

Learning from Earthquakes

Scaffolding as Adaptive Architecture

Paolo Belardi^a, Monica Battistoni^b, Camilla Sorignani^c

^aUniversity of Perugia, Department of Civil and Environmental Engineering, Perugia, Italy, paolo.belardi@unipg.it; ^bUniversity of Perugia, Ce.Di.Pa. Centre for Cultural Heritage Digitalisation, Perugia, Italy, monica.battistoni@unipg.it; ^cUniversity of Perugia, Department of Civil and Environmental Engineering, Perugia, Italy, camilla.sorignani@unipg.it

Abstract

Post-seismic landscape appears as a fragmented and disarticulated space which, by adopting a structuralist approach, can be deconstructed into three primary components: the ruins, rubble and scaffolding constitute the dramatic legacy of calamitous events, but also the potential underlying reconstruction, both material and immaterial. In this general framework, scaffolding represents, on one side, emergency solutions that protects the building's stability and the citizens' safety but, on the other side, can assume the role of active elements by electing the earthquake's heritage as a flywheel for the reactivation of the places' memory and the re-appropriation of its identity. Consider the Abruzzi village of Buonanotte, where Buonanotte Contemporanea project elects temporary structures as works of art capable of re-functionalizing urban space and regenerating collective identities. The buildings' statics merge with the territorial culture, activating synergies between different disciplines and knowledges. In this context, the Colab-19 collective also represents an architectural laboratory dedicated to the design of urban space in a sustainable and temporary key as a response to the post-pandemic emergency. The adaptive reuse of scaffolding as innovative and low-cost solutions allows the designers to realise widespread interventions in the Bogotá city aimed as much at sustaining the economic sector as at fostering the community's engagement. These experiences represent the starting point of the project Church in progress designed by the Hoflab studio in Perugia: a functional building structure for the restoration of the sanctuary of Maria Santissima Assunta in Rasina, designed around the 16th century by Francesco di Giorgio Martini. Devoid of the central vault due to seismic events occurring at the end of the 20th century, the project elects the scaffolding as a communicative icon that prefigures an archetypal theca covered with fibre fabric skin and resin that allows a glimpse of the ruins outline.

Keywords: Earthquake, Scaffolding Architecture, Temporary Structures

Introduction

After every earthquake, public attention focuses primarily on assessing material damage, with the aim of overcoming the state of emergency through actions aimed at addressing basic needs. At a later stage, once the emergency phase has passed, the debate shifts to discuss the reconstruction, covering both material and immaterial aspects, which necessarily

take into account the complexity of the social, psychological and economic aspects involved. Whenever reconstruction is discussed, there is a debate between two different and divergent approaches: on the one hand, the possibility of rebuilding an architecture “where it was and how it was”, reactivating its memory through the mimesis of its previous configuration, and, on the other, the opportunity to reject the pre-existing configuration by creating an architecture with no links to the original one (Belardi 2019).

«But destruction is an architecture too, a deconstruction that follows rules and calculations, an art of breaking down and rebuilding, that is, of creating another order».¹ (Magris 1986, 13). Magris’ words reveal an intermediate point of view, based on a careful reading of the post-earthquake landscape: fragmented and disarticulated space which, by adopting a structuralist approach, can be deconstructed into three primary components: the ruins, rubble and scaffolding constitute the dramatic legacy of calamitous events, but also the potential underlying reconstruction, both material and immaterial. Understanding the state of the places therefore gives rise to the opportunity to rebuild “with what was there”, according to an approach that, on closer inspection, has always been part of Italian and European architectural culture (Belardi 2020, 17). In fact, the idea of reusing rubble had already attracted the interest of Mario Bottoni, who in 1946 decided to build Monte Stella in the QT8 district of Milan using the rubble produced by the Second World War bombing (Bottoni 1995). This project anticipates what happened twenty years later in Gibellina, where Alberto Burri froze the rubble of the city as relics under a white sheet of reinforced concrete (Clementi 1990, 28). We also find this approach in Eastern culture, specifically in the Wang Shu’s Ningbo Museum, which preserves the remains of destroyed villages from tornadoes in the wall texture, reclaiming the traditional craft technique of *wa pan* (McGetrick 2009). Referring to the ruins, the desire to integrate them into the design while maintaining their current condition recognisable means restoring their functional activity while enhancing their communicative potential. In this sense, Koning’s project is emblematic, elevating the ruins of a former furnace to an observatory where visitors can admire the landscape. Equally significant is Dimitris Pikionis’ project for the Acropolis in Athens, which recomposes fragments and archaeological finds into an abstract pattern that has become the paving texture of access to the archaeological site (Furlong 2014). Finally, the restoration project for the Doria Castle in Liguria, which, in addition to the structural consolidation of the external walls, involves the creation of walkways and light vertical connections that allow visitors to once again inhabit the castle ruins. If we consider the post-seismic landscape as result of its primary components and assume that it is possible to embrace an adaptive approach aimed at recovering and reusing the material produced by the catastrophic event, this methodology can also be applied to the third and final component, scaffolding, in an attempt to transform them into permanent icons of collective memory and identity.

Scaffolding as Adaptive Architecture

In this general framework, scaffolding represents, on one side, emergency solutions that protects the building’s stability and the citizens’ safety but, on the other side, can assume the role of active elements by electing the earthquake’s heritage as a flywheel for the reactivation of the places’ memory and the re-appropriation of its identity. Through art and architecture, the performative substance of scaffolding is manifested, traceable as a

temporary modification of space, beyond any materiality and stylistic taxonomy.

Within this general framework, numerous teams of professionals are conducting experimental activities with the aim of electing scaffolding as permanent solution of adaptive architecture. This is the case of the village of Buonanotte (Abruzzo, Italy), where the art of building statics merges with the culture of the territory, activating synergies between different disciplines and areas of knowledge. A similar approach has been developed by Colab-19, a collective architect's group which supports the use of sustainable and temporary architecture to regenerate urban space and collective identities as a response to the post-pandemic emergency. The following case studies demonstrate how, very often, art and architecture are entrusted with the task of expressing a regenerative and multiplier potential, capable of transforming space into a plurality of places and recognising, even in emergency conditions, the opportunities inherent in the original components of the landscape (Felici 2006).

«What struck me the most [...] was his ability to transform that space into a variety of places, houses and corners [...] that multiply multiplicity».² (Rossi 1990, 29)

The village of Buonanotte in Montebello sul Sangro, a small town perched on a saddle between Maiella and Lake Bomba, was abandoned after the landslide of 1960s. Following a long period of decay, a multidisciplinary team of professionals proposed the Buonanotte Contemporanea project, supported by Abruzzo region in the framework of the promotion and development of tourism in small towns and inland areas. For this reason, the primary objective of the project was to legitimise the village existence by promoting awareness and, thanks to the restoration of the site safety through both structural and artistic interventions, generating processes of participation and reactivation of the local economy and sociality. The result is a new attractive pathway that crosses the entire village, through which artists and architects have worked together to design site-specific artifacts that integrate the consolidation structures with the territorial and anthropological aspects, thus activating synergies between different disciplines (Fig. 1). The first artwork entitled BN_L_AIFE_20_295, designed by Artan Shalsi, in addition to providing structural support, catches visitors' attention with a striking display of reflective images. The second artwork entitled Kaleidoscope, designed by Vincenzo Marsiglia, is a large cell that protects and secures a steep area between two buildings, inviting visitors to safely immerse themselves in the nature of the place. The pathway is closed by the artifact A Broken Line, designed by Jasmine Pignatelli, which is generated by the dynamic sequence of signs that support two unstable facades; it creates a variable and uncertain space that characterize the contemporary appearance of Buonanotte village. «At Buonanotte, the artists' interventions dialogue with the ruins of the village, and with the surreal absence of the human figure, to contribute to the creation of an experimental, poetic and safe itinerary, in which artistic research responds in a structural way to the architectural needs of consolidating the village». (Mantelli 2021, 105)

As soon as the village becomes a place where contemporary art, nature and architecture converge in a single work, it produces a mutation in value and meaning always attributed to what has taken root over time. The dimension of the construction site generated by the project was able to amplify the relationships within the territory and to caught opportunities from the outside. Colab-19 is a laboratory of architecture dedicated to design sustainable spaces for post-pandemic scenarios: the architects group promote the use of scaffolding

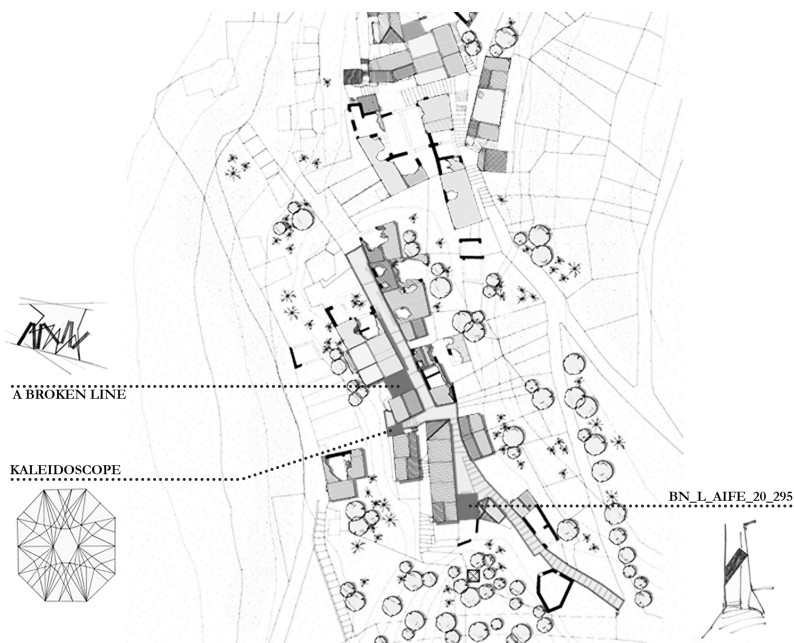


Fig. 1. Buonanotte Contemporanea (authors' elaboration, 2025)

architecture to regenerate urban space and community identities. Through the adaptive reuse of low-cost temporary structures, architects are carrying out widespread projects in the city of Bogotá aimed at supporting the community economic and social sector. In fact, Bogotá is a city that has been gravely affected by the pandemic, both in terms of duration of forced quarantines and for the complexity of homeworking in terms of adequacy of residential spaces for most of the population. This has led to an internal socio-economic crisis where, as an example, plenty of restaurants have been forced to shut down. At this point, the municipality launched the program Bogotá a cielo Abierto with the aim of reopening hundred streets for outdoor dining without a real budget to carry out the architectural interventions. So, they decided to use materials that could be easily found and recycled or reused into architecture: it results that scaffolding was the most appropriate construction system due to its modularity, accessibility, and “outdoor feel” (Colab-19 2021b). In this sense, La Perse is a habitable building infrastructure that has allowed the restaurant activity to take place in the local plaza de la Perseverancia, with respect to social distancing regulations. Scaffolding represents the supporting structure, which is decorated with textile draping that protects from the sun, creates more isolated spaces, and warms the environment as if inside one’s own home (Fig. 2a). As an extension of the previous project, Colab-19 (2021a) designs La Concordia Amphitheatre, a flexible structure capable of housing gastronomic, commercial and recreational activities, highlighting the diversity of uses and the cultural importance of the square. The ephemeral structure uses scaffolding to create a multi-level open-air theatre that follow a U shape and, as a theatre curtain, rounds

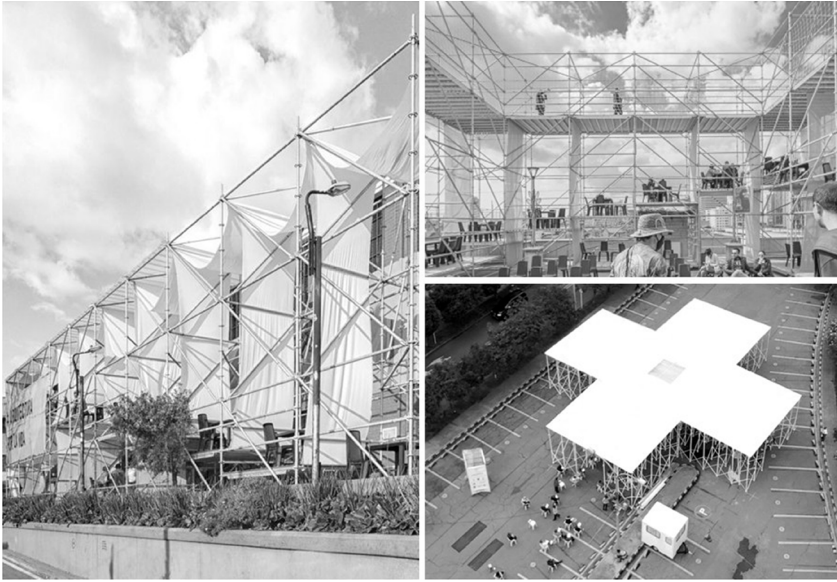


Fig. 2a) *La Perse*. Colab-19 (left); b) *La Concordia Amphitheatre*. Colab-19 (top right); c) *Alhambra's Cross*. Colab-19 (bottom right) (authors' collage, 2025)

a central stage which can hosts a variety of events (recreational activity, performance, concerts, mass) (Fig. 2b). Finally, as their latest design project for the municipality of Bogotá, Colab-19 (2023) designs the Alhambra's Cross as prayer chapel in the middle of supermarket car park that enables citizens to attend mass and participate in social activities. Even though previous experiences with scaffolding involved the use of mainly vertical structures, this time the architects favored a horizontal layout as the main compositional element for the chapel's design. The results was a greek cross typology that stands out as a landmark within the urban iconography of Bogotá (Fig. 2c). In the specific social context of pandemic crisis, the experience of Bogotá highlights how synergy between public and private actors can have a tangible impact on the urban planning, regenerating decentralized spaces and emphasizing the importance of designers' role in finding adequate solutions to manage exceptional economic and social conditions.

Church in Progress

The dramatic seismic events that have affected the Umbria region over the last thirty years have revealed the need to experiment new forms of adaptive reuse of damaged historic architecture in a contemporary key. In this context, the ARTquake research activity³ has been conducted, which delves into the concept of building "with what was there" through a flexible approach to the post-seismic reconstruction (Belardi 2018). The research outcomes highlight how relating to pre-existence means: building above, below, next to, around, inside, in front, behind, between, as, beyond and on the existing, demonstrating an adaptive and sustainable approach to architectural design (Belardi 2024). Within the aforementioned

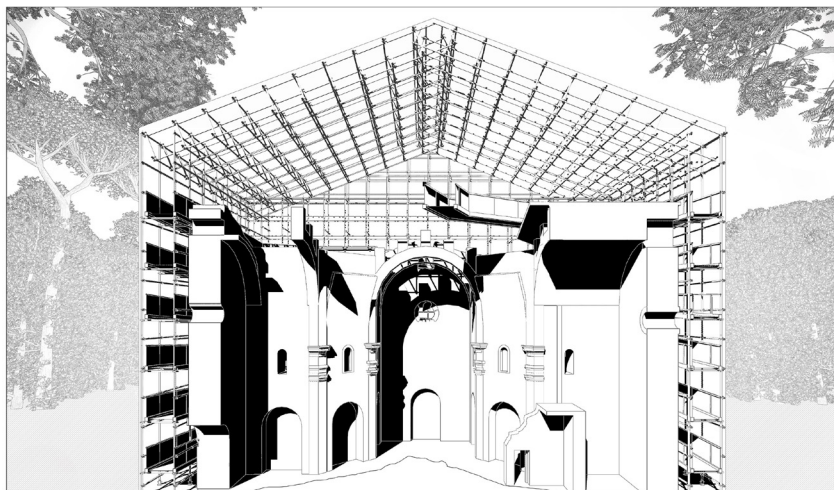


Fig. 3. *Church in progress*, Paolo Belardi, Sara Aglietti and Alessandro Moriconi, perspective section (2022)

research activity, in 2022, the experimental project *Church in Progress*⁴ was drawn up, promoting the restoration of the sanctuary of Maria Santissima Assunta in Rasina in the Upper Tiber Valley. The architecture was built in the 16th century to a design by Francesco di Giorgio Martini, but the structure loses the roof following the collapse of the central vault during the 1997 earthquakes. The architectural approach takes in place an unusual building structure made by scaffolding, which elects the ruins as the core of the project. The temporary structure becomes a communicative icon which prefigures an archetypal theca made of Innocenti tube crossed by a system of suspended walkways which, incorporating the existing walls, evoke the spatial complexity of Richard Buckminster Fuller's Biosphere Environment Museum (1967) and wrapped in an i-Mesh fibreglass skin which, thanks to the transparency guaranteed by the Morellet pattern, reproduces the ambiguity of the presence/absence relationship that characterises the basilica of Siponto (2016) by Edoardo Tresoldi (Belardi 2023). The project generates an evocative setting amplified both by the sequence of suspended pedestrian ramps that delimit the reticular structure and by the cross-section walkway on the top, which runs through the centre of the church and marks the end of the visitors' pathway with a zenithal view of the hall (Fig. 3). Therefore, the project revitalises, in a sustainable way, a place that would have been intended to be abandoned, both because it embraces the philosophy of building around and above what already exists, and because involved the use of recycled materials (Innocenti tube and Keller grating) and sustainable materials (i-Mesh fibreglass texture). All those materials, while completely enclosing the outer shell of the scaffolding, allows a glimpse of the outline of the ruined church (Fig. 4). The temporary structures act as a protective envelope for the existing architecture, ensuring both the reversibility of the intervention as well as the complete preservation of the ruin.



Fig. 4. *Church in progress*, Paolo Belardi, Sara Aglietti, Alessandro Moriconi, infographic simulation (2022)

Conclusions

The article emphasises how adaptive reuse, in the sense of recovering existing environmental resources and virtuous waste management, also means reusing the three primary components of the post-earthquake landscape, such as ruins, rubble and scaffolding. Specifically, temporary structures, if interpreted as construction equipment designed to create shapes as well as construction equipment designed to ensure safety, can contribute not only to preserving identities but also to enhancing the landscape. This is especially true in the case of a fragmented and disarticulated landscape as post-seismic landscape and particularly in Italy, given that in our country, as Ennio Flaiano ironically pointed out, nothing is more stable than the temporary.

Notes

1. Authors' translation. Original quote: «Ma anche la distruzione è un'architettura, una decostruzione che segue regole e calcoli, un'arte di scomporre e ricomporre ossia di creare un altro ordine.»
2. Authors' translation. Original quote: «Ciò che mi ha colpito di più [...] è stata la sua capacità di trasformare quello spazio in una varietà di luoghi, case e angoli [...] che moltiplicano la molteplicità.»
3. The research activity has been conducted in the Umbrian crater by an interdisciplinary team

composed of students and professors from both the University of Perugia and the “Pietro Vannucci” Academy of Fine Arts.

4. *Church in Progress* project was drawn up in 2022 by a multidisciplinary team from the Department of Civil and Environmental Engineering at the University of Perugia, consisting of Paolo Belardi, Sara Aglietti and Alessandro Moriconi. The project was presented as part of the Atlas Proarch exhibition (Mantua, Milan Polytechnic Regional Campus, 2024).

Bibliography

Belardi, Paolo. “ARTQUAKE. Guardavo le macerie e immaginavo il futuro.” In *IFAU '18 – Territori fragili. Paesaggi_Città_Architetture / Fragile territories. Landscapes_Cities_Architecture*, Università degli Studi G. d' Annunzio, Chieti-Pescara, 520-527. Roma: Gangemi Editore, 2018.

Belardi, Paolo. *Macerie prime. Ricostruire luoghi ricostruire identità*. Perugia: Fabrizio Fabbri Editore, 2019.

Belardi, Paolo. *Learning from Norcia. La Chiesa delle Macerie*. Perugia: Il Formichiere, 2020.

Belardi, Paolo. “Church in Progress. Costruire intorno all'esistente.” *SEED Design Actions for future* 2, 160-167, 2023.

Belardi, Paolo. *EX ANTIQUO. Costruire sopra, sotto, accanto, intorno, dentro, davanti, dietro, tra, come, con, oltre, sull'esistente*. Siracusa: LetteraVentidue Edizioni, 2024.

Bottoni, Piero. “Ascensione al Monte Stella.” In *Una nuova antichissima bellezza. Scritti editi e inediti 1927-1973*, edited by Graziella Tonon, 457-476. Roma-Bari: Laterza, 1995.

Bellizzi, Mario. *Le opere provvisorie nell'emergenza sismica*. Roma: Agenzia di Protezione Civile – Servizio sismico internazionale, 2001.

Clementi, Alberto. *Il senso delle memorie in architettura e urbanistica*. Roma-Bari: Laterza, 1990.

Colab-19. 2021a. “La Concordia Amphitheater.” Accessed October 30, 2025. <https://divisare.com/projects/436222-colab-19-alberto-roa-la-concordia-amphitheater>

Colab-19. 2021b. “La Perse.” Accessed October 30, 2025. <https://divisare.com/projects/436218-colab-19-andres-toquica-diez-veinte-estudio-la-perse>

Colab-19. “Alhambra’s Cross, chiesa temporanea a Bogotá, Colombia.” *L'industria delle Costruzioni*, 485, 112, 2022.

Felici, Alberto. *Le impalcature nell'arte e per l'arte. Palchi, ponteggi, trabiccoli e armature per la realizzazione e il restauro delle pitture murali*. Firenze: Nardini Editore, 2006.

Ferlenga, Alberto. *Le strade di Pikionis*. Siracusa: LetteraVentidue Edizioni, 2014.

Giannetti, Ilaria. *Il tubo Innocenti. Protagonista invisibile della Scuola italiana di Ingegneria*. Roma: Gangemi Editore, 2011.

Magris, Claudio. *Danubio*. Milano: Garzanti Editore, 1986.

Mantelli, Maura. “Buonanotte Contemporanea.” *AND Rivista di Architetture, Città e Architetti* 39, 102-109, 2021.

McGetrick, Brandan. “Ningbo Historic Museum.” *Domus* 922, 67-74, 2009.

Rossi, Aldo. “Ettore Sottsass. Large, medium and small size private houses.” *Terrazzo. Architettura & Design* 4, 29-64, 1990.