Factors influencing post-earthquake reconstruction spatial transformations

An examination of the reconstruction of the historical centre in Venzone, Friuli region, Italy (1976–2006)

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Abstract

Among all Italy's city reconstructions after earthquake disasters, only the 1976 Friuli earthquake reconstruction was completed among publicly funded projects. Numerous studies have been conducted on the lessons learned from policymaker and city planner perspectives, with some examining the mid-term reconstruction evaluations by using the Haas recovery and reconstruction model. However, few long-term evaluations have been conducted on the spatial transformation of historical centres. This study examined the spatial transformation of the historical centre in Venzone, which was one of the most earthquake affected settlements in the Friuli region. The evaluation of the reconstruction process revealed the influencing factors for the spatial post-earthquake reconstruction transformation process in Venzone's historical centre. To guide project implementation, the first influential factor was to define the primary streets and squares, to which reconstruction priority was given. The second factor was to have only one primary technician in charge of all design projects in one town block. The third factor was the appointment of an architect to prepare the reconstruction plan and act as the overall project coordinator. Those influential factors should be referenced in long-term planning in the earthquake reconstruction of Italian historical town centre.

Keywords

influential factor, protection regulation, intervention unit, spatial transformation, Italian post-earthquake reconstruction.

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INTRODUCTION

Every year, many countries need to address complex issues, many of which are related to recovery from catastrophic events, such as natural and anthropogenic disasters, for which post-disaster reconstruction planning is vital. Italy is one of the most disaster-prone countries in Europe, with earthquakes having regularly caused significant damage to small historical towns.[1] Since the late 1960s, most Italian historical centres have been under the protection of national town planning development and preservation regulations.[2] Therefore, post-earthquake reconstruction can be extremely complex, with the spatial planning projects taking a long time to implement. The National Council of Engineers reported that the 1976 Friuli earthquake reconstruction was publicly funded and only this reconstruction case was completed in 2006.[3]

Some reconstruction studies have been conducted from policymakers' and city planners' perspectives and others have had general discussions on the lessons learned.[4] For example, Norsa[5] analysed the government's response to emergencies, such as the construction of temporary housing and private sector restoration projects three years after the Friuli earthquake disaster and found that in contrast to the failure to recover from the 1968 Belice earthquake, the Friuli earthquake recovery was a good example of the sequencing of emergency reconstruction situations into longer-term planning processes. Some research has also focused on mid-term evaluations by using the Haas recovery and reconstruction model.[6] For example, Hogg[7] examined the reconstruction and revitalisation process in the historical centre of Venzone and surrounding settlements and found similarities between the process in Venzone and Haas' theoretical process model. In contrast to Hogg's study, Alexander[8] reviewed practices in the historical small settlements affected by the 1968 Belice and 1980 Irpinia earthquakes and concluded that existing reconstruction models built on experiences in towns with different regional characteristics, such as the United States, could not be adapted to small historic settlements in Italy.

Although there is not yet any unified view on the applicability of theoretical models, less research has focused on long-term evaluations of the spatial transformation of historical centres after the 1976 Friuli earthquake, and been few Italian case studies have been conducted on the factors influencing the reconstruction processes. Therefore, this study examined the specific factors associated with the reconstruction of Venzone's historical centre, which was one of the most affected settlements in the Friuli region, which is located in northeastern Italy. Prior to the earthquake, the Venzone historical centre had been registered and protected as a national cultural heritage without the need for any ordinary planning approvals, such as the "*Piano Regolatore Generale*" and the "*Piano Particolareggiato*." In 1976, Venzone had a population of approximately 3,000; however, in 1976, its historical centre was devastated by two major earthquakes, one on May 6 and another on September 15, which destroyed almost all the buildings and forced a majority of its citizens to take temporary refuge along the Adriatic Sea.

To examine the spatial transformation of Venzone's historical centre, this study evaluated the reconstruction projects for each intervention, for which the following methodology was adopted. First, with a focus on government-led and bottom-up processing protocols, a literature survey was conducted to verify Venzone's overall reconstruction process. Second, the essential characteristics of Venzone's reconstruction plans, such as the building typology and

intervention categories and units, were reviewed. Third, the timing of the project approvals, construction initiation, and completion of each unit was examined. Finally, based on results, the post-earthquake reconstruction factors influencing the spatial transformation process in the historical centre in Venzone were identified.

GOVERNMENT-LED AND BOTTOM-UP PROCESSING PROTOCOLS FOR VENZONE'S RECONSTRUCTION PROCESS

The National Council of Engineers reported in 2016 that all publicly funded projects had been completed in 2006 after the 1976 Friuli earthquake.[9] To understand the overall reconstruction process in Venzone, based on the literature survey, this section examines the two protocols and classifies them into a timeframe. The first government-led protocol had four primary phases.

Decree Law no.13 of May 13, 1976, which was enacted by the central government, outlined the basic policy for the emergency response,[10] which was followed by Regional Law no.33 of July 21, 1976, which outlined the policy for the temporary housing site developments.[11] Following this, on August 2, the Venzone Town Council approved the temporary settlement site selection for the building of the prefabricated houses, after which construction started.[12] After the second earthquake on September 15, 1976, the victims were evacuated to accommodations along the Adriatic Sea until the end of December 1976 and from January 1977 onward, they were moved into the completed temporary housing.[13]

By the end of January 1977, all temporary settlement construction projects had been completed. Regional Law no. 30 of 20 June 1977 established the provisions for the restoration of the buildings in the historical centre,[14] and Regional Law no.63 of 23 December 1977 established the provisions for the preparation of a detailed district plan for the historical centre reconstruction.[15] It was further decided that Venzone's entire historical centre, which had been listed as a national cultural heritage site in 1965, would continue to be listed as a national cultural heritage site because restoring the devastating damage by using remaining material was deemed possible.[16] Therefore, on 6 December 1977, the National Cultural Heritage Committee presented the guidelines for Venzone's reconstruction.[17]

Following the National Cultural Heritage Committee guidelines and the enactment of Regional Law no.63, in January 1978, the Venzone Municipality started preparing a detailed district plan for the historical centre reconstruction.[18] Starting in August 1976, the International Council on Monuments and Sites and the Italian Ministry of Cultural Heritage and Environment started a historical survey of Venzone's historical centre, the report for which was delivered in September 1978.[19] These survey materials and reports were therefore referred to in a detailed district plan for the historical centre reconstruction, which was approved by the Town Council on 23 April 1980.[20]

Following the approval, the reconstruction design projects were drawn up for each joint project area, with the first design project being approved by the Town Council on 31 December 1981, after which the construction began.[21] Most projects had been completed by the end of

December 1988, with all others being completed by November 1993.[22] Redevelopment work to convert the temporary settlements established during the emergency response period into residential areas or green spaces began after August 1988.[23]

Secondly, as noted bellow, three primary phases were mentioned in the bottom-up processing protocols. The '*Amici di Venzone*', a civic organisation for the protection and study of the historical and artistic heritage of Venzone, had been active from its foundation in 1971.[24] The '*Comitato di Coordinamento per il Recupero dei Beni Culturali*', an autonomous organisation, was established to protect the cultural heritage by volunteer citizens of Venzone and architects, restorers, historians, and archaeologists from all over Italy after the first earthquake occurred.[25] In July 1976, the organisation put forward an action plan to the municipal government to recover and protect the building materials from the damaged cultural heritage,[26] which was approved after the second earthquake on 15 September 1976. Consequently, from September 1976, work began on transporting, organising, and numbering the cultural heritage building materials.[27]

The Venzone citizens who had taken refuge in the accommodations along the Adriatic returned to the temporary settlements around the historical centre in January 1977.[28] Therefore, on 28 February, the municipality government destroyed the collapse-proof wooden frames of the buildings facing one street in the historical centre, which prompted the citizens of Venzone to establish a citizens' council on 19 March termed the '*Comitato 19 Marzo*' to discuss the historical centre reconstruction and disseminate information to the evacuees in the temporary housing and throughout Italy through the local newspaper, *Cjase Nestre*.[29] Under the slogan '*Dov'era e Com'era* (where it was, how it was)', the citizens' council, which was seeking to restore the historical centre to its original location, organised a petition, which was presented to the regional government and the national Ministry of Cultural Heritage and Environment on 20 August.[30] Subsequently, in December 1977, the national cultural heritage commission, the '*Consiglio Nazionale dei Beni Culturali*', recognised that the historical centre of Venzone should remain a national cultural heritage monument and approved a reconstruction guideline to restore the historical centre.[31]

When the reconstruction guideline request was approved, the '*Comitato 19 Marzo*' continued to publish its local newspaper to advise people on the reconstruction, and the '*Amici di Venzone*' was also active during the reconstruction project and published activities reports at the end of each year.[32]

The government-led and bottom-up protocols for Venzone's reconstruction process were divided into phases based on the literature survey. Figure 1 shows the overall picture of these four phases, integrating the above described two protocols.

- Phase I (1976.5-1976.12): Emergency response and heritage protection start-up phase
- Phase II (1977.1-1977.12): Evacuation and heritage restoration policy request phase
- Phase III (1978.1-1980.4): Planning and heritage restoration status sharing phase
- Phase IV (1980.5-1993.11): Project implementation and heritage restoration status sharing phase

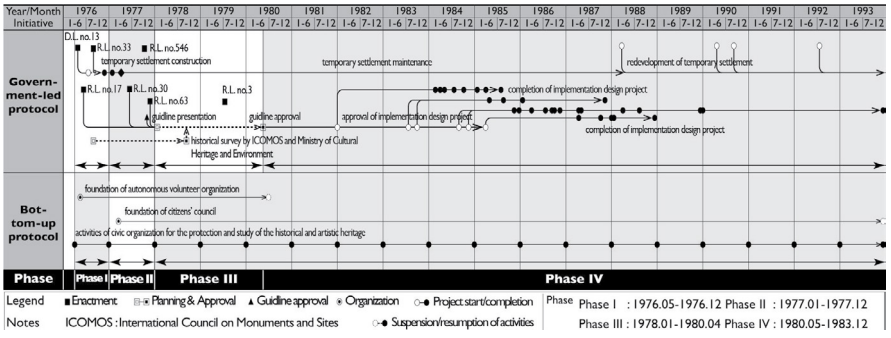

Fig. 1. Venzone's four-phase reconstruction process. Source: Author.

Following the heritage protection efforts initiated in Phase I, restoration requests were approved in Phase II, and the historical centre reconstruction planning and project implementation was instigated in Phase III. This study conducted a detailed analysis of the project approval, construction, and completion timing to clarify the spatial transformation of the historical centre from Phase IV onwards, which involved the design project implementation.

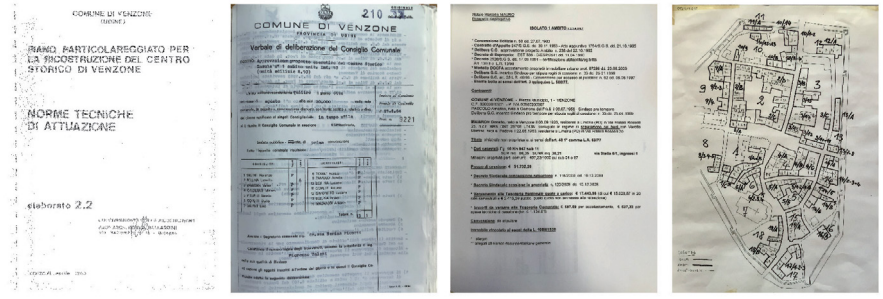

Fig. 2. Original documents referred to. Source: Venzone Municipal archives.

ESSENTIAL CHARACTERISTICS OF VENZONE'S RECONSTRUCTION PLAN

The previous section identified the overview of the historical centre spatial transformation. With the development of the reconstruction guidelines and detailed district plans, it was assumed that the basic preconditions for the spatial transformation were in place. Therefore, this section gives an overview of the essential features of the reconstruction plans based on the original documents from the Venzone Town Hall archive. Figure 2 shows some of the original documents that were consulted; the technical implementation rules, town council minutes, documents related to the project construction starts and completions, and diagram of the unitary intervention areas that had been completed. Moreover, Figure 3 illustrates typological classification and operational reconstruction plan with the intervention categories.

Fig. 3. Typological classification (left) and operational reconstruction plan with the intervention categories (right). Source: Venzone Municipal archives.

Table 1 summarises the key technical terms relevant to the spatial transformation analysis. As seen from the typological class and unitary intervention areas, the detailed district plan for the historical centre reconstruction was based on a typological architectural survey analysis. Given these definitions, the typological classes defined the individual building characteristics for the intervention.

The Venzone historical centre typological classes summarised were divided into nine principal classes from class 1 to class 9, with classes 1, 3, and 4 each having two subclasses. Although an explanation of the individual classes was omitted, from the original classes and their time transformations, the historical centre buildings had nine primary characteristics before the earthquake.

General Provisions	Definition
1. Building Unit [EN] Unità Edilizia [IT]	Complex consisting of the body of the building, distinguishable from the adjacent ones, and the uncovered area connected to it, the parts of which are organised in a unitary manner for the purposes of the intervention under the various aspects of distribution, function, style, typology, etc., presenting characters of architectural individuality verified through the critical study of the processes of formation and historical transformation
2. Typological Class [EN] Classe Tipologica [IT]	Homogeneous area to which building units with the same typological scheme are allocated for the purposes of intervention
3. Building Type [EN] Tipologia Edilizia [IT]	Specific spatial organisation in which the constituent elements are governed by precise relationships according to repeated typical patterns
4. Unitary Building Aggregation [EN] Aggregazione Edilizia Unitaria [IT]	Complex made up of buildings and open areas where an identifiable process of complex formation and transformation has developed from the original building units
5. Intervention Unit [EN] Unità d' Intervento [IT]	Complex consisting of buildings and open spaces including, according to typological complexity, one or more building units
6. Unitary Area of Intervention [EN] Ambito Unitario di Intervento [IT]	Building complex that includes one or more intervention units in a complete way, generally endowed with functional autonomy and resulting from a comprehensive transformation process

Table 1. Definitions for the key technical terms. Source: Based on Norme Techniche di Attuazione (1980).

Typological Classification

No.	Type	Name of Class
Class1	Main	Building unit with a single-lot terraced building type of layout
Class1.1	Sub	Building unit belonging to basic class 1. with the variant of the staircase arranged (inside-outside) in the rear front
Class1.2	Sub	Building unit of base class 1. with the variant of the staircase arranged in line next to the back wall
Class2	Main	Building unit with single lot terraced building conversion type
Class3	Main	Building unit with conversion type of double lot terraced building in line
Class3.1	Sub	Building unit with conversion type of terraced building on double plot
Class3.2	Sub	Building unit with in-line transformation type
Class4	Main	Building unit with type of planting and transformation/organic growth of courtyard building
Class4.1	Sub	Building unit belonging to basic class 4. with the variant of double facing
Class4.2	Sub	Building unit belonging to basic class 4. with the variant of single facing
Class5	Main	Building units of monumental layout
Class6	Main	Building unit with typical 19th and 20th century transformation typology
Class7	Main	Building unit with unidentifiable typology
Class8	Main	Buildings existing at the Napoleonic Cadastre and unbuilt in 1976 or built in that period but not consistent with the morphological and typological organisation of historical centre
Class9	Main	Newly built building now existing

General Categories of Intervention

No.	Object	Name of Category
Category A	Building body	Reconstruction with predominant restoration
Category B	Building body	Reconstruction with predominant reinstatement
Category C	Building body	Reconstruction with typological and philological reinstatement
Category D	Building body	Reconstruction with rationalisation of existing building layout
Category E	Building body	Reinstatemente of release
Category F	Building body	New building with planivolumetric prescriptions
Category G	Building body	Existing buildings that can be converted with planivolumetric prescriptions

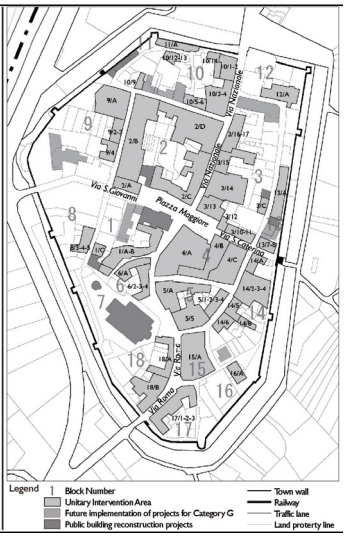

Fig. 4. Typological classifications (upper left) and intervention categories (lower left) for Venzone's historical centre. Location of unitary intervention area, street and plaza (right) in historical centre. Source: Venzone Municipal archives.

The intervention categories for each unit were defined in the operational reconstruction plan based on the typological classifications and were divided into general and specific intervention categories. The general categories defined the provisions for the implementation of the architectural plans, building works, and external space developments and were divided into two categories: one that targeted buildings and the other that targeted the spaces. The sub-category targeting the buildings was assumed to have a significant influence on the start and completion of the project construction.The category targeting the buildings was divided into a further seven sub-categories from A to G. Sub-categories A, B and C had higher protection regulations than the other categories, sub-category D was for reconstruction based on a reasonable judgement of the existing building system. Sub-category E was for the demolition and non-reconstruction of the remaining parts of the defined buildings. Sub-category F was focused on areas in the planovolumetric survey wherein the reconstruction was based on a typology survey. Therefore, three categories were focused on building types that had been the most updated before the earthquake. Sub-category G included buildings that had been newly constructed and remained standing, with the provisions in sub-category F applying to future reconstruction.

In addition to the building regulations described thus far, the technical rules also included guidance provisions to facilitate project implementation. Each project intervention was considered within the unitary project for the complete block and thus required unitary project block approval. The unitary implementation was conducted in phases based on the annual programme prepared and coordinated by the Municipal Office historical centre; therefore, no secondary building units could be constructed if the corresponding main building units had not been completed. The reconstruction was organised organically, with the first projects

No. of block	No. of U.I.A.*3	Name of Appointed Technician/Project Designer	Name of Cooperative per Project	No. of Property*4	General Categories of Intervention	Approval Date	Main Street and Square facing*1
1	1/A-B	Arch. Maurizio Brufatto	BORC DAL PALAC	n.a.	A,C,D	1982.10.22.	n.a.
1	1/C	Arch. Maurizio Brufatto	n.a.	n.a.	D	1984.08.08.	n.a.
2	2/A	Prof. Arch. Gino Valle	TRIFORA	3	C,D,E	1983.06.29	Piazza Maggiore, Via S.Giovanni
2	2/B	Prof. Arch. Gino Valle	TRIFORA	n.a.	A,B,C,D,E	1984.08.08	n.a.
2	2/C	Prof. Arch. Gino Valle	TRIFORA	11	B,C,D,E	1985.02.22	Piazza Maggiore, Via Nazionale
2	2/D	Arch. Maurizio Brufatto	n.a.	n.a.	B,C,D	1983.04.21	Via Nazionale
3	3/10-11	Arch. Francesco Doglioni	PALAZZO ORGNAMI-MARTINA	2	C	1982.10.22	Via S.Caterina
3	3/12	Arch. Francesco Doglioni	PALAZZO ORGNAMI-MARTINA	1	C,D,E	1982.10.22	Piazza Maggiore, Via S.Caterina
3	3/13	Arch. Francesco Doglioni	PALAZZO ORGNAMI-MARTINA	5	C,D	1981.12.22	Piazza Maggiore, Via S.Caterina
3	3/14	Arch. Francesco Doglioni	PALAZZO ORGNAMI-MARTINA	n.a.	B	1985.02.22	Via Nazionale
3	3/15	Arch. Francesco Doglioni	PALAZZO ORGNAMI-MARTINA	2	B	1981.12.22	Via Nazionale
3	3/B	Arch. Francesco Doglioni	n.a.	1	D	1985.03.25	Via Nazionale
3	3/C	Arch. Francesco Doglioni	n.a.	1	C,E	1984.10.24	n.a.
4	4/A	Studio Conti e Associati	SU SU VENZONE	14	B,C,D,E	1983.06.29	Piazza Maggiore
4	4/B	Studio Conti e Associati	SU SU VENZONE	8	C,D	1983.06.29	Piazza Maggiore, Via S.Caterina
4	4/C	Studio Conti e Associati	SU SU VENZONE	3	B	1983.06.29	Via S.Caterina
5	5/1-2-3-4	Dott. Arch. LORIS Sormani	BORC DAL LAT	4	C,E	1982.10.22	n.a.
5	5/5	Dott. Arch. LORIS Sormani	BORC DAL LAT	4	B	1982.10.22	n.a.
5	5/A	Dott. Arch. LORIS Sormani	BORC DAL LAT	6	B,C,D,E	1984.08.08	n.a.
6	6/2-3-4	Arch. Maurizio Brufatto	BORC DAL PALAC	4	D,G	1981.12.22	n.a.
6	6/A	Arch. Maurizio Brufatto	n.a.	4	C.D	1984.10.24	n.a.
7	n.a.	n.a.	n.a.	n.a.	B,C	n.a.	n.a.
8	8/A	Arch. Maurizio Brufatto	n.a.	2	C,F	1987.01.31	Via S.Giovanni
8	8/3-4-5	Arch. Maurizio Brufatto	BORC DAL PALAC	10	D,E	1981.12.22	n.a.
9	9/A	Dott. Arch. Carlo Santamaria	SAN GIOVANNI	9	B,E	1985.02.22	n.a.
9	9/2-3	Dott. Arch. Carlo Santamaria	SAN GIOVANNI	4	C,E	1982.10.22	n.a.
9	9/4	Dott. Arch. Carlo Santamaria	SAN GIOVANNI	1	B,C,E	1982.10.22	n.a.
10	10/1-2	Arch. Francesco Doglioni	TORI FORS	3	C,D,E	1981.12.22	Via Nazionale
10	10/3-4	Arch. Francesco Doglioni	TORI FORS	4	B,C,D,E	1981.12.22/1982.10.22	Via Nazionale
10	10/5-6	Arch. Francesco Doglioni	n.a.	2	D,F	1984.08.08/1984.10.24	n.a.
10	10/9	Arch. Francesco Doglioni	TORI FORS	2	D	1981.12.22	n.a.
10	10/12-13	Arch. AIGUSTO ROMANO Bureli	LI Muris	3	D,E,G	1982.01.11	n.a.
10	10/14	Arch. AIGUSTO ROMANO Bureli	LI Muris	n.a.	D	1983.09.28	n.a.
11	11/A	Arch. AIGUSTO ROMANO Bureli	LI Muris	5	D	1985.03.25	n.a.
11	11/5-6-7	Arch. AIGUSTO ROMANO Bureli	LI Muris	3	C	1981.12.22	n.a.
12	12/A	STUDIO TECNICO S.T.P.G. etc.*2	n.a.	15	C,D	1984.10.24	n.a.
13	13/A	Arch. Degan Bianchet Alfonso	BARBACANE	6	A,C,D,F	1984.07.25	n.a.
13	13/7-8	Arch. Degan Bianchet Alfonso	BARBACANE	2	C	1981.12.22	Via S.Caterina
14	14/A	STUDIO TECNICO S.T.P.G. etc.*2	BARBACANE	7	C,E	1984.10.24	Via S.Caterina
14	14/2-3-4	STUDIO TECNICO S.T.P.G. etc.*2	BARBACANE	5	B,C,D,G	1983.11.03	n.a.
14	14/5	STUDIO TECNICO S.T.P.G. etc.*2	BARBACANE	3	C,D	1981.12.22	n.a.
14	14/B	STUDIO TECNICO S.T.P.G. etc.*2	BARBACANE	4	D	1984.08.08	n.a.
14	14/6	STUDIO TECNICO S.T.P.G. etc.*2	BARBACANE	2	C,D	1981.12.22	n.a.
15	15/A	Arch. SIMONITTI Valentino	BORC DAL LAT	5	C,D,E	1984.08.08	Via Roma
16	16/A	Dott. Arch. Maria TAMBURINI	S. Caterina	1	E,F	1984.06.20	n.a.
17	17/1-2-3	Dott. Arch. Maria TAMBURINI	S. Caterina	8	C,D,E	1981.12.22	Via Roma
18	18/A	Arch. SIMONITTI Valentino	BORC DAL LAT	n.a.	D,E	1984.10.24	Via Roma
18	18/B	n.a.	n.a.	n.a.	C,D	1984.10.24	Via Roma

NOTE *1 Main streets and square are defined as Via Nazionale, Via Roma and Via S.Giovanni, Piazza Maggiore, Via S.Caterina. *2 STUDIO TECNICO S.T.P.G., PITTERI Graziano, PIRZIO BIROLI
*3 Unitary Intervention Area *4 Refering to the owner of the building, not the land.

Table 2. Essential Characteristics of the unitary intervention areas. Source: Based on Piano Operativo della Ricostruzione (1980) and Verbale di deliberazione del Consiglio Comunale.

implemented being the buildings lining the primary streets and the square, such as *Via Nazionale*, *Via Roma*, *Via S.Giovanni*, *Piazza Maggiore*, and *Via S.Caterina*. The final discussion in this study considers the influence of the physical preconditions for implementing the guidance preconditions on the spatial transformation process.

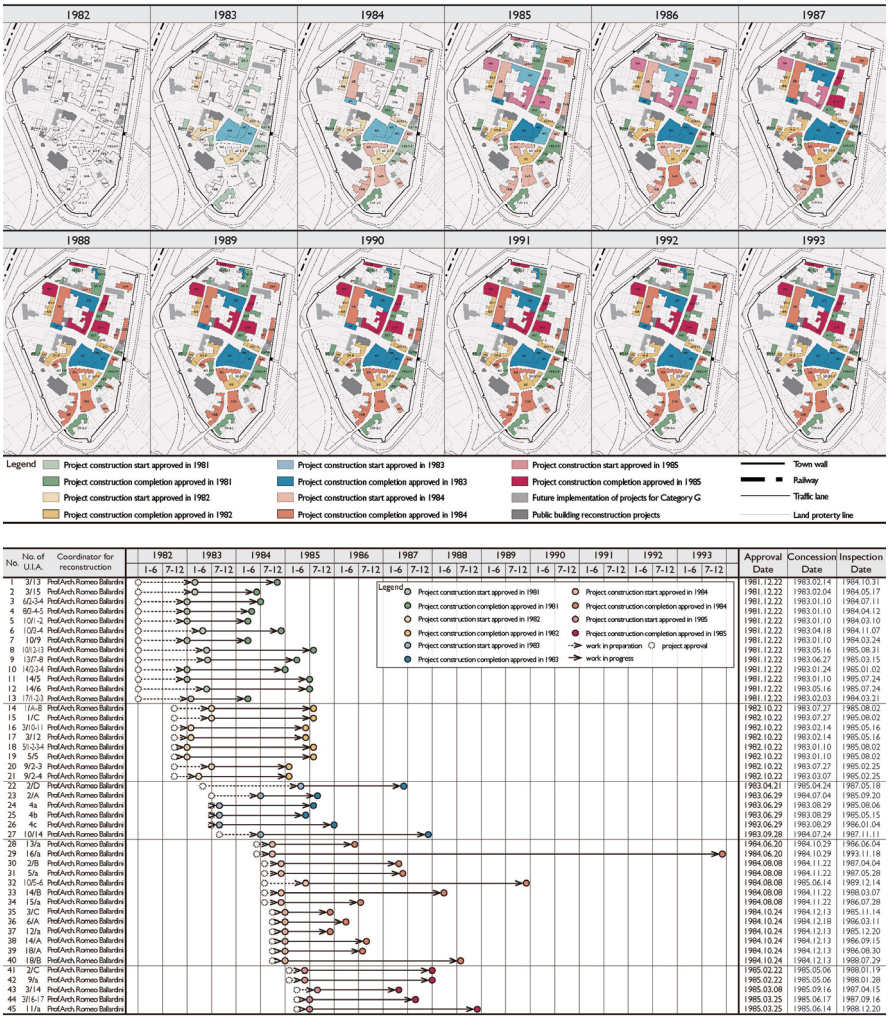

Fig. 5. Spatial transformation process focused on the construction start and completion (top: visualisation on map) (bottom: visualisation on the bar chart). Source: Based on Progettazione Esecutiva, Verbale di deliberazione del Consiglio Comunale and Documento di Concessione e Collaudo.

CONDITIONS FOR THE SPATIAL TRANSFORMATION WITH A FOCUS ON PROJECT IMPLEMENTATION

Each unitary intervention area or project implementation unit had characteristics in line with the physical and guidance preconditions. Table 2 summarises the key features of the unitary intervention areas and lists the 48 unitary intervention areas[33] for the 18 blocks. Technicians were appointed to each block and most projects were cooperative. The unitary intervention

categories were extremely diverse, with less than half facing the main streets and squares as defined in the technical rules.

The unitary intervention areas were arranged in the same order as the Town Council project approvals, with the spatial transformation process being visualised using maps and graphs as shown in Figure 5. As mentioned in the implementation regulations set out in the technical rules, the implementation project approvals were granted over a five-year period from 1981 to 1985 as outlined in Figure 5. By 1985, construction on all implementation projects had started, with the final project being completed at the end of 1993. Most projects that started early were facing *Piazza Maggiore*, *Via S.Caterina*, and *Via Roma* (note; the projects that had already started in 1984). This trend was further observed in the projects completed early (note; projects completed in 1986). Half the projects facing *Via Nazionale* were started in 1983; however, as no construction was started in 1984, all projects started in 1985. Therefore, all projects along this street were completed in 1988, thereby confirming the discrepancies with the implementation-related guidance precondition. As the preparation of the annual programme, the project approvals, permissions to start construction, and project completion inspections were coordinated by *arch. Romeo Barardini*, who was a professor at the University of Bologna, had been assumed to be the planner for the detailed district reconstruction plan and had played an important role in ensuring the reconstruction quality by ensuring that the strict preconditions were complied with.

CONCLUSION

This study examined the influential factors for the spatial transformation in the post-disaster earthquake reconstruction process. It evaluated the project implementation conditions associated with Venzone's spatial transformation of its historical centre. Based on the detailed understanding of the project approval, construction start, and completion processes and accounting for the essential physical and guidance preconditions in each unitary intervention area, three factors were found to influence the earthquake reconstruction process.

To guide the project implementation, the first factor was prioritising the main streets and squares, which was stipulated in the technical rules associated with the implementation regulations specifying the inductive preconditions. The visualisation of the spatial transformation process revealed that some projects facing some streets and squares were started and completed early, which was a crucial factor. By focusing on the revitalisation of the main streets and squares, which were the primary social and economic activity centres, the lives and livelihoods of citizens were more rapidly rehabilitated. Furthermore, the analysis revealed that some projects took a long time to implement although they were located on major streets; therefore, exploring the reasons for this requires further investigation.

The second factor found was that a single technician was responsible for the multiple implementation design projects within one block. This term was stipulated in the technical rules for the implementation regulations for the organisation of the basic characteristics in each

unitary intervention area. This factor was surmised to be a local norm to ensure effective coordination of the multiple implementation design projects within one block. As Venzone is a small town, it has a small historical centre and relatively small town blocks. If this finding was to be used in future earthquake reconstruction projects, determining the maximum number of projects coordinated by a single technician for particular block sizes is crucial.

The third factor was that a planner was appointed as the project implementation coordinator to prepare the reconstruction plan. A detailed district plan for the reconstruction of the historical centre was drawn up by architect Baraldini. He continued to act as the reconstruction project coordinator during the project implementation phase, checked the implementation design drawings, authorised the project construction starts, and inspected the buildings after completion. By establishing the strict technical rules set out in the reconstruction plan and supervising the following of these rules, he ensured that the appropriate spatial transformations were conducted, which contributed to the high-quality reconstruction. Mechanisms for the smooth overseeing of these types of special rules and guidelines may also have been a factor in the recovery process.

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DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author.

NOTES ON CONTRIBUTOR(S)

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ENDNOTES

1. Oliva, "La difficile Ricostruzione dell'Aquila" 50.
2. Piccinato, *The Town Planning Review*.
3. Consiglio Nazionale Ingegneri, "I costi dei terremoti in Italia" 6.
4. Aldo Norsa, "The Reconstruction of Friuli - Emergency Versus Long-Term Planning". Gianni Pietro Nimis, *La Ricostruzione Possibile-La ricostruzione nel centro storico di Gemona del Friuli dopo il terremoto del 1976*. Sandro Fabbro, "La ricostruzione del Friuli: un problema, una ricerca, un progetto".
5. Aldo Norsa, "The Reconstruction of Friuli - Emergency Versus Long-Term Planning" 264.
6. Haas J. Eugene, Robert W. Kates and Martyn J. Bowden, "Reconstruction Following Disaster" 280.
7. Sarah Jane Hogg, "Reconstruction Following Seismic Disaster in Venzone, Friuli" 179.
8. David Alexander, "Preserving the Identity of Small Settlements during Post-Disaster Reconstruction in Italy" 235.
9. Consiglio Nazionale Ingegneri, "I costi dei terremoti in Italia" 6.
10. Presidente della reppublica, Decreto-Legge n.227/1976.
11. Friuli-Venezia Giulia Region, Regional Law n.33.1976.

12. Comune di Venzone, Deliberazione del Consiglio Comunale n.32/1976.
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15. Friuli-Venezia Giulia Region, Regional Law n.63.1977.
16. Comune di Venzone, "Piano Particolareggiato per La Ricostruzione del Centro Storico di Venzone - Relazione Illustrativa" 3. Amici di Venzone, "Venzone: La ricostruzione di un centro storico" 31.
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22. Comune di Venzone, Progettazione Esecutiva in Venzone Municipality archives.
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25. Ibid., 21.
26. Ibid., 13.
27. Ibid., 27. Comune di Venzone, "Piano Particolareggiato per La Ricostruzione del Centro Storico di Venzone - Relazione Illustrativa" 2.
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29. Amici di Venzone, "Venzone: La ricostruzione di un centro storico" 29.
30. Ibid., 29. Comune di Venzone, "Piano Particolareggiato per La Ricostruzione del Centro Storico di Venzone - Relazione Illustrativa" 3.
31. Comune di Venzone, "Piano Particolareggiato per La Ricostruzione del Centro Storico di Venzone - Relazione Illustrativa" 3. Amici di Venzone, "Venzone: La ricostruzione di un centro storico" 31.
32. Amici di Venzone, "Cjase nestre: (supplement al Bollettino del Coordinamento delle Tendopoli): 1977-1980".
33. Building permits and completion inspection documents have been obtained for 45 of the 48 unitary intervention areas at Venzone Municipal archives. Therefore, the spatial transformation process of the 45 areas is analysed in Figure 5.

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