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Planning tools for historic centres reconstruction. An overview of Central Italy 2016 earthquake

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***Abstract* – This contribution aims to discuss about the role of urban planning for the recovery of the urban historical heritage, summarizing a research in progress concerning the reconstruction process after the Central Italy 2016 earthquake. A synthetic comparison between recent Italian earthquakes is presented, analysing weakness and strength of different strategies for historic centres recovery. Several tools and consolidated knowledge are available, but at the same time the attention paid to a tighter integration between safety and conservation of built heritage seems to be not so developed yet. A glance on last reconstruction choices reveals the opportunity to develop more effective strategies for historic centres and built environment according to a clear vision about recovery goals.**

I. INTRODUCTION

The role of cultural heritage formed by historic centres and settlements, and the conservation and recovery of urban values in territories affected by seismic risk can be considered a strategic topic, in a stratified context as the Italian one is. It is possible to discuss about methods and tools – "correct measures" – to promote effective and aware interventions. It is also important to clarify whether the building scale is the right one to recover historic urban heritage or rather - at it definitely seems - an urban perspective should be found as a necessary reference.

The debate concerning the reconstruction of historic settlements newly arise after every earthquake. Several discussions took place during last decades from different points of view: normative [1], about emergency management [2,3], on possible reconstruction layouts [4] or about conservation of built heritage [5]. But in this large debate, after almost 9 years from the 2016 earthquake, the reconstruction approach still does not seem to offer a definitive answer. Conditioned by the attempt to speed up the reconstruction by shortening the projects processing times (with results not entirely in line with expectations), a new planning phase is developing, complex but potentially more effective; rather, one could say it should have been addressed earlier. However, reconstruction results depend on normative framework but also - and more - by the way this frame is interpreted and applied by different actors, first of all public bodies and municipalities.

This contribution, based on first results of an ongoing research conducted by the authors, aims to take a look at how the reconstruction of more damaged settlements was set up after 2016 Central Italy earthquake. Two issues represent the main reference in a planning perspective: the conservation of historic heritage and the scales considered in the reconstruction process.

A synthetic comparison between different recent earthquakes in Italy is proposed (1997, 2009, 2012), highlighting similarities and differences of context, strategies and adopted tools. Then a focus on specific reconstruction tools in Central Italy reconstruction is faced, showing potentialities and critical aspects concerning historic settlements recovery. The conclusions suggest possible research developments.

II. RECENT EARTHQUAKES IN ITALY

The relation between post-seismic reconstruction and urban planning, particularly in the recovery of urban historic heritage, lead to adopt different strategies during last decades: restoration, recovery or foundation of new settlements [4]. Some factors seem to be particularly important: the diversity of the effects of the earthquake, different territorial response, the socio-economic and cultural references, since all of them can influence the political choices and intervention models.

Two examples can be particularly useful.

The 1968 Belice earthquake, in Western Sicily, was faced by a strategy based on the abandonment of damaged settlements. The reconstruction act (L. 79/1968) after only three weeks already disposed de-localization choices to promote recovery, according to main political and socio-economical references of that period of time. [6,7]. In 1976 Friuli earthquake, instead, a strong will to recover cultural heritage and existing settlements arose from central institutions and local communities; even though in a dialectical relationship between different principles and priorities (as the well know slogan "factories first, then houses and churches" shows). In 1968 the *ex-novo* reconstruction, a sort of political and cultural manifesto, involved a strong renewal, but also an evident discontinuity from the urban memories and local

construction knowledge. In 1976 the reconstruction represented a model where a specific attention to existing built environment formed a significant example of cultural heritage recovery [8].
A similar look can concern more recent events: Umbria-Marche 1997, Abruzzo 2009, Emilia-Romagna 2012. All of them had a wide territorial impact. However, even with similar intensities, urban damages, emergency management, institutional and normative reactions showed several differences (Table 1).

Regions / year	Umbria-Marche 1997	Abruzzo 2009	Emilia-Romagna 2012	Centro Italia 2016-7
Magnitudo (Richter)	5.6 – 5.8	5.9	5.9 - 5.7	6.0 - 6.5
Intensity (MCS)	VIII-IX	IX-X	VII-VIII	X
Casualties	11	308	29	299
Territorial extension	4000 kmq	2087 kmq	2700 kmq	8000 kmq
Temporary emergency settlements	tents, containers, public housing	tents, containers, hotels, MAP, C.A.S.E.	tents, hotels, PMAR	tents, hotels, CAS, SAE
Urban planning tools	**PIR** L.61/1998	PdR L.77/2009	PdR Lr 16/2012	PSR DL 123/2019
Geological studies	MS Geologist Council	MS Pilot Project	MS OC 70/2012	MS- III OC 24 e 55/2017

Table 1. Comparison between 1997, 2009, 2012, 2016 earthquakes in Italy

The 1997 Umbria-Marche earthquake affected small and medium hill and mountain settlements, with deep and tight connections between ordinary buildings and cultural heritage of a high historic and landscape value. The already evident depopulation process pushed Regional administrations to choose a recovery strategy based on the Friuli model "reconstruction, development, participation" [9, 4]. During the emergency phase a particular attention was paid not to eradicate population from their living places; reconstructions were defined in order to reduce built environment's vulnerability and to recover cultural heritage also at an urban scale. *Recovery integrated programs* (PIR) introduced by L. 61/1998, despite some procedure complexities, revealed to be useful to coordinate several actions on public and private built aggregates, open spaces, infrastructures and cultural heritage in historic settlements, allowing to promote unitary projects [2, 10]. Observing from nowadays, one could say that these results could be also considered as the late fruit of consolidated skills still owned by the State institutions, not yet completely absorbed by the prevailing of Regional prerogatives (as disposed by the subsequent Constitutional reform in 2001) [11].

In 2009 Abruzzo earthquake two different realities were hit: the historic centre of L'Aquila, a very important context for cultural and administrative functions, and an articulated settlement system composed by small villages and municipalities around L'Aquila. Reconstruction displayed in two directions. Several new residential districts (the C.A.S.E. project), to temporarily recover the city population while reconstructing the historic centre, which caused a significant urban sprawl without basic urban facilities [12]; and the *Reconstruction plans* (PdR - DCD 3/2010) attempting to recover the historic features of urban fabrics. The PdR plans were not able to achieve a detail level and the needed effectiveness to obtain the conservation of urban values of historic centres [13]. Actual results mostly depended on designers and planners' ability and - when mandatory - on Superintendencies regulations. Plans could rarely develop a strategic vision or urban renewal proposals, often confining themselves to define the economic resources needed for reconstructions [14]. On the other hand, looking at specific knowledge, the response was more productive. Several acts (starting from L. 77/2009) promoted *Seismic Microzoning* studies (MS) and afterwords the *Emergency Limit Condition* analysis (CLE), useful tools for seismic prevention [15].

The 2012 Emilia-Romagna earthquake (involving also Lombardia and Veneto) affected a densely populated and industrialised territory, with a polycentric settlement system, often organized in inter-municipal administrations, where co-planning - and also the urban scale seismic prevention - formed a quite consolidated background. Reconstruction acts (Lr 16/2012) introduced Reconstruction plans again but in a wider scale, the entire municipality, and different urban scale interventions: recovery, reconstructions, urban planning modifications. However, while in general these procedures can be considered effective - also for their speed according to industrial system needs - some critical aspects concerned interventions on cultural heritage, many of them not finished yet after more than ten years, despite a specific coordination was decided between state and Regional institutions to sped up projects review [16].

III. CENTRAL ITALY RECONSTRUCTION: BETWEEN PLANNING AND SIMPLIFICATION

Differences between tools - and their names too - showed in Tab. 1 can be explained by the differences between events and affected territories but also by the absence of general references. Times and nature of main legislative and planning responses diverge too.
Central Italy earthquake (2016-2017) hit a very complex territory: 4 Regions, many fragile municipalities (included in the *Inner Areas National Strategy*, SNAI), already affected by demographic contraction, and composed by settlements formed by many small historic villages reciprocally connected. Nevertheless, the reconstruction

approach was based on normative responses and a general trend where a planning dimension still struggles to emerge. While for previous earthquakes a shorter time was needed to define planning reconstruction tools, in Central Italy the initial responses started to be applied only with *Extraordinary reconstruction programs* (PSR) in 2019, in a process which is still going on in 2025. This delay should be framed considering the level of destruction, the complexity of damaged settlements and the importance of the historic urban heritage hit by the earthquake.

Main planning references: reconstruction programs (PSR) in different Regions

Immediately after the events, the reconstruction approach did not exclude a planning vision. Several normative measures (starting from Dl 189/2016) introduced criteria to define more damaged areas to be included in *Detailed implementation plans* (PUA). Furthermore a specific tool was previewed, a sort of master plan for reconstruction (*Documento direttore per la ricostruzione*, DDR), promoting coordination of different reconstruction interventions and developing strategies (OC 39/2017).
However this strategy has been soon weakened, at least in some Region. PUA have been defined quite late and in few cases, especially in Lazio and Abruzzo, DDR had almost no implementation, may be also because its role was not clearly understood by municipalities [17].
Most of all, several subsequent simplification acts made planning tools less important and effective. For instance, 'compliant' interventions (i.e. reconstruction projects respecting general features of pre-existing buildings) are allowed in PSR even they derogate from existing general planning regulations (L. 123/2019); and implementation plans (PUA) become only optional (DL 76/2019, OC 107/2020, OC 130/2022). These dispositions were confirmed in regulations for private reconstruction (*Testo Unico* 2023).
According to Regional Special Offices for Reconstruction data (USR), total number of PSR and PUA is respectively 45 and 60; not so big at least compared to the damaged context extension (140 municipalities with an average of 23 settlements each one) (Tab.2) [18].

	Abruzzo		**Lazio**		**Marche**		**Umbria**		**Total**	
Mun.	23 (6)		15 (6)		87 (29)		15 (3)		140 (44)	
	PSR	PUA	PSR	PUA	PSR	PUA	PSR	PUA	PSR	PUA
1	-	2	3	1	3	13	1	-	7	16
2.	3	-	1	-	4	3	-	-	8	3
3.	1	-	4	-	5	-	-	-	10	0
4.	3	1	2	-	12	29	3	11	20	41
Tot.	7	3	10	1	24	45	4	11	45	60

Mun: municipalities in the seismic crater - D.L. 189/2016 (most affected municipalities – OC 101/2020); **1.** In progress; **2.** Adopted by the City Council; **3.** Approved in Permanent Conference; **4.** Approved by the Deputy Commissioner for Reconstruction

Table 2. Number of PSRs and PUAs approved (April 30, 2025). *Opendata http://sisma2016data.it*

In the ongoing research, the field of analysis has been focused on the 20 municipalities with definitively approved PSR (Fig.1). This study showed a large diversification, partially related to different territorial characteristics and complexity of hit municipalities. Actually the territorial dimensions goes from 20 sq Km (Pioraco) to almost 300 sq km (Norcia), and the number of historic villages and hamlets composing the settlement system vary as well: from 4 (Campotosto and Pioraco) to 69 (Amatrice). PSR are designed mostly referring to the entire municipal extension; sometimes for different sub-municipal precincts and single villages (Amatrice), different parts and villages (Accumoli, Acquasanta, Visso), only for the main historic centre (Tolentino) or for just a single district (Pioraco) (Tab.3). Different scales are used, but a clear preference for small centres or town district emerges.

Municipality	**km²**	**n. Villages**	**n. PSR**	**PSR scale**	**n. PUA**
Lazio					
Amatrice	174,39	69	1	SM	1
Accumoli	87,34	17	1	V	-
Abruzzo					
Campotosto	51,72	4	1	M	-
Cortino	69,94	20	1	M	-
Montereale	104,41	27	1	M	-
Umbria					
Norcia	275,57	25	1	M	8
Cascia	180,83	41	1	M	-
Preci	82,02	18	1	M	3
Marche					
Acquasanta terme	138,39	56	1	V	-
Arquata del Tronto	92,18	13	1	M	7
Camerino	129,88	34	1	M	7
Fiastra	8	18	1	M	-
Montegallo	48,46	23	1	M	9
Pieve Torina	74,80	22	1	HC	-
Pioraco	19,45	4	1	D	-
Sarnano	63,17	35	1	M	-
Tolentino	95,12	48	1	HC	-
Visso	100,4	13	1	V	-
Ussita	55,3	12	2	M	-

Table 3. PSR scale (M: Municipal; V: Villages; SM: Sub-Municipal; HC: Historic centre; D: District)

If one focus on the conservation choices referred to historic centres many differences between Regions and municipalities can be seen. In a specific document, containing *Guidelines for PSR* (Annex to OC 107/2022), several criteria and references are suggested to promote interventions in urban historic fabrics. Some PSR acquire these indications as regulations for buildings and aggregates recovery; in other cases (quite few) municipalities themselves provide specific and more detailed regulations. However, these implementations

seem to be made less effective by the above-mentioned regulations for compliant interventions.

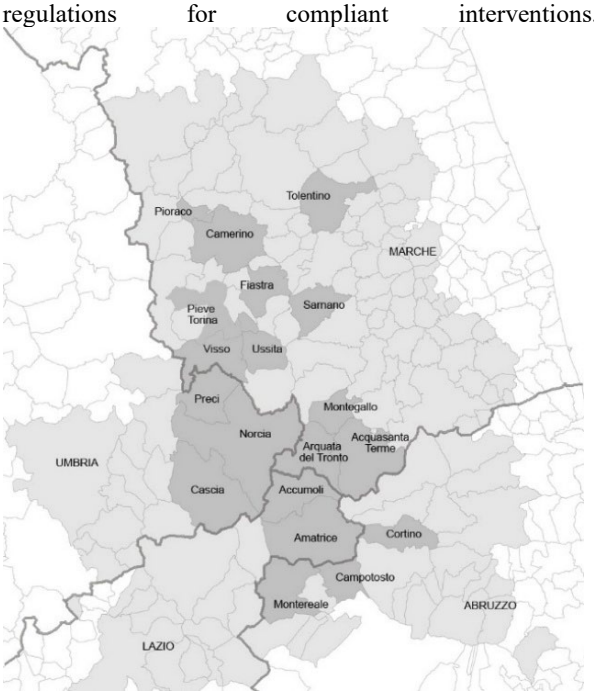

Fig.1 Definitively approved PSR as of April 30. 2025. Opendata http://sisma2016data.it

Application of Reconstruction programs

For most damaged territories, it does not seem so inappropriate to attribute the observable setback of the reconstruction process to this simplified approach as well; since it implies a reduced use of the potential of the reconstruction planning tools, especially concerning the historic urban heritage recovery goals [19]. The weakness of interventions control tools at an urban scale did not allow to effectively coordinate different initiatives on buildings and open urban spaces. As a matter of fact, for compliant interventions (actually often defined according to very generic criteria) the reconstruction of entire building aggregates can be achieved by simple procedures, but without any specific screening. In essence, an urban matter is treated as if it were a sum of building scale issues. On the one hand, specific planning tools - such as PSR - were introduced, potentially useful to define planning actions on urban settlements, even if concrete applications are not so widespread. On the other hand, the building scale approach risks to reduce the chance to control strategic initiatives on historic heritage and urban spaces. [17]. Most of all, in concrete applications, a single-intervention-based approach prevails; which strongly affects on the reconstruction effectiveness, where conservation and protection of the built environment, as well as the recovery of historic values should find a balance [20].

Both in DDR and in PSR specific indications for the definition of the *Minimal urban framework* (SUM) can theorically take place. But this chance, even if mentioned by the PSR Guidelines, has almost never been applied in practice (a significant exception is represented by the inter-municipal PSR for Leonessa, Borbona, Posta in Lazio Region). A wider and multi-scale approach could represent a more effective way to preserve the trace of the urban pre-existing layouts, albeit with inevitable reinterpretation; and it could also have and important impact on the safety of historic centres and on the definition intervention priorities.

A planning view is necessary to concretely articulate regulations for historic heritage - built typologies, continuity of built fronts, alignments on pathways and squares, visual directions to be kept. At the same time it could represent an useful framework to identify matter of conflicts, define shared decisions, coordinate different choices in the reconstruction discussions - and so to reduce response times.

Planning tools for urban seismic prevention

It is interesting to look back at the starting points. The already existing urban scale prevention tools, before the earthquake, were the CLE analysis and MS studies (I level); some of them were already approved before the event and then updated to the new urban situation. As it is known, CLE is not exactly a urban planning tool, but it can represent a specific reference for strategic buildings, main infrastructures of emergency areas [21, 2]. When CLE concerns historic centres as well, its planning value can represent a double meaning: as a reference to define interventions aiming at increasing urban safety but also conservation of historic building and aggregates [2].

Region/Munic.	CLE pre	HC	CLE post	HC
Lazio				
Amatrice	2016	in	-	-
Accumoli	-	-	2020	out
Abruzzo				
Campotosto	2020	near	-	-
Cortino	-	-	-	-
Montereale	-	-	-	-
Umbria				
Norcia	2017	in	-	-
Cascia	2023	in	-	near
Preci	2023	near	-	out
Marche				
Acquasanta Terme	2015	in	2022	near
Arquata d. Tronto	2015	in	2021	out
Camerino	2015	in	2022	near
Fiastra	2014	in	2022	in
Montegallo	2016	in	2022	in
Pieve Torina	2016	in	2021	near
Pioraco	2017	in	2021	in
Sarnano	2016	near	2022	near
Tolentino	2017	in	2022	in
Ussita	2015	out	2021	out
Visso 1 e 2	2016	out	2021	out

Table 4. Relations CLE-historic centres (HC) before and after

2016 earthquake (in: inside historic centres; out: outside the historic centres; near: on the edge of the historic centres)

Pre-earthquake CLE analysis can be compared to post-seismic ones, focusing on historic centres. Before 2016, the majority of concluded validated CLE analysis (11 out of 16 in total) concerned historic centres, intercepting a quite wide amount of historic strategic buildings and interfering aggregates. After earthquake, the updating (especially for Marche Region) changed the approach, imposing an external emergency system. Only 4 cases (Fiastra, Montegallo, Pioraco e Tolentino) kept their previous CLE configuration (Table 4). There are many reasons. On the one hand, after a seismic damage, the emergency system has to develop in accessible places, and that often means displaying it out of the historic centres. On the other hand, specific choices can be mentioned: Marche's Guidelines for Civil protection plans - to which CLE refer - idicates not to plan any strategic element for emergency management inside vulnerable areas (DGR 765/2019). In the four cases identified, although the emergency functions have been relocated outside the oldest part of the town, the strategic infrastructure connecting the CLE elements was not changed. This is due to the specific characteristics of those settlements, structured along routes crossing the old town and facing many historic buildings. It is clear that, in some cases, the structural characteristics of the settlement and the lack of redundancy of the routes guide the configuration of the emergency management system more than recovery strategic choices.
From this point of view, it could sayed that the earthquake came “too early” comparing to these CLE analysis, and did not give local administrations the time to provide the needed interventions in historic contexts. These interventions could have had an important role not only in reducing damages but also in obtaining a wider conservation of built heritage.

IV. CONCLUSIONS

It is possible to highlight several open questions and some necessary insights.
Almost nine years after the earthquake, many private reconstructions started and, in some cases, were completed, with results that can be often seen as inadequate for the reference scale and the way they were implemented, especially for the historic settlements in the more damaged municipalities. The way to interpret the compliant interventions is entrusted only on designers sensitivity more than on regulations or local controls, because when interventions are self-declared as compliant they are not subject to in-depth proceedings. But it also depends on the intervention categories: it’s one thing to talk about recovery or restoration of existing buildings, but quite another to face a demolition with reconstruction. Not only because the latter implies the loss of the original matter, but also for the frequent architectural licences noticeable in many interventions, since they are often based on only partial knowledge of the pre-existing state of historic buildings. Demolitions and reconstructions are clearly more than restorations; and so in these conditions one should define as compliant some intervention more similar to a re-invention. Which might also be interesting, if treated with the necessary awareness and depth. But this would imply the ability to reinterpret urban values, and most of all requires a vision for the urban recovery and development; therefore also a plan, no matter the way it is called, to adapt general responses to the local conditions. This seems to be a rarely explored path, and this awareness does not seem to be very widespread.
From a planning perspective, the possibilities offered by the normative framework are still to be applied; the reconstruction of entire urban centres has been considered as a sum of building scale interventions. And now the procedures, and also the general trend, seems to be balanced between two paths. If reconstruction is seen as a simple matter of rebuilding volumes, one must to be aware that the risk is a further loss of historic heritage; and furthermore, to be coherent, one might as well proceed to a wider and drastic simplification. But it is obvious that in this way one is pursuing opposite goals, completely different from recovering historic centres. If, on the contrary, the urban value of reconstruction and the importance of historic heritage is recognised, a reconsideration seems to be urgent; multi-scale references should be applied, so at an urban scale too, and a revision of compliant intervention criteria should be defined.
The present situation requires to act on two levels at least: rethink tools and widen the reference knowledge. Not only for now, “to save what can still be saved”, also because after nine years a complete change is very difficult to imagine. But these suggestions could be important most of all for future events, promoting prevention and conservation actions for historic centres in seismic risk areas. Seismic retrofitting of historic buildings can enhance the data collection and promote prevention, preparedness and response capacities in case of natural disasters [22]. These data seem to be not so far from those which can be considered usual in ordinary planning processes, and certainly they are not not much more complex comparing to what is already treated in municipal plans.
Often it is just a matter of making existing studies more systematic, accessible and usable. If one recalls the difficulties encountered to acquire these data after an earthquake, the importance to collect this elementary information in a preventive phase clearly appears, especially for elevated risk areas. The way to treat these studies and their level of detail may vary. But this issue seems to be a relevant and priority research program.

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