



Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



METHODOLOGIES FOR ADAPTING HUMAN SPACE TO CHANGES INDUCED BY NATURAL EVENTS: URBAN REGENERATION AND RE-HABITATION OF SETTLEMENTS AFFECTED BY SEISMIC EVENTS: CASE HISTORY

DIEGO ZURLI

zorro562003@virgilio.it



TODI

Tuesday 22 July 2025

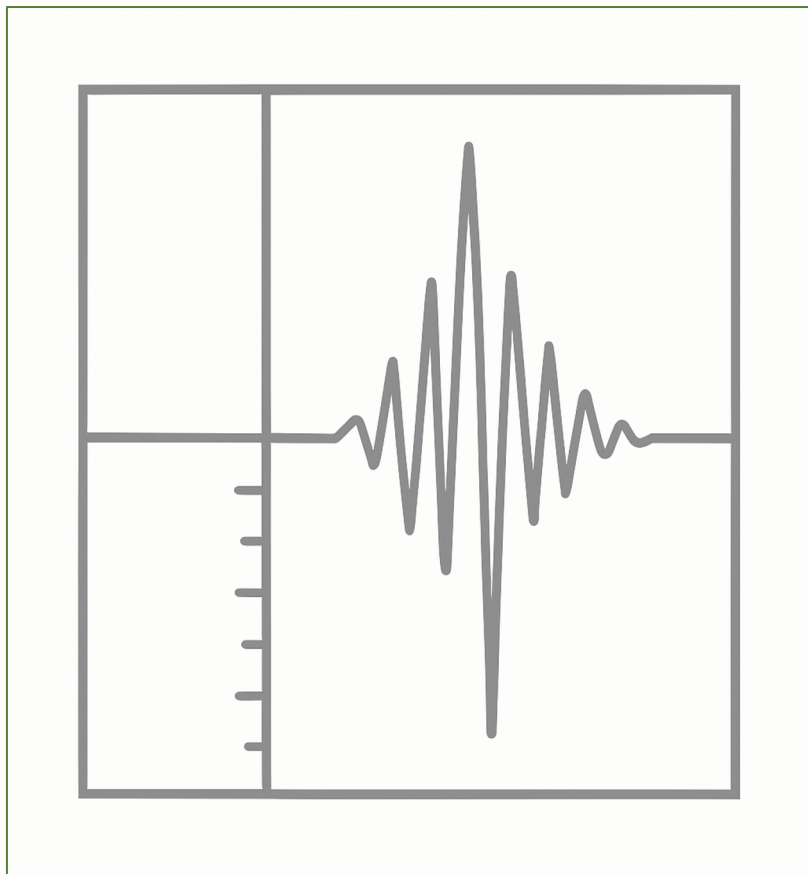


Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



SEISMIC EVENTS IN VALNERINA

**FIVE EARTHQUAKES
(in 45 years):**

- ✓ October 6, 1971
- ✓ December 2, 1974
- ✓ September 19, 1979
- ✓ September 26, 1997
- ✓ October 30, 2016



Third Edition

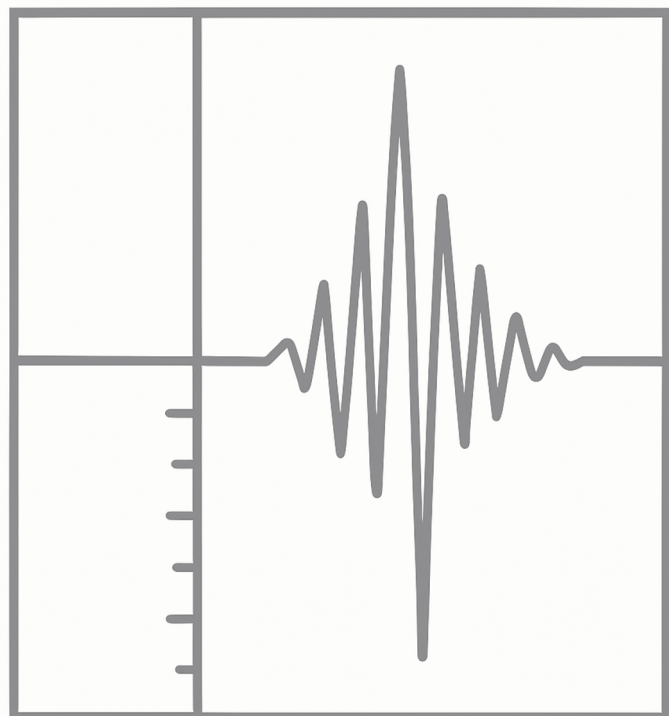
RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



SEISMIC EVENTS IN VALNERINA



In such contexts, the emergency-based approach alone, the one typically used by civil protection systems, is no longer sufficient.

“We must rethink our attitude toward earthquakes, recognizing that when we fail to prepare for the predictable, the unpredictable always happens”



Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025

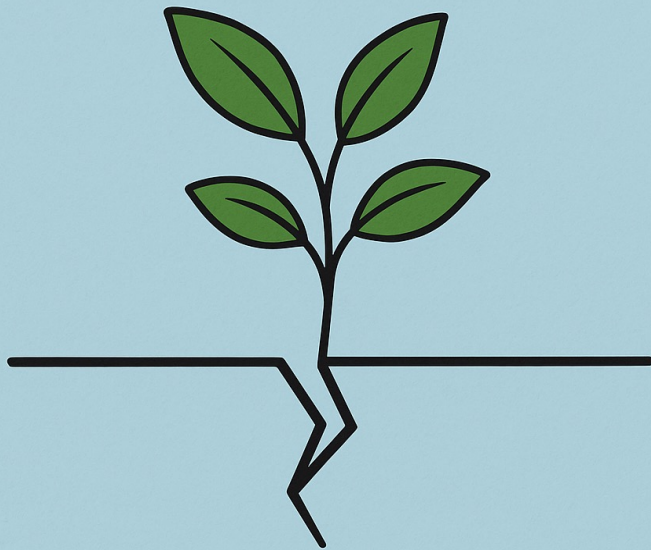


RESILIENCE: HOW TO DEFINE IT

"Resilient" is nowadays one of the most frequently used adjectives by architects, and urban planners

It expresses the urgent need to adopt behaviors and strategies capable of effectively addressing the multiple challenges affecting territorial governance

Several authors have attempted to better define the meaning of resilience in the urban context, identifying, through concrete examples, possible responses to critical issues such as climate change, and the actions needed to confront it



RESILIENCE



Third Edition

RISK MANAGEMENT

Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness

20 - 27 July 2025



CITIES HAVE ALWAYS BEEN RESILIENT AND SMART

Intelligent solutions and technologies that improve urban life have existed in every age and context

Cities have always known how to adapt to environmental conditions, economic shifts, and social structures

This capacity is the foundation of their survival.

Marc Augé wrote that “*cultures live if they change, and die when they stop changing*”. So, embracing change in a responsible and proactive way has always been the best strategy for resisting the pressure of historical events

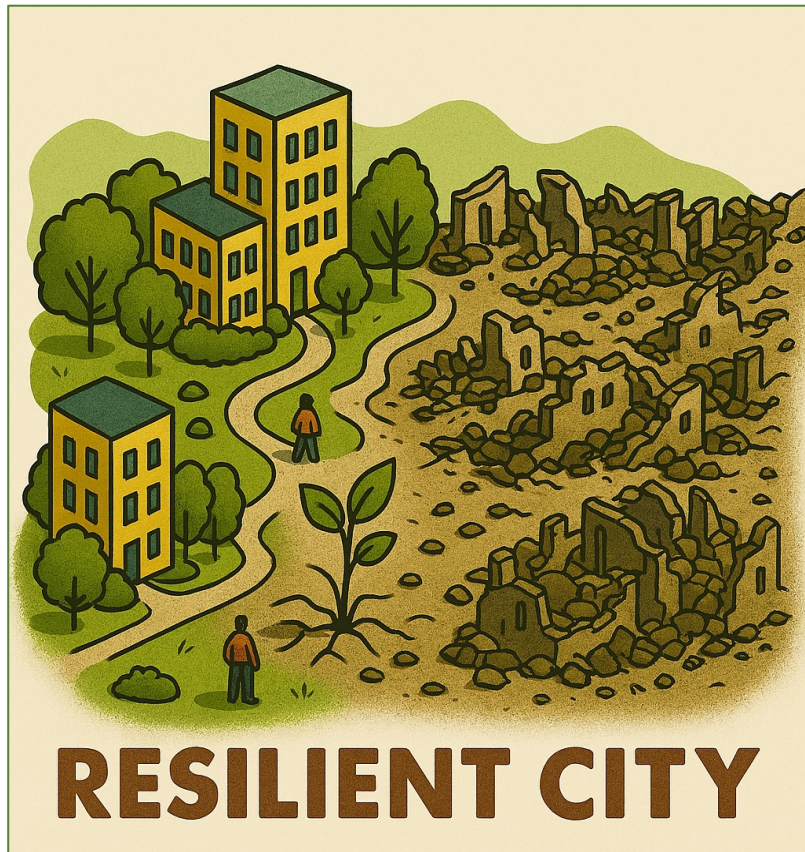


Third Edition

RISK MANAGEMENT

Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness

20 - 27 July 2025



URBAN RESILIENCE: THREE DIFFERENT APPROACH:

- *As the ability to maintain ecological balance within urban development.*
- *As the capacity to adapt to climate change and reduce the use of natural resources.*
- *As the ability to consciously manage and mitigate both natural and human-made risks, while improving environmental and social quality at urban and territorial scales*

These three approaches are not mutually exclusive. On the contrary, they often intersect and influence each other and should be considered together



Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



Let's focus on the third approach: the conscious management of risks within the evolving framework of urban and territorial planning tools

A concrete example of this approach is the Coordinated Regional Multi-Risk Prevention Plan developed by the Umbria Region and approved in 2014

This plan outlines a series of integrated civil protection strategies aimed at increasing the safety of people and public and private assets



Third Edition

RISK MANAGEMENT

Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness

20 - 27 July 2025



THE EARTHQUAKE OF NORCIA IN 1859: THE BIRTH OF THE BORGIO PIO PROJECT

The project had two main goals:

- To modernize the city, following 19th-century urban planning principles: wider streets, organized blocks, and better construction standards;
- And to build a safer neighborhood, with lower density and better materials to reduce the damage in case of future earthquakes.

Borgio Pio was not just a physical place it was a symbol of hope and rebirth for a wounded city dreaming of a better future



Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



TERRITORIAL AND URBAN PLANNING AND CIVIL PROTECTION

The Territorial Urban Planning Plan (PUT), required municipalities to adopt local or inter-municipal emergency plans, based on regional guidelines, as part of the structural component of their General Urban Plans (PRG).

They required municipalities to produce risk maps at the local scale, identify equipped areas and infrastructures intended for population safety and emergency operations, and assess their geological and hydrological compatibility as well as logistical accessibility.



Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



**TWO KEY CONCEPTS: MINIMUM URBAN STRUCTURE (SUM)
AND THE EMERGENCY LIMIT CONDITION (CLE)**

MINIMUM URBAN STRUCTURE (SUM)

The Minimum Urban Structure is a concept introduced by the Italian Civil Protection to define the set of functions, buildings, infrastructures, and public spaces considered essential for managing an emergency and maintaining the minimum functioning of a community after a disaster (typically an earthquake).





Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



MINIMUM URBAN STRUCTURE (SUM)

Objective of the SUM

To ensure operational continuity in the immediate consequences of a catastrophic event, by keeping essential services up and running.

For this reason, the SUM must be resilient, easily accessible, and designed to withstand at least partial damage.

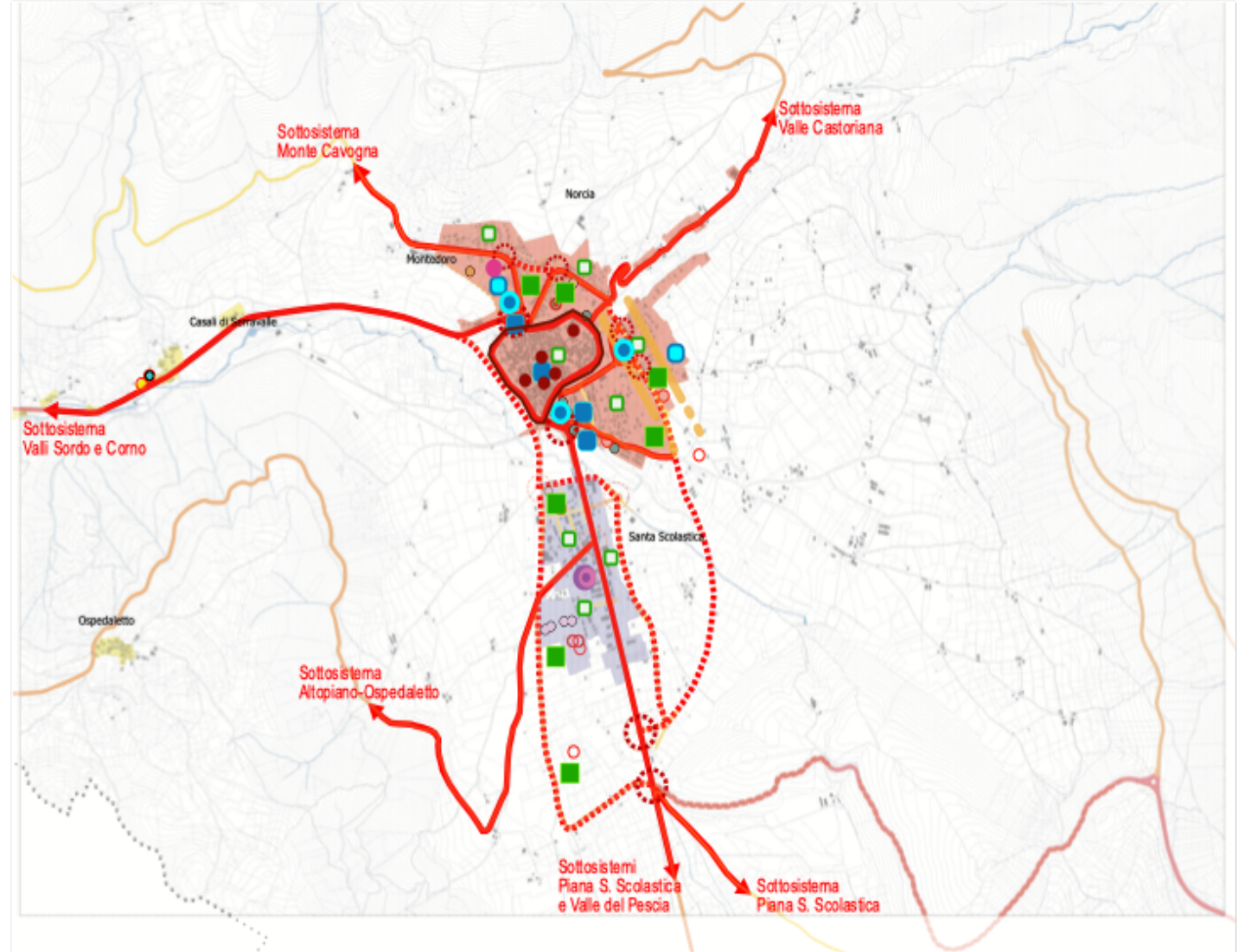




MUNICIPALITY OF NORCIA: MINIMUM URBAN STRUCTURE (SUM)

Comune di Norcia
Piano Regolatore Generale - PARTE STRUTTURALE
febbraio 2021

CAPOLUOGO



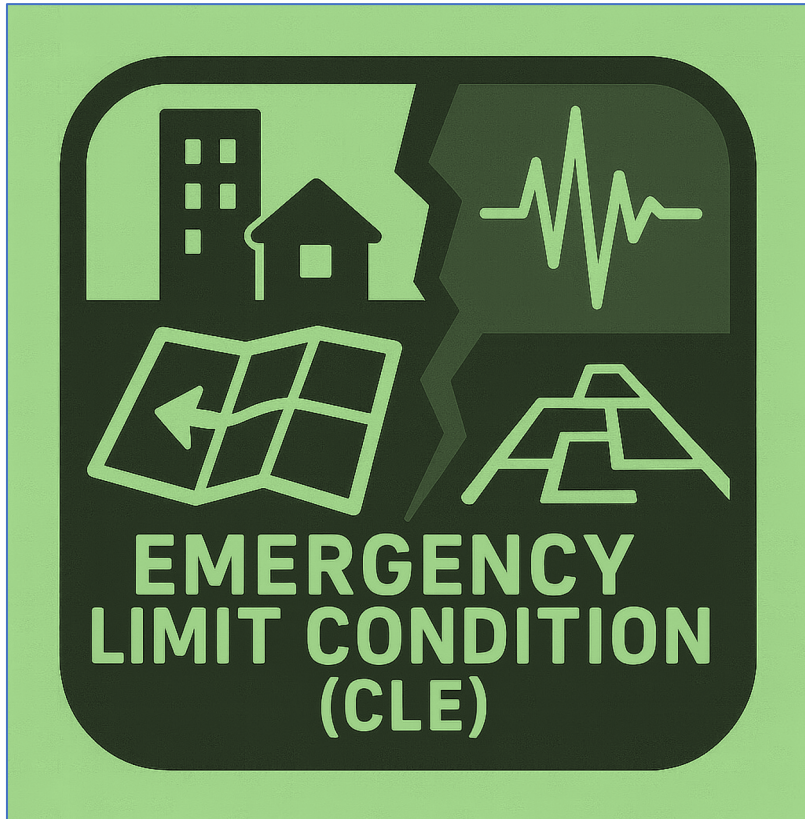


Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



EMERGENCY LIMIT CONDITION (CLE)

The Emergency Limit Condition (CLE) is a technical-strategic concept connected to the SUM, introduced to estimate the residual capacity of the urban system (buildings, infrastructure, and public spaces) to manage an emergency after a strong earthquake, but before the full reconstruction phase.

In seismic engineering, the CLE defines a threshold beyond which a structure can no longer perform its emergency functions. It doesn't necessarily mean the building collapses, but rather that it loses functional usability for vital post-earthquake operations.

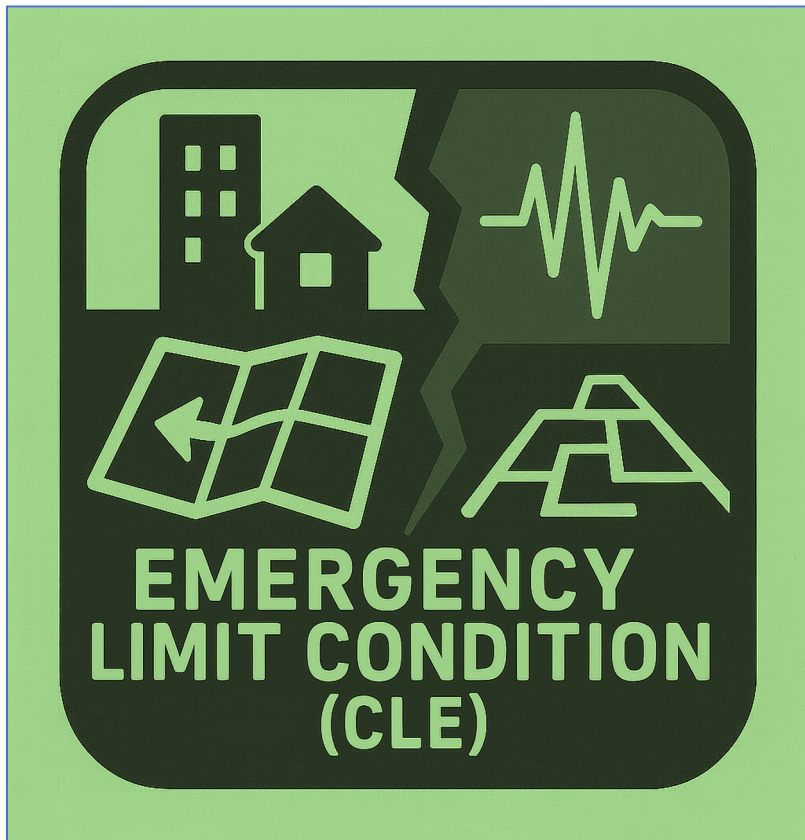


Third Edition

RISK MANAGEMENT

Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness

20 - 27 July 2025



EMERGENCY LIMIT CONDITION (CLE)

CLE Indicators:

- *Structural and non-structural damage compatible with immediate use.*
- *Accessibility to strategic structures.*
- *Functionality of basic services (electricity, water, communications).*
- *Remaining logistical capacity of public spaces.*

It's a functional rather than a structural concept: it measures the ability of the urban environment to resist at seismic stress and keep operating for emergency purposes.

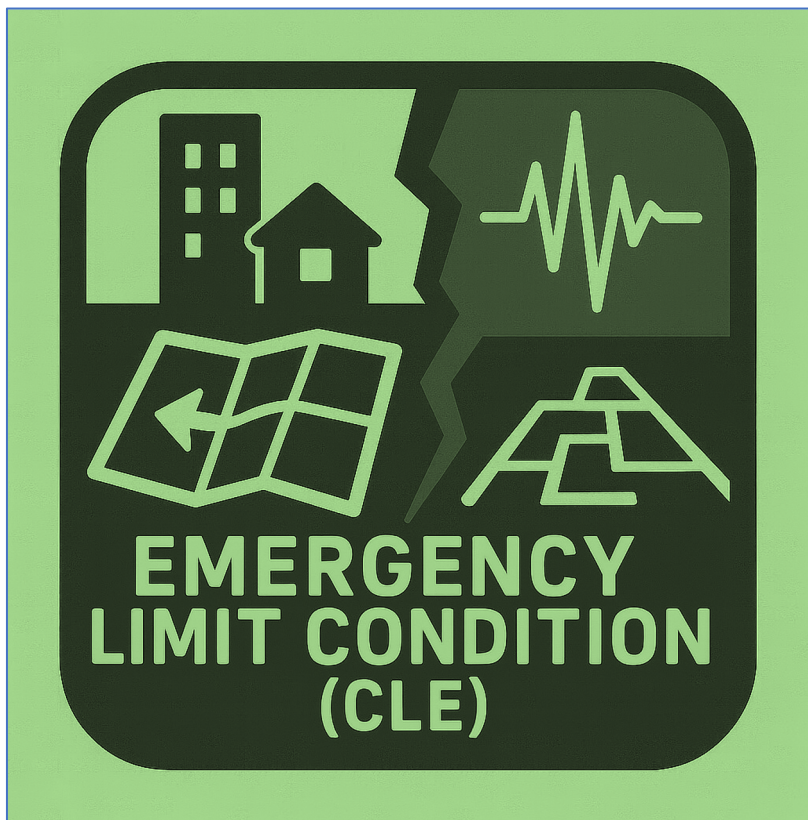


Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



EMERGENCY LIMIT CONDITION (CLE)

Thanks to resources provided by the Civil Protection Department and especially the EU structural funds, it was possible to extend this analysis to most of the municipalities in Umbria. These municipalities conducted the analysis using their internal resources, supported by expert technicians made available through an agreement with ANCI (National Association of Italian Municipalities).

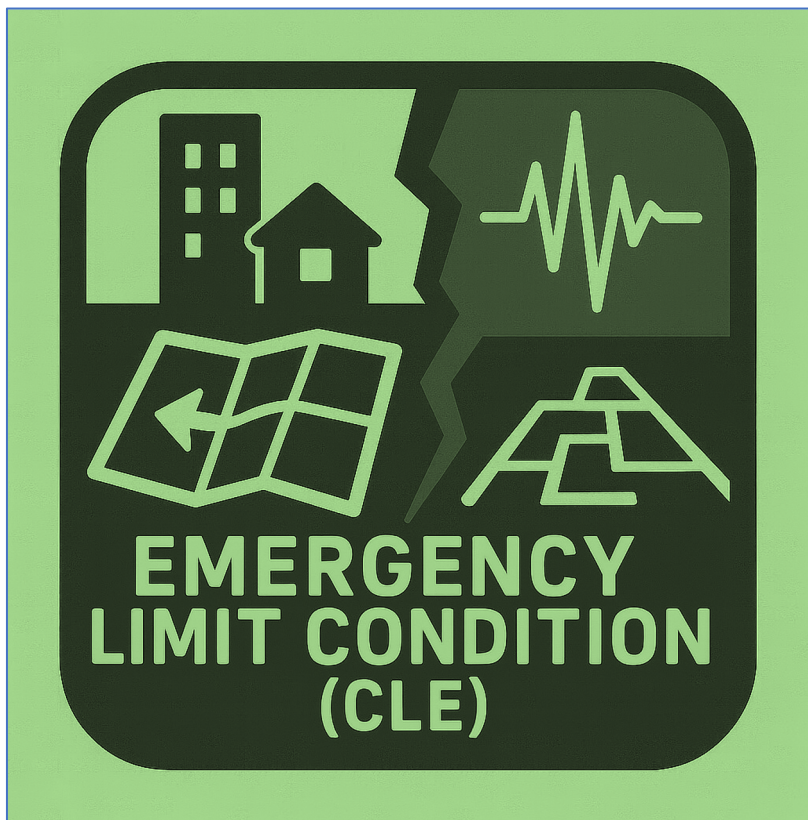


Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



EMERGENCY LIMIT CONDITION (CLE)

The aim of this analysis is to identify strategic buildings necessary for emergency management as defined in the municipal civil protection plan, and to represent them in a cartographic document. This map includes:

- *The identification of emergency areas;*
- *The road connections between strategic buildings and emergency areas;*
- *The transport infrastructures ensuring connectivity with the surrounding territory.*

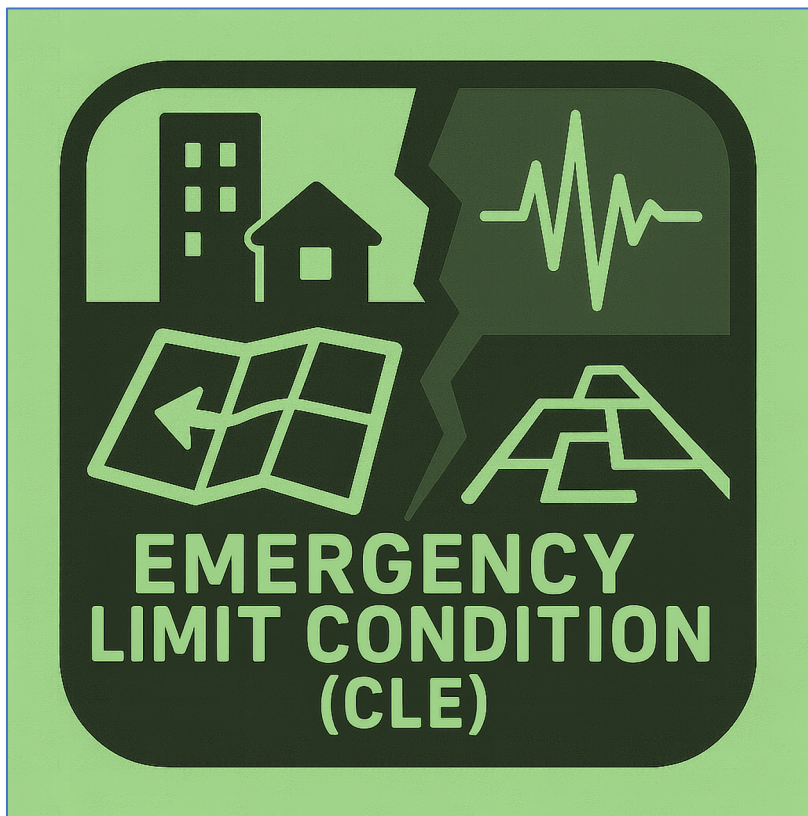


Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

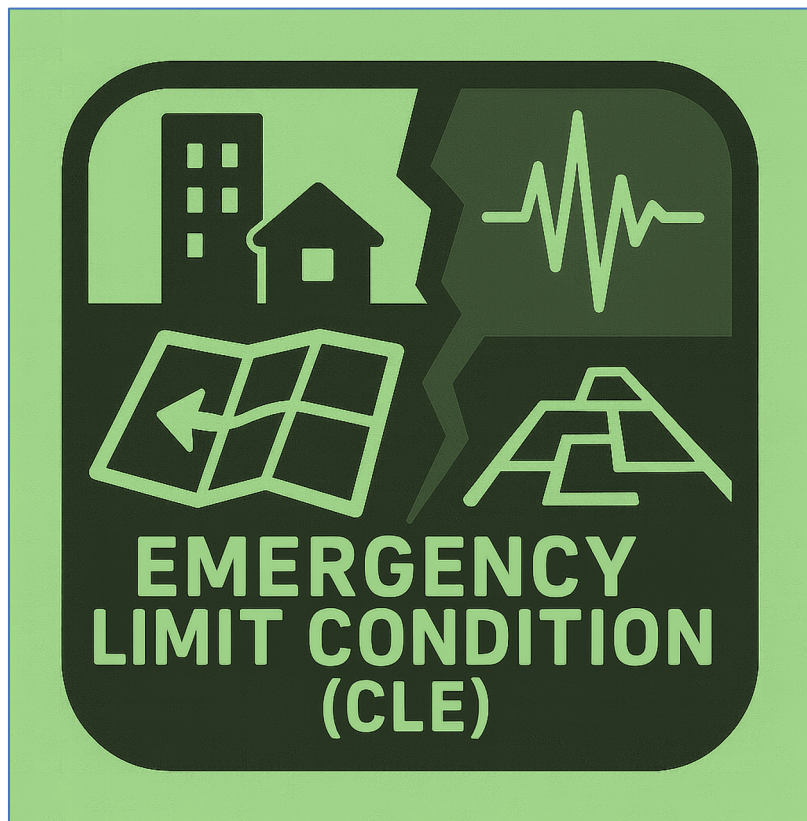
20 - 27 July 2025



EMERGENCY LIMIT CONDITION (CLE)

The cartography also highlights structural aggregates and units interfering with access routes or emergency areas. The analysis is completed by digitally transferring all data into an IT platform. The ultimate goal of this analysis is to provide an updated, comprehensive, and representative overview of buildings and road infrastructures that must remain fully operational in the event of a seismic event to effectively manage the emergency.

Thanks to this work, it is now possible to compare the consistency between the provisions contained in civil protection or emergency plans and those in spatial planning tools, with the aim of integrating various planning instruments and correcting any identified weaknesses.

[illegible]



Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



HOW DO SUM AND CLE WORK TOGETHER IN PLANNING?

The SUM defines what must keep functioning after an earthquake, while the CLE sets the minimum performance level those components must perform their roles effectively.

In practical terms, within urban planning and technical design, this means:

- *Identifying the SUM within the urban fabric (using technical and social criteria).*
- *Assessing the seismic vulnerability of its components.*
- *Defining necessary actions to meet the CLE: reinforcement, upgrades, usage changes, etc.*

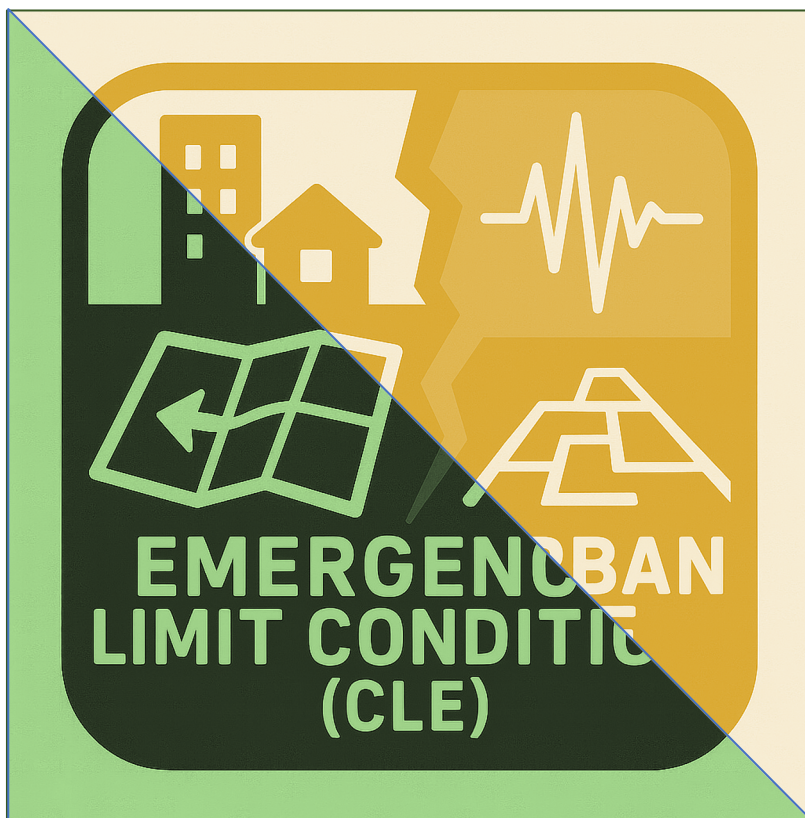


Third Edition

RISK MANAGEMENT

Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness

20 - 27 July 2025



IMPLICATIONS FOR ARCHITECTS AND URBAN PLANNERS

These concepts represent a shift from a purely building-focused safety perspective to a systemic view of the territory: the aim is not just to resist disasters, but to keep functioning afterwards.

This means:

- *Working on urban resilience projects, even at a small scale.*
- *Integrating risk mitigation strategies into everyday design.*
- *Engaging with Civil Protection and emergency experts from the early stages.*
- *Thinking in systemic and strategic terms, not just aesthetic or functional.*

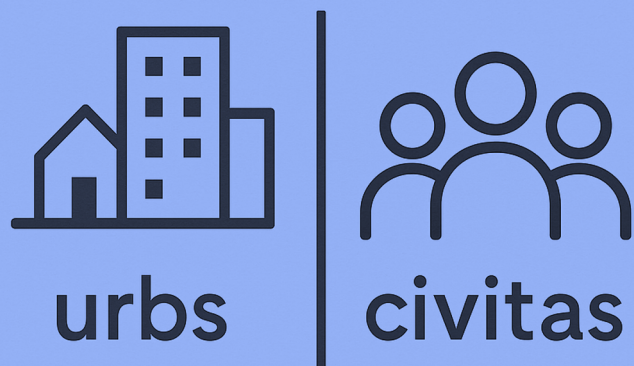


Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



FROM REBUILDING TO RE-INHABITING: EXPERIENCE AND PERSPECTIVES

We've looked at a number of experiences involving seismic-resistant building restoration, the reconstruction of the city as a physical space — meaning its buildings — the role of urban planning, and the shift from a focus on single buildings to a broader, city-wide perspective. We've also touched on how urban planning relates to civil protection.

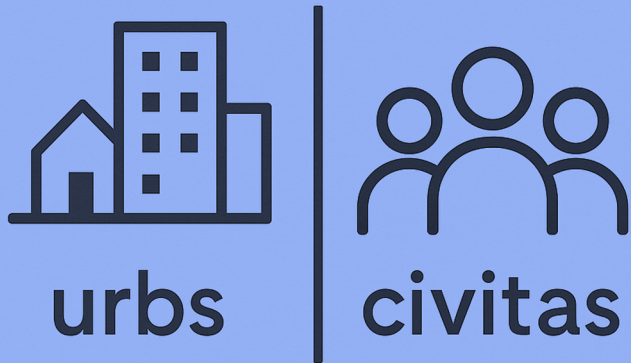


Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



FROM REBUILDING TO RE-INHABITING: EXPERIENCE AND PERSPECTIVES

When the ancient Romans spoke of the city, they used two different but closely connected words: *urbs* and *civitas*. *Urbs* referred to the physical city — the buildings, the streets, the walls, the temples, the markets: everything you can touch, design, or build. *Civitas*, on the other hand, was not a physical place, but a community of people: citizens who shared laws, rights, and duties — but also a sense of belonging and participation.

An *urbs* without *civitas* is an empty city. It's just a collection of walls, however beautiful or solid they may be. That's why, after an earthquake or a disaster, rebuilding homes and infrastructure is not enough. We must rebuild trust, social life, economy, and culture. In other words, we need to bring *civitas* back to life.

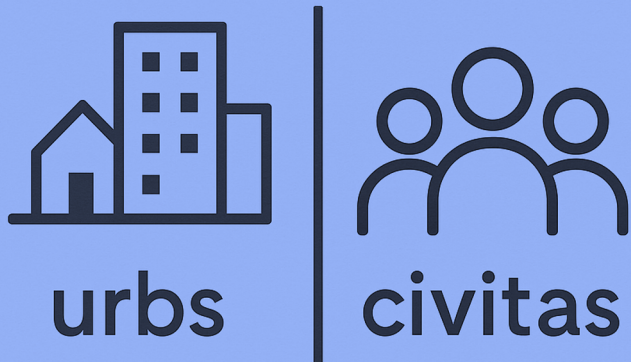


Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



FROM REBUILDING TO RE-INHABITING: EXPERIENCE AND PERSPECTIVES

Repairing damaged buildings is of course essential: it's only the first step. But it's not sufficient. Because when an earthquake strikes, it doesn't just damage buildings: it fractures relationships, weakens bonds, and spreads fear and uncertainty. People begin to wonder whether it's still worth staying, living, or investing in that place.

That's why every reconstruction process should have a clear goal: to rebuild trust. To renew that often unspoken, yet essential, pact that binds people to the places they inhabit. Only then can life truly return, not just residency.

Because in the end, it's not just about rebuilding walls: it's about rebuilding communities.



Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



COMPLEX URBAN PROGRAMS



COMPLEX URBAN PROGRAMS

The entire experience of the Umbria Region, throughout more than forty years of administrative life, has consistently moved in a specific direction, shaped by particular territorial and methodological conditions

Thanks to the absence of large metropolitan conurbations and the presence instead of a network of small and medium-sized towns, most of them of notable quality and located within a well-preserved landscape, Umbria has gradually Umbria has gradually focused on developing and testing its own model.



Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025

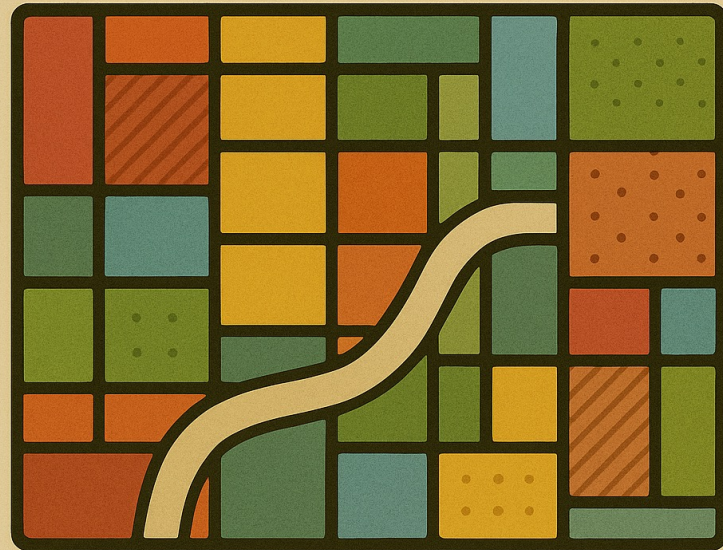


COMPLEX URBAN PROGRAMS

In the first half of the 1970s, the Region became aware of the urgent need to address the abandonment of smaller settlements, particularly in the inland Apennine areas.

The process of the disuse and decline of portions of the built environment in these zones led the Region, together with the Government Economic Ministry, to develop a study called 'Pilot Project for the Conservation and Revitalization of Historic Centers along the Umbrian Apennine Ridge.'

Although this initiative largely remained on paper, it contained the seeds of a completely new and original programmatic approach, which would later find at least partial implementation in what came to be known as 'complex programs.'



COMPLEX URBAN PROGRAMS



Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025

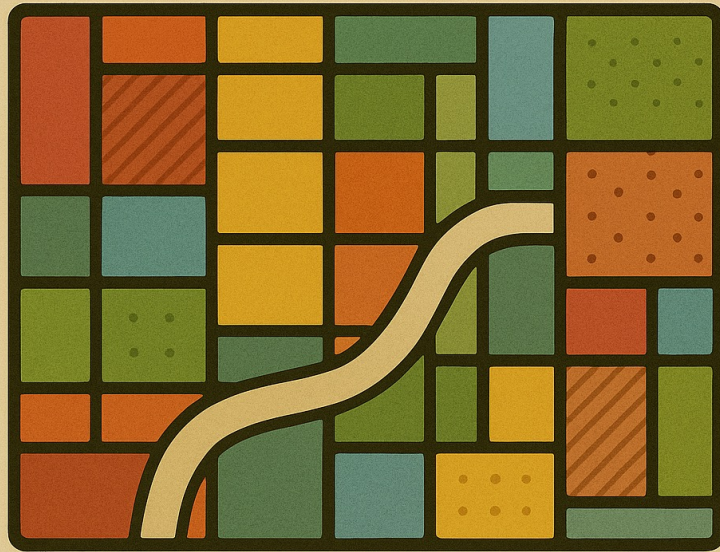


COMPLEX URBAN PROGRAMS

The approach for tackling the abandonment of historic centers cannot rely solely on the physical rehabilitation of urban spaces. Instead, it is essential to implement measures and actions that support and encourage the continuation and, where possible, the re-establishment of economic and productive activities.

This is a fundamental condition for ensuring the continued presence of residents, just as important as the recovery of architectural and historical-artistic heritage, the upgrading of infrastructure networks, improvements to urban mobility, parking facilities, and so on.

The Complex Urban Programs which emerged in later years, took on a meaning that was entirely different from traditional urban planning tools.



COMPLEX URBAN PROGRAMS



Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025

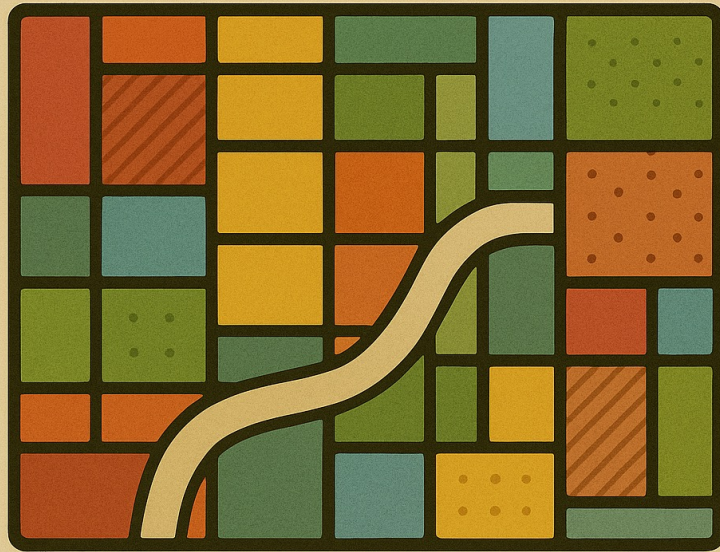


COMPLEX URBAN PROGRAMS

Their true innovation consists in the fact that they gradually developed a new way of intervening in the existing city, one that reaffirmed its 'plural' nature by encouraging a 'horizontal' approach that actively involved citizens and institutions, public and private actors alike.

This is a fundamental condition for ensuring the continued presence of residents, just as important as the recovery of architectural and historical-artistic heritage, the upgrading of infrastructure networks, improvements to urban mobility, parking facilities, and so on.

These programs diversified the types of interventions and drew on resources of various kinds and origins.



COMPLEX URBAN PROGRAMS



Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025

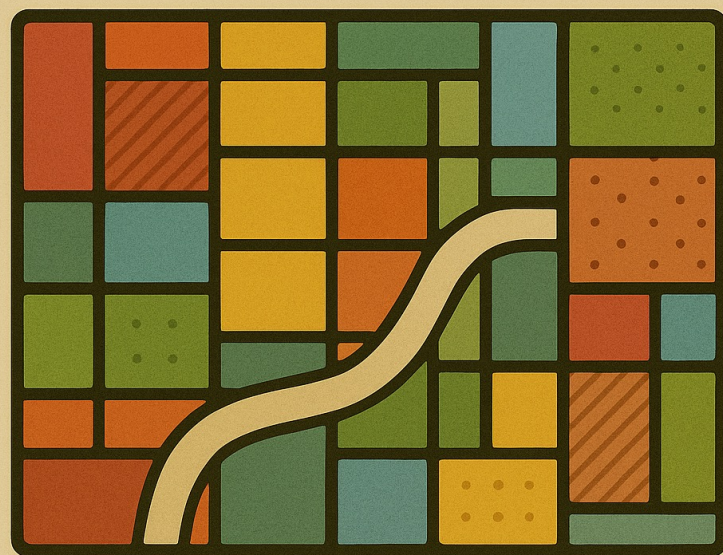


COMPLEX URBAN PROGRAMS

Over the years, this strategy has undergone many adjustments whenever Complex Urban Programs, often known under different names and with varying content, such as Neighbourhood Contracts, Integrated Redevelopment Programs, or Sustainable Urban Renewal Programs, ecc.

They have been employed to tackle the regeneration of run-down or abandoned parts of the city.

These projects were shaped through shared decision-making and participatory planning processes, which often inspired a strong sense of engagement and even identification among those involved.



COMPLEX URBAN PROGRAMS



Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025

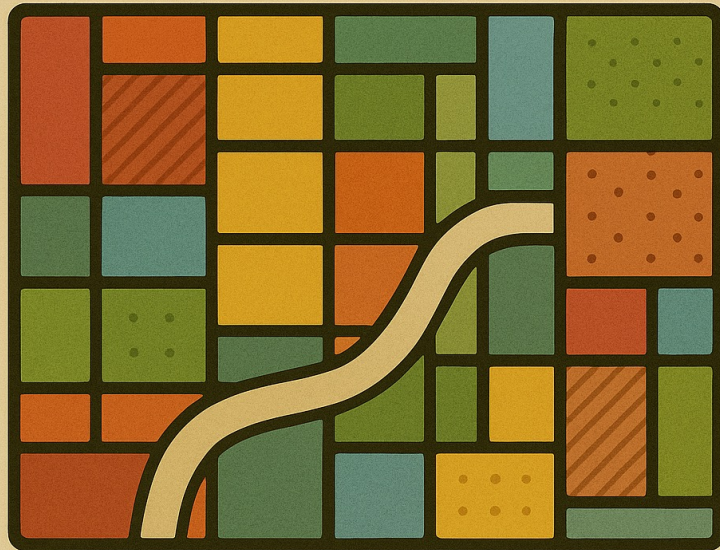


COMPLEX URBAN PROGRAMS

Returning to the main topic of seismic retrofitting of urban spaces, one of the most innovative shifts following the 1997 earthquake was the transition from individual-building interventions to block-level planning, introducing the concept of integrated reconstruction through tools like the Integrated Recovery Programs (PIR).

The core idea is to reduce vulnerability by acting on entire building blocks, offering incentives (such as volume bonuses) to encourage seismic safety upgrades.

Seismic vulnerability becomes part of municipal planning, both in the structural section of the Master Plan, and in the operational section, especially in relation to strategies aimed at reducing urban vulnerability.



COMPLEX URBAN PROGRAMS



Third Edition

RISK MANAGEMENT

Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness

20 - 27 July 2025

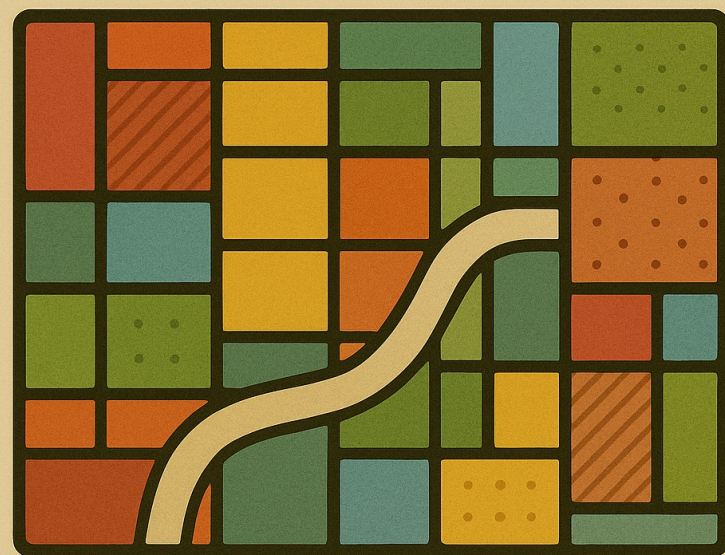


COMPLEX URBAN PROGRAMS

Another important step was the integration of seismic vulnerability into municipal planning tools, both in the structural and operational components of local master plans. This approach connects urban planning with seismic risk management.

Key actions have included:

- *Comprehensive seismic hazard and microzonation studies completed in all Umbrian municipalities;*
- *Detailed assessments of urban vulnerability, supported by innovative seismic certification tools;*
- *Structural interventions on strategic and essential buildings (schools, hospitals, cultural heritage), funded through regional, national, and EU resources;*
- *Scientific collaborations with Italian universities to develop new models and methods for evaluating urban seismic risk.*



COMPLEX URBAN PROGRAMS



Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



SEISMIC RISK PREVENTION PROGRAMS

Among the many actions taken by the Umbria Region to reduce seismic risk, one important initiative has been the launch of dedicated Seismic Risk Prevention Programs.

These programs have made it possible to carry out numerous structural upgrades on public buildings considered strategic or socially important, as well as several interventions to strengthen or improve the seismic performance of private buildings.



Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025

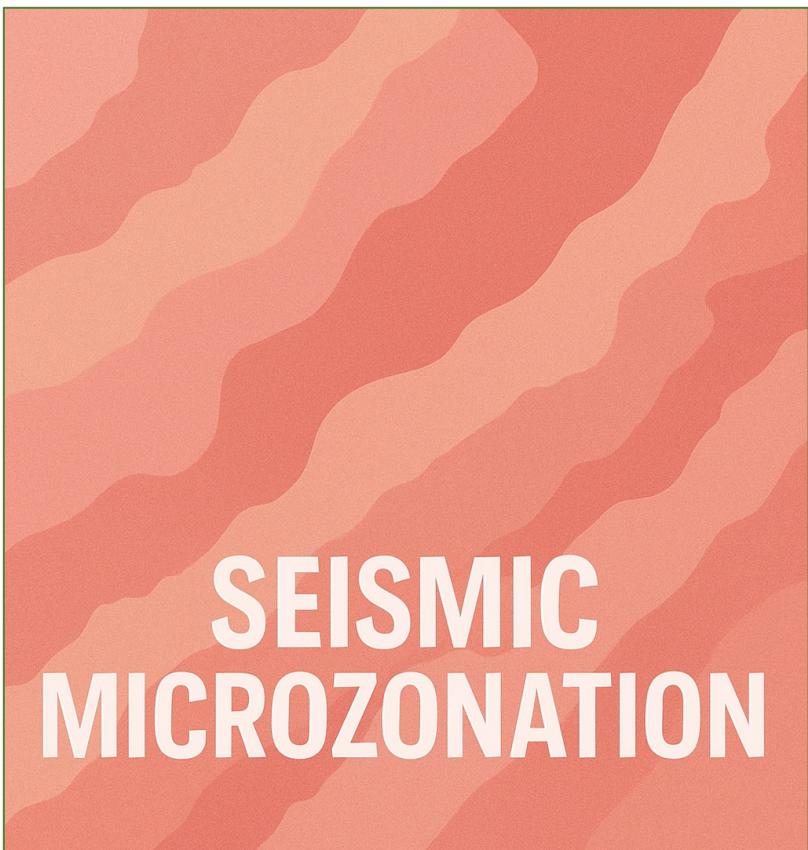


SEISMIC MICROZONATION

Thanks to this work, every municipality in the region now has a basic-level seismic microzonation map. These maps are a valuable tool for guiding planning decisions, helping to ensure that new developments are better aligned with seismic safety goals. They also lay the groundwork for more in-depth studies, which allow urban areas to be analyzed in greater detail when needed.

In some municipalities, these more detailed microzonation surveys have already been carried out. And more broadly, this process has allowed the Region to create a comprehensive map of local seismic hazards, highlighting areas that are more likely to experience ground shaking or other types of local seismic instability.

**SEISMIC
MICROZONATION**



SEISMIC MICROZONATION L'AQUILA

MICROZONAZIONE SISMICA

Esempio di carta di MS L'Aquila centro (LIVELLO3)



ZONE STABILI



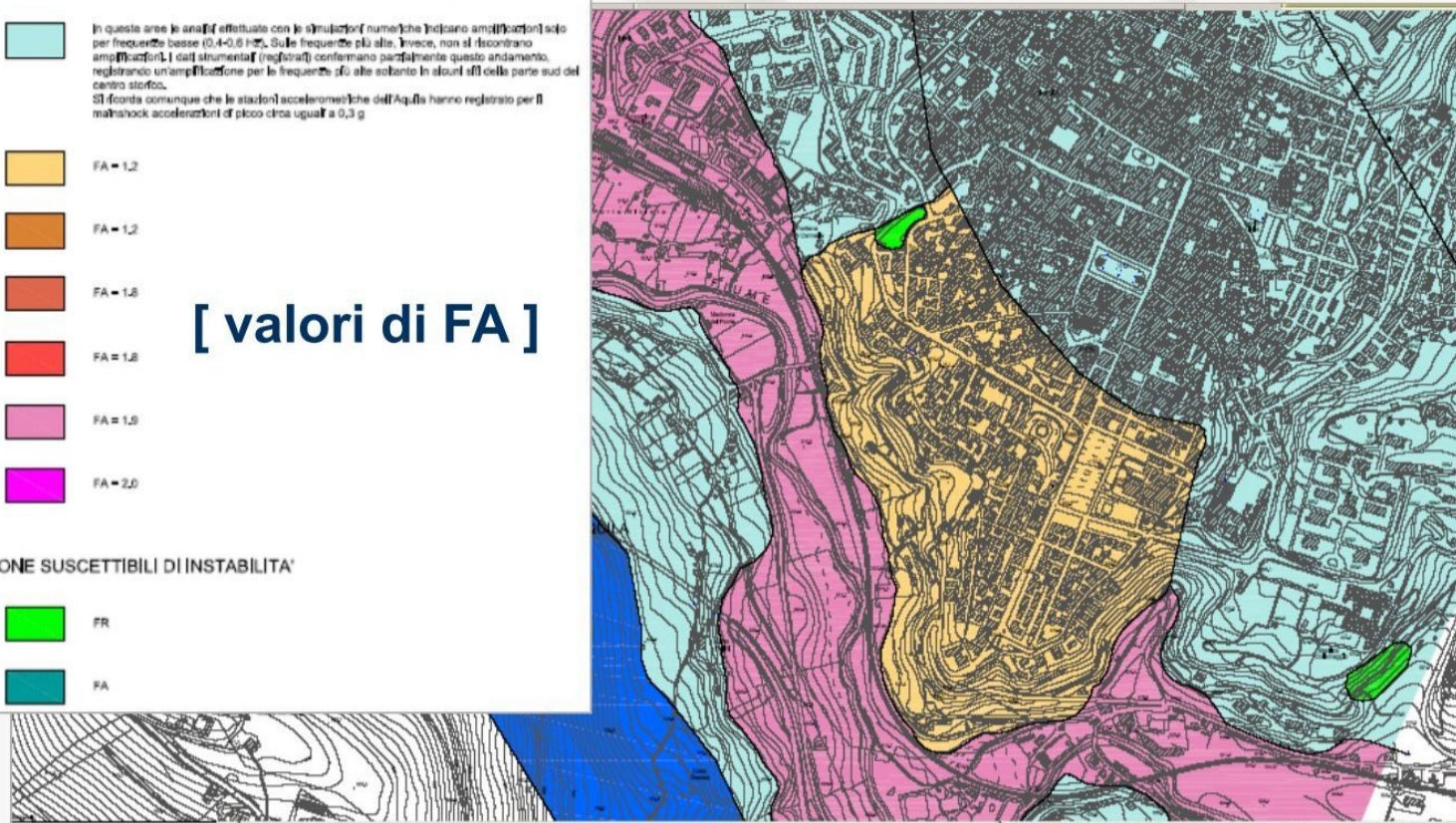
ZONE STABILI SUSCETTIBILI DI AMPLIFICAZIONI LOCALI

In queste aree le analisi effettuate con le simulazioni numeriche indicano amplificazioni solo per frequenze basse (0.4-0.6 Hz). Su frequenze più alte, invece, non si riscontrano amplificazioni. I dati strumentali (registrati) confermano parzialmente questo andamento, registrando un'amplificazione per le frequenze più alte soltanto in alcuni siti della parte sud del centro storico. Si ricorda comunque che le stazioni accelerometriche dell'Aquila hanno registrato per il terremoto accelerazioni di picco circa uguali a 0,3 g.



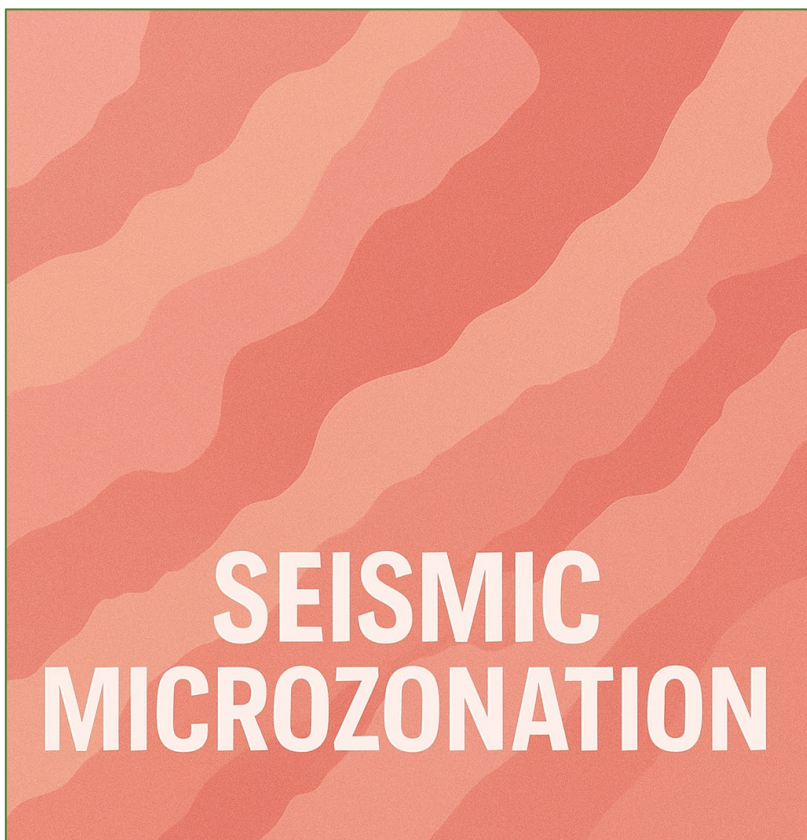
[valori di FA]

ZONE SUSCETTIBILI DI INSTABILITA'





SEISMIC MICROZONATION PRATA D'ANSIDONIA





Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



**STUDIES AND
RESEARCHES**

STUDIES AND RESEARCHES - URBAN VULNERABILITY

The 1997 earthquakes also provided a crucial opportunity to address the issue of urban vulnerability, thanks to several major research initiatives carried out in collaboration with prestigious Italian universities. It's important recalling that, even earlier, some particularly significant applied studies had been developed in the aftermath of the 1979 Valnerina earthquake.

These studies, made possible through the scientific contribution of the Politecnico di Milano, led to the drafting of specific regulations for the reconstruction of the Valnerina area. They also laid the groundwork for the creation of the 'Building Recovery Archive of Umbria', which included vulnerability assessments for more than 10,000 buildings.



Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



**STUDIES AND
RESEARCHES**

STUDIES AND RESEARCHES - THE “AEDES” FORM

Later on, the 1997 seismic event offered the chance to further advance this work: with the support of the Faculty of Engineering at the University of Perugia, a dedicated earthquake damage assessment form was developed, along with a method to quantify damage, that anticipated the current AEDES forms now officially adopted by the Italian Civil Protection Department in subsequent seismic emergencies.



Third Edition

RISK MANAGEMENT

Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness

20 - 27 July 2025



FINAL REMARKS

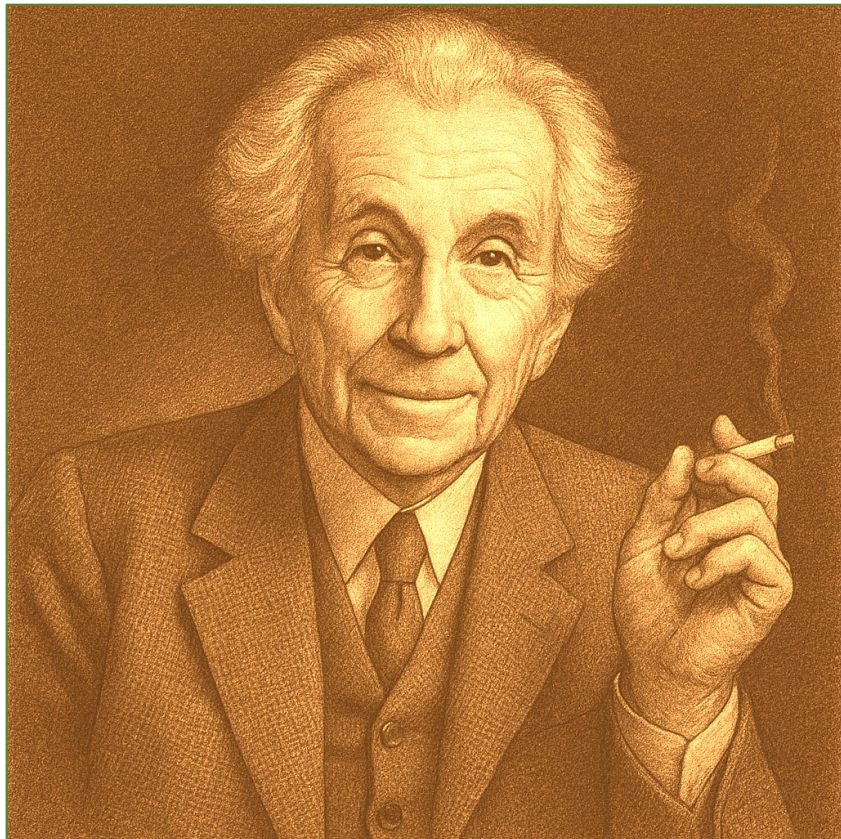
*"Rigidity was not the right answer,
but flexibility and resilience were.*

Why fight the earthquake?

Why not outsmart with it and sympathize with it?"

Frank Lloyd Wright, *An American Architecture*.

Facing and living with earthquakes, “outsmarting them,” as one of the greatest architects of all time suggested who designed his early application of base seismic isolation technologies in the construction of Tokyo’s Imperial Hotel (without necessarily having to sympathize with them), is a truly demanding challenge for each of us, we are now called to give our very best in the rebuilding processes that are currently taking place, and in those yet to come.





Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



FINAL REMARKS

'The guiding thread that has long characterized Umbria's approach to past reconstruction efforts, and those we are yet to face, must continue along the same path: continuing to firmly keep unite tradition and innovation, identity and social cohesion, environment and economy. Only in this way reconstruction can once again become a powerful driver for the economic revival for the communities, while at the same time serving as a remarkable opportunity to strengthen their social bonds.

It is an ambitious goal, one that can only be successfully met if we find the strength to keep the "URBS" — the physical city — united with the "CIVITAS" — the community of its inhabitants — which together embody a space of social inclusion, rights, and the collective accumulation of shared symbols and values.



Third Edition

RISK MANAGEMENT

**Knowledge, Forecasting, Prevention,
Protection, Planning, Preparedness**

20 - 27 July 2025



THANKS FOR YOUR ATTENTION

Diego Zurli