) and become a resource for increasing housing quality.

Energy-environmental - Dense urban fabrics whose buildings were characterized by mainly opaque envelopes often entailed a deficit in the luminous contribution, above all for the lodgings and the functions placed on the lower floors. The possibility of obtaining small courts or small passages (breaking up the larger lots) has allowed us to experiment with different solutions for the increase of the lighting supply and for the ventilation of the lodgings. The public/private open spaces, obtained thanks to the reduction of the original volume, together with some block of staircases have been used as environmental energy devices, intended for solar accumulation or optimization of the ventilation flows. In addition, the elevations have been diversified in relation to the environmental conditions of exposure and orientation, respecting a relationship between fullness and emptiness consistent with the local building tradition.

Technological-constructive - The reconstruction should foresee a qualitative increase of the new building patrimony also in terms of technological equipment and construction quality. Home automation, disability services, efficient connection networks, high levels of comfort are also useful aspects to create the conditions for a new attraction. Considering the local building production context and the indispensable ”reversibility” in relation to the permanence of seismic risk, we resorted to ”light” construction systems, mainly prefabricated and dry assembled, integrated with ”heavy” reinforced concrete parts (block of stairways and bases). The ground floor basement (”light” structure on a ”massive” base) becomes an anti-seismic device, a semi-public functional plan which, in cases of reconstruction how it was/where it was, could adhere to the original urban layout, collecting in this sense the suggestion from the work of Alberto Burri, created in 1984 on the remains of Gibellina destroyed in 1968 following the Belice earthquake. The light systems adopted refer to wooden (frame systems rather than panels) and steel (in the Cold Formed Steel variant, used in many European countries for systems with two-dimensional and three-dimensional elements). In both cases the logic of the stratified construction and some applications experimented with products on the market has allowed to develop solutions in which stone, used as a ”dry” coating, or plaster, persist as a finishing element of the building façade according to the local housing culture.

With specific regard to the constructive strategies and their effectiveness, “off-site” housing is the model pursued. Unlike the past seasons of prefab housing, that current industrial know-how could enable a significant reduction of the time and costs of building Furthermore, using a high proportion of precision-manufactured components,

materials and systems is reported to bring other significant advantages over traditional construction, including superior quality control through prefabrication, better energy performance and reduced site deliveries, noise and pollution - and thus less disruption to existing communities. The sophistication and range of manufactured systems and components available today – and the opportunities that digital techniques and processes offer - mean that factory-made construction has enormous potential to make a positive contribution to reconstruction housing needs. However, the same level of consideration needs to be given to design, placemaking, amenity, infrastructure and public realm, as it would for any project built using traditional construction methods, to ensure that quality remains at the core of delivering new factory-made homes that will support and sustain local communities for the long term.

Figure 1: Pescara del Tronto after 2016 earthquake.

4. Conclusion

The theme of the reconstruction of the central Italian villages cannot be dealt with exclusively in urban and building terms. The procedural aspects and the role of the communities are, for example, only some of the questions that are a step behind the architectural and constructive choices. The research object of the paper has produced to date design addresses and sometimes original solutions, also identifying some key points for the definition of new ”housing quality” objectives, considering this last

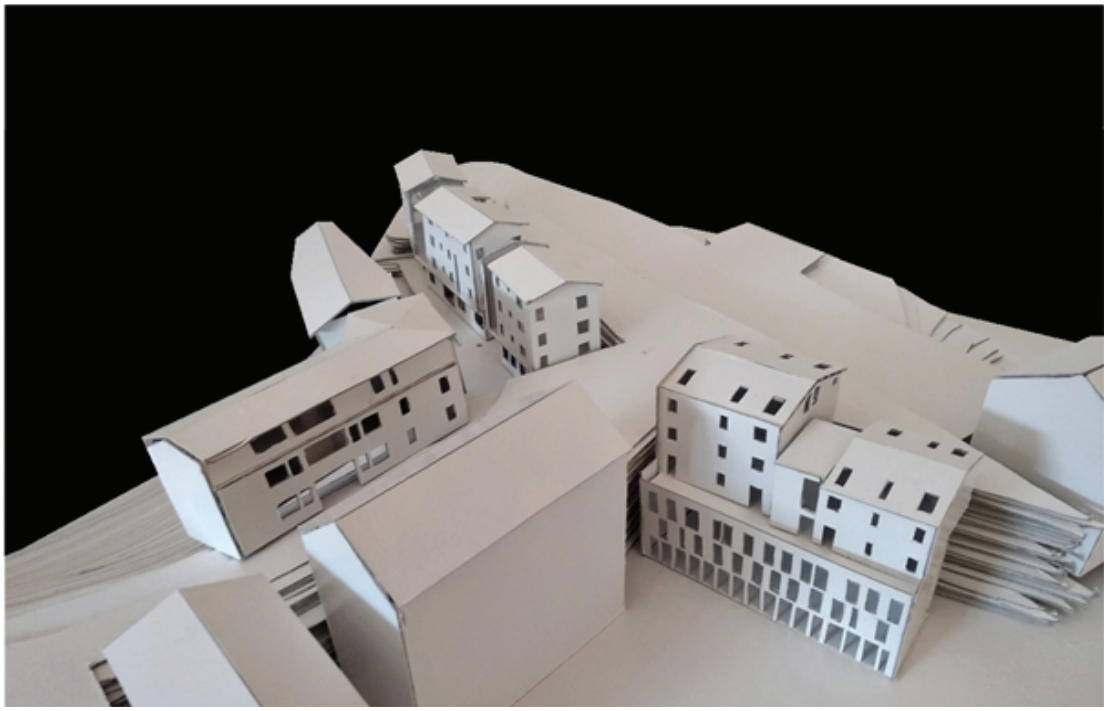

Figure 2: Pescara del Tronto: model of study of new buildings.

term in a partial meaning that refers exclusively to the quality of the accommodation and urban space, in the awareness that the quality of housing is a dynamic and multidimensional parameter that involves many aspects including social, economic, environmental and even psychological. Among the identified points, some are real strategic themes emerging from the design research: a) flexibility and customization of housing as evolutionary strategies of internal environments; b) respecting the original urban layouts or the orographic constraints (in the case of off-site reconstruction), introduction of public/private spaces, indoor/ outdoor that also function as an environmental device; c) technological equipment of medium/high profile, also in relation to the principles of home automation and usability to different skills; d) increase of the passive behavior of buildings through the integration between traditional systems (attics, ventilation channels, etc.) and innovative devices (solar greenhouses, integrated photovoltaic systems, etc.. e) use of dry and partially prefabricated construction systems combined with housing solutions that refer to traditional materials used in an innovative way. These issues constitute a first nucleus of project themes that will be developed in the continuation of the research. Reasoning on these points represents an action of responsibility within a design culture that sees the earthquake, an undesirable event as well as a catastrophic, as an opportunity for an advancement of what is now lost; for the re-construction of an evolved, desirable building heritage, capable of intercepting new and different housing needs.

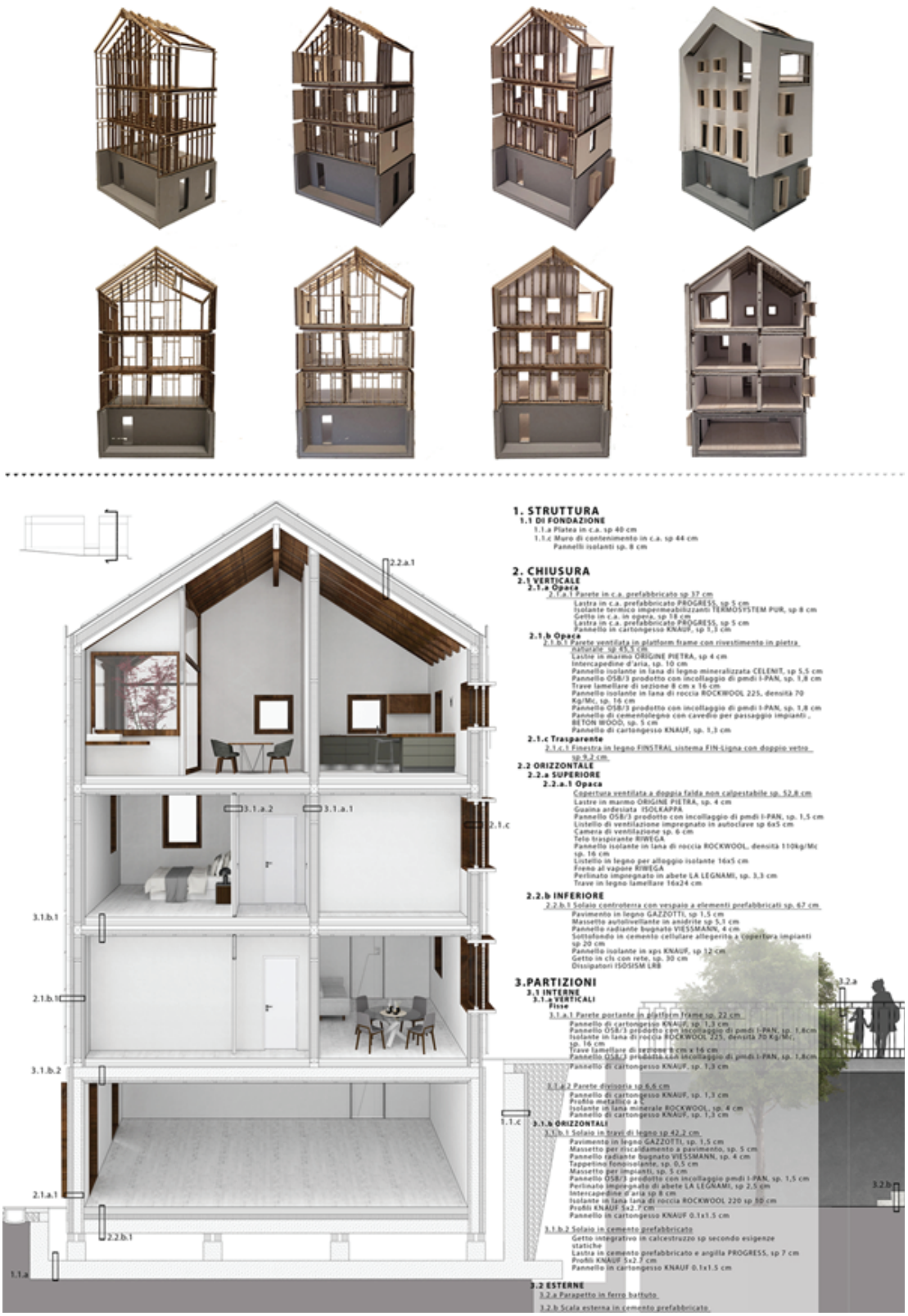

Figure 3: Strategies technological-constructive and detail section of new buildings.

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