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Urban Safety—Socio-Technical Solutions for Urban Infrastructure: Case Studies

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Abstract: Urban space's physical and environmental characteristics impact urban public safety. Specifically, many areas in the older urban core are morphologically unsafe. The historic city's resilience to natural disasters and emergency phenomena often surpasses expectations thanks to settlement principles, post-disaster transformations, and redundancies that enhance the performance of the historic built environment. Yet, the necessity to introduce new qualities to reclaim urban heritages scattered throughout the territory, often abandoned or sparsely populated, underscores the need for maintenance and management measures to boost safety and resilience. This study aims to identify technological components in urban space that influence the safety of places and define a design method for safety planning in historic urban settings. Urban safety interventions encompass various technological aspects in conjunction with the widespread distribution of equipment, adaptation of public and private facilities, and networked infrastructure and services. This paper delineates the elements that converge in the technological design of an appropriate historic town center to address potential emergencies. It presents the initial findings of studies conducted on a minor center with a strong historical value. This document aims to be useful for administrations of smaller municipalities, as the proposed method can be replicated in similar contexts.

Keywords: urban safety technologies; emergency city plan; seismic performance; urban regeneration; small towns and rural communities

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1. Introduction

Urban public safety is entrusted to the Municipal Emergency Plan (PEC, Piano di Emergenza Comunale, PEC) or Municipal Civil Protection Plan (PPCC, Piano di Protezione Civile Comunale): a set of operational intervention procedures for an expectation in an area that incorporates the program of forecasting and prevention. The PEC is the tool for authorities to use to prepare and coordinate assistance operations to protect the population and assets in an area at risk. It aims to ensure that the standard of living is preserved when put at risk by situations of serious discomfort [1].

The PEC is a strategic document establishing the measures and actions to be taken to prevent and deal with emergencies and disasters that may occur in the municipal territory. The purpose of proper planning is, first and foremost, to prevent an increase in risk situations by ensuring that spaces are needed for crisis management.

The issue of urban security has been repeatedly highlighted at the EU level. Due to the increase in the number and severity of disasters worldwide, the New Urban Agenda calls for better consideration of contingencies in urban planning [2,3]. Via Decision No. 1313/2013/EU of the European Parliament and of the Council, the Commission and the Member States work together to improve the planning of disaster response operations under the Union Mechanism. This includes developing disaster response scenarios, mapping resources, and planning to mobilize response instruments [4].

As referred to in Article 10 of Decision No. 1313/2013/EU, disaster management planning and scenario development are closely related. While scenarios provide specific risk evidence and information, disaster resilience goals drive their construction.

In Italy, L. no. 100 of 12 July 2012, Conversion into law, with amendments, of Decree-Law No. 59 of 15 May 2012, on urgent provisions for the reorganization of civil protection, Article 15 assigns Municipalities the approval, verification, and updating of the PEC, drawn up in coordination with plans and programs for land management, protection, and rehabilitation [5].

The Plan's directions must be compatible with the existing urban planning tools and with the formal and structural preservation of the built environment of historic centers. PEC has a preventive function aimed at vulnerability mitigation and also seeks to revalue places regarding quality, redevelopment, and urban valorization [6].

Over the years, several measures have been implemented to support municipal emergency Civil Protection planning. However, none of them have succeeded in rigorously defining the contents, standards, and procedures to include in Emergency Plans [7]. The state of emergency planning in southern Italy is rather critical: in Sicily, only 190 of 390 municipalities have a Municipal Emergency Plan. This highlights the need to address this issue.

Different branches of the scientific literature deal with sectoral emergency management by type of risk: seismic [8,9], flood, hydrogeological and landslide, and fire [10]. However, emergency management should consider more risk typologies, be contextual to urban planning, and be part of a wider cyclical process, including mitigation and normality restoration. The difficult assessment of the urban environments and the dense historical fabric's characteristics still hinder the Emergency Plan's effectiveness [11,12].

Another part of the current literature focuses on designing disaster resilience systems [13] or building-scale emergency management [14]. There is a lack of information on emergency planning integrated into urban space. Regarding urban centers with a strong historical value, the literature is even more lacking and most often is only associated with the seismic vulnerability of historic buildings [15].

Thus, the literature still shows a fragmented picture of urban safety (which is addressed by single risks) and is lacking regarding contexts with strong historical aspects. Small municipalities' delay in implementing Emergency Plans highlights the current difficulty in defining safety in response to urban emergencies. Hence, the aim of this paper is to provide technicians and municipalities with a method based on the integration between urban space design and planning measures to identify and prepare functional spaces in response to a state of emergency. This encompasses the various possible risks to which a specific context is vulnerable without limiting it to seismic ones.

Integrated into ordinary planning, safety planning is a fundamental tool for organizing the urban center against the possible risks to which it is exposed and convergent on actions to enhance and develop it. The PEC should share the same basic inputs as the Urban Development Plan (Piano di Sviluppo Urbano), which aims to regulate urban and spatial functions by adapting urban development needs to the territory's natural features (geomorphological, hydrological, etc.). Both plans adopt planning measures and constraints based on risk assessments provided by superordinate sector plans (seismic, flood, etc.). This integration allows planning to guide emergency management and prioritize structural interventions in vulnerable areas [16].

Although it has been rare in the literature to find the relationship between safety and urban landscape development for a decade, there is now talk of turquoise design theories. Turquoise refers to the combination of the color blue, associated with resilience, and the color green, related to urban development, which now embodies the concept of sustainability. Resilience is intended as the ability to respond to extreme events and emergencies and return to normality [17]. The relationship between emergency planning and urban and building design starts from resilience as a societal goal and reaches individual buildings [18]. The essence of "turquoise design" is the meaning of resilience: merging safety and protection measures with the broader goals of sustainability [19].

While there is increasing pressure to respond to the blue and green agendas in the creation of the built environment, there is little knowledge about the simultaneous implementation of these agendas [20]. These paradigms sometimes differ or contradict each other, demanding trade-offs in the decision-making process. Given these synergies and discrepancies, some authors now refer to the "clash of green and blue" agendas and claim the importance of a turquoise agenda that can effectively integrate principles of sustainability and resilience [21]. Synergies between resilience (particularly its safety-related aspects) and sustainability could include developing landscape systems that comply with safety principles and the awareness of other elements that contribute to urban landscape valorization, such as environmental design. Watercourses, tree planting [22], and strategically designed flower beds can increase the landscape value and be used as physical barriers to circumscribe an area and direct its viability. Moreover, these elements can be used within systems to reduce a specific risk in the area; think, for example, urban drainage functions and, therefore, the ability to contain flooding in urban areas. This binomial can also be interpreted at the building scale: for example, technological elements that meet fire safety or seismic prevention requirements can also be realized to optimize energy performance, sound insulation, etc.

Technological analyses are required since a PPCC must indicate functional reorganization, urban traffic rationalization, regeneration at various urban scales, network systems, services, etc. Safety is pursued through prevention; the PEC also ensures this at the building scale, especially in historic urban centers, where risk is accentuated by the construction evolution of cities, with new parts weighing on old foundations, which are sometimes inadequate.

In addition, selecting sensitive, tactical, and strategic buildings and waiting areas requires a need-performance analysis and a basic survey action within the technological process. The systemic-scale application of the need–performance concept is a well-established practice in Architectural Technology methods. Constructing and unveiling the resilience of physical systems and cities provides renewed justification and support for it [23]. Federal Emergency Management Agency (FEMA) regulations in the United States have been formulated using these methodological terms for some time. The need for class safety (see UNI 8289 standard Edilizia. Esigenze dell'utenza finale. Classificazione, [24]), too, shows a high connection with the concepts of vulnerability and resilience. Thus, despite its appreciable expeditious features, the process cannot be bound to a deterministic–prescriptive approach. Instead, it requires a performance approach to correlate user demand scenarios with the existing performance, constraints, and specificities that characterize the built environment [25]. This contribution follows this perspective, intended to aid technological design for implementing the PEC measures. Technological design methods to reduce the vulnerability of urban centers according to a renewed multi-scalar and multi-sector integrated design approach are detailed and applied in a case study. This theme correlates with the principle of Smart Living, as urban safety makes cities livable and human-scale, improving quality of life by enhancing residents' active participation and risk awareness.

2. Methods

The research starts with a state-of-the-art analysis of the elements that characterize the PEC and could affect the morphology of historical urban space from a technological perspective. The study focuses on Sicilian territory and, in particular, inner areas. In many cases, these areas have retained historical urban centers, with little or nothing affected by the massive urbanization that has affected Sicily's major centers. The experimentation involved emergency planning in a center of the Sicilian hinterland with valuable characteristics and high historical–artistic value. It was conducted with a focus on the following aspects: in-depth knowledge of the territory from the morphological, environmental, social, and juridical perspectives; analysis of the risks affecting the territory; evaluation of the resources (human and material) available and/or necessary to overcome an emergency; and consolidated action strategies. Thus, systems and elements for spatial risk reduction and alternatives for emergency and rescue planning in urban areas were identified. One of the basic criteria was the flexibility of the Plan so that it could be used in all emergencies, including unforeseen ones, and quickly become operational.

The objectives are the mitigation of risks by identifying and designing the measures capable of ensuring effective resilience of the urban center and functionality in the event of an emergency and the improvement of quality of life by considering the resources and emergencies interpreted and expressed by the population. On the basis of the analyses and projects, however, training in emergency responses for staff and the community is essential. In summary, the analyses consisted of the following:

- Analysis of current urban planning tools, mountain range orography, watersheds, and the geological context, with special reference to orogenic episodes.
- A survey of the urban system to identify its physical and functional vulnerabilities and criticalities, with particular regard to accessibility and mobility (infrastructures serving the urban center and connecting it to the territory), but also to detect its adaptability and congenital efficiency and/or redundancy characteristics;
- A survey of the built heritage to identify its typological, construction, and structural characteristics and design and to determine its predictable collapse mechanisms, structural and, in general, physical vulnerability, functional obsolescence, and the possibility of minimal but effective maintenance and retrofit interventions aimed at improving static-structural behavior even in the case of an earthquake;
- Analysis of the following significant risks:
    - Geomorphological risks (instabilities and hazard areas): the Hydrogeological Management Plan (Piano Stralcio di Assetto Idrogeologico, PAI) indicates instabilities and thus defines hazard areas, was divided into five classes;
    - Hydraulic: this risk was individuated and delimited following a preliminary characterization of the physical environment under study. The hydrographic network and the boundaries of the main basin and the sub-basins were individuated, and then a preliminary characterization of the river and its courses was performed. Potential flood areas were identified through historical data and territorial analyses.
    - Seismic: In recent years, the Municipality has performed seismic surveys using the seismic refraction method (SRM) to obtain information on the structure and thickness of geological formations. This method studies the propagation of longitudinal and transversal seismic waves, determining the substrate’s elasticity module.
    - Interface fire: this risk affects contiguous areas or zones where the contact between anthropic and natural areas occurs (Wildland–Urban Interface, WUI); thus, two buffer zones were identified, with a relative distance of at least 50 m and a 200 m buffer perimeter outside the urban center.
    - Road risk and vulnerability. The first step was to distinguish the levels of road risk as follows: pedestrian routes; driveways with a width > 3 m; driveways with a width < 3 m; squares and plazas; the number of building floors and the ratio between street width W and the height of the surrounding buildings H, considering a high vulnerability if the ratio was lower than 1 and low if the ratio was higher than 1.

The design phases were as follows:

- The identification of systems and elements for spatial risk reduction and emergency management (Augustus method) and damage relief in rural, fringe, and interface areas, with a substantial increase in coping capacity and risk management in the municipality.

- The identification of emergency and assistance planning alternatives in urban and post-event settings, including sensitive buildings (hosting functions or elements that need to be safeguarded appropriately in the event of a disaster), tactical structures (structures that could potentially be used in the event of a disaster), and strategic structures (with a predefined use for the safeguarding of people and property).
- The identification and size of waiting areas (places of first reception for the population; they are not subject to risk). These areas were sized based on 1 sq.m./inh. parameter, the on-site surveys, and the resident population in each cadastral area; thus, the surfaces of the waiting areas were related to the number of inhabitants in each cadastral micro-area.
- The individuation of stacking areas. Areas near road junctions or reachable by large vehicles were considered. The minimum need was set to 4 sq.m./inh.
- Individuation of reception areas: these areas were sized based on the number of inhabitants in the involved areas, considering the 15 sq.m./inh. parameter. Drafting a preliminary project for positioning the tent camp on the individuated territory allowed the optimal organization of reception areas.
- The identification of retrofit and structural improvement interventions was undertaken, considering typological and construction characteristics, low-cost opportunities, compatible interventions, and the acceptable improvement of factories' capacity of response.
- The individuation of security lines and areas for civil protection activities. The security line is destined for the traffic of rescue vehicles: it traces a fast and safe route to connect the waiting areas with the reception areas and the main roads connecting the closest health centers.
- The individuation of possible gates is determined to manage the incoming and outcoming traffic in the whole territory or the areas hit by the event.

3. Elements Characterizing the PEC That Affect the Morphology of Historical Urban Areas

Compared with modern urban areas, in historic centers, the urban space and the built heritage have peculiar characteristics. These could complicate the containment of risks and the organization of a PEC in the choice of functions and streetscape. The high density of buildings, inadequate adaptation of buildings for non-residential purposes, the proliferation of unoccupied or abandoned buildings that often store large quantities of combustible materials, and, above all, the presence of old, poorly maintained electrical systems, are, for example, leading causes of fire hazards [10].

In inner territories, the urban center is usually located in a hilly/mountainous area for strategic choices; this morphology could make the urban center vulnerable to landslide risks. Narrow roads, steep slopes, cluttered or even inaccessible evacuation routes, and unresolved architectural barriers pose issues for exodus and viability. They also complicate problems related to the inoperability of emergency vehicles.

However, historic centers present many opportunities: in historic urban systems and related buildings, both valuable and not, their vulnerability is strongly related to their resilience, which can hold quite a few surprises. Buildings born mainly in the absence of design protocols—which are nowadays usual—are characterized by redundancies, tolerances, and system endurances beyond expected or threshold values associated with high potential. In the time of crisis, these can help define the coping capacity and resilience of the system. The surprise can also be in the opposite direction.

The inherent resilience of traditional architectures and building systems is often evident, as they can absorb impacts by deforming without collapsing. Thanks to this, they can often be restored with even minor repair work, as shown by their stratigraphy and sedimentation. In some cases, the main categories of resilience do not seem too far from the characteristics of even highly sedimented historic cities [26].

PECs can have different levels of complexity, spatial extent, and action scope. Still, they all result from the interpolation of three analysis grids: spatial vulnerability, systemic vulnerability, and the examination of available resources. Vulnerability is determined by a thorough knowledge of the territory from a morphological and environmental point of view and the analysis of the hazards weighing on it, assessing whether the resources available and/or necessary to overcome an emergency are decisive in defining action strategies. Just as vulnerability is defined in three different declinations—direct, induced, and deferred—resilience, its opposite can be identified at various operational levels. The new requirements renew the need for a systemic analysis of architectural and urban contexts. The systemic conception is essential in relation to resilience, considering that it does not characterize individual elements but whole systems and is based on the relationships between the elements composing a system rather than on their reactive capacities [27].

The design of safe urban spaces must consider the evolution of land use and changes in expected scenarios. Indeed, one requirement of PECs is operational flexibility in response to emergencies, including unforeseen ones. The design actions involving the built environment are the survey of waiting, reception, and stacking areas; the identification of sensitive, tactical, and strategic buildings; the verification of networked services; the hierarchization of urban routes and the tracing of security lines; and the verification of the state of preservation and safety work on buildings and infrastructure.

In an established urban and built environment characterized by hazard (H), planning tools must include both adaptive strategies, which impact the exposure (E) factor by proposing new configurations of the urbanized space’s physical layout, and mitigation strategies, which reduce the vulnerability (V) factor by consciously intervening in the existing built heritage. This methodological design approach allows the risk (R), intended as a measure of the expected damage in a given time interval, to be reduced by acting on the parameters of exposure (E) and vulnerability (V), which are functionally related to the risk itself [28].

Safeguard measures for the population in case of foreseeable events aim to remove the population from the danger zone; special consideration must be given to people with reduced autonomy (elderly, disabled, children). Therefore, an initial assessment involves verifying the conditions of use by all and identifying the easiest route, free of architectural barriers. Therefore, an evacuation plan must be prepared, including actions for a rapid differentiated vehicular and pedestrian exodus, the reactivation of public transport, transportation of raw materials and strategic materials, the optimization of traffic flows along escape routes, and the access of emergency vehicles to the affected area.

Some recent applications of IoT systems and blockchain-based devices, which can be installed without physical networks, might help quantify traffic flows, thus improving urban resilience [29,30]. Microgrid clustering techniques can minimize delays in the communication time of each microgrid, guaranteeing higher reliability in the case of main grid failure [31]. These communication models can guarantee continuity in emergency situations, even when traditional infrastructures fail. Moreover, efficient IT data elaboration techniques and localization technologies might be crucial for real-time responses to urban crises [32,33]. New technologies also help improve training for emergencies through immersive virtual environments, creating realistic scenarios for emergency simulations. This could help improve practical preparation, filling the gap between theoretical planning and actual emergency responses [34].

A relevant element is the multi-scale survey of the current state, along with the prior preparation of suitable buildings and areas to accommodate the materials, vehicles, and personnel needed for rescue operations. The second phase of the survey involves cataloging areas potentially suitable for the organization of civil protection operations identified by the plan. Accurate knowledge of the current state also makes it possible to plan the securing and revitalization of structures and entire areas that have fallen into disuse and can be regenerated. Such an operation has immediate repercussions for the valorization of the centers. If wisely recovered, they can become drivers of the tourist economy for their entire territories. This is because regenerated areas, in non-emergency times, can also be used by the urban community. Consider, for example, stacking areas, which could host multifunctional areas (e.g., venues for fairs or city festivals) due to their size. Moreover, strategically placed, they can become service parking areas to improve the center's usability. Continuous maintenance is guaranteed if emergency areas have multipurpose characteristics to perform an ordinary function. This allows their rapid utilization for the reception of the population and/or the storage of resources necessary for relief and overcoming the emergency.

There are three types of emergency areas [35]: waiting areas, places where initial assistance is provided to the population immediately after the disaster event or after the early warning phase is signaled; reception areas as places for receiving and assisting the population removed from their homes for short, medium and long periods; and stacking areas as places where men and vehicles necessary for relief operations to the population are gathered.

Waiting areas must be identified keeping in mind their main requirement, that is, being true "safe places." In the exodus phase, at the end of the catastrophic event, the surviving population—previously informed and trained—must be able to orderly assemble according to a predetermined pattern in reasonably safe conditions with respect to the occurrence of the different types of residual risk (delayed structural collapse, land subsidence, rock-fall, irregular tidal waves, etc.). Another criterion followed is to favor, as much as possible, public areas over private ones because they are more accessible at all times. The number of areas to choose is a function of the number of inhabitants and the receptive capacity of available spaces, e.g., squares, openings, parking lots, public or private spaces deemed suitable and not subject to risk.

Reception areas can be existing public and/or private buildings that meet the population's housing needs (hotels, sports centers, military facilities, schools, campgrounds, etc.); tent cities, which cannot be used for more than 2–3 months and are usually made with preconstructed modules; or emergency housing settlements (prefabricated and/or modular systems), used after existing buildings and tent cities.

Stacking areas for rescuers and resources should be chosen close to operational centers where relief and useful resources for local emergency management depart. The size of these areas should be sufficient to accommodate an average population of between 100 and 500 people.

The first requirements of the areas described above are zero risk (areas not subject to flooding, near unstable slopes, adjacent to structures at risk of collapse, at risk of forest fires, etc.) and, when possible, the location near infrastructure for the supply of water, electricity, and sewage disposal resources. In addition, such areas must be located near a highway interchange or a roadway that is accessible to large vehicles and easily reachable. Secondly, urban areas served by major healthcare hubs are preferred. Finally, considering the city's urban morphology, they are chosen to serve the entire urbanized area evenly. Preference is given to large equipped, areas with a high presence of infrastructure, allowing the creation of helipads when necessary.

To regulate inbound and outbound traffic in risk areas and facilitate rescue activities, the Municipal Police and other law enforcement agencies set up gates at road junctions. This allows for diverting traffic, avoiding traffic jams and total gridlock. These, too, must be chosen after interpreting the built environment and defining and prefiguring intervention alternatives. The use needs of the existing building stock must be verified to identify strategic and tactical buildings. The former must stay operational during and after the emergency event, including hospitals, police barracks, Carabinieri, municipal technical offices, registry offices, etc. Instead, tactical buildings are intended to accommodate the city community during and after the rescue operations. They are usually schools, gyms, theaters, and church classrooms, which can accommodate more users thanks to their size. Such choices require observing the state of conservation and developing possible technical solutions concerning conservation, rehabilitation, retrofit, maintenance, safety, and functional adaptation interventions.

The reciprocal relationship between the urban system and the buildings must be focused on, especially the building/environment interface and the interaction nodes. Indeed, the conditions of the two-way influence relationship between the building and its context must be verified [36]. The latter significantly affects a building's use conditions, especially regarding accessibility (accesses, crossings, pathways, adjacent buildings, overlooks, etc.), infrastructure and service provision, surrounding mobility, and pressures and stresses of various kinds, such as pollution, vibrations, etc. However, the building also plays its part in the safety of the urban context, as the vulnerability of street fronts threatens the safety of people and property, atmospheric emissions, and consumption, stressing the service and tolerance thresholds of infrastructure.

The same concepts are used for Emergency Limit Condition (CLE, Condizione Limite per l'Emergenza) Analysis. It refers to the urban settlement's condition where, following a seismic event, the operability, accessibility, and connection with the territorial context of strategic functions necessary for emergency management activities are preserved [37]. This condition must be maintained despite physical and functional damage disrupting almost all present urban functions, including residences. CLE analysis is generally carried out after the disaster event and when drafting the PEC. In addition to identifying buildings and areas that provide strategic emergency functions, the study aims to identify accessibility and connection infrastructure at different levels of the urban scale and to recognize structural aggregates and individual structural units that may interfere with the road system.

4. Case Studies: Examples of PECs in Smaller Sicilian Centers with Strong Historical Value

Inner areas have suffered a demographic and economic decline over the past few decades. Thus, they now stand as fringe areas, territories with an abandoned built heritage, lacking services, depopulated, and sometimes almost ghost-like. At the same time, these areas have maintained a high resilience to artificial elements and uncontrolled urbanization and still show a notable architectural and landscape heritage. If valorized, the latter can act as a driving force for the socio-economic regeneration of these territories. In many of these small urban centers, scattered in the rural and inland areas, not surprisingly, the city almost entirely coincides with the historic center. The city's problems almost asymptotically coincide with those of the historical center. These areas are strongly connoted by an ancestral genius locus, which is strongly discernible among buildings that look like ruins despite their physical integrity. These buildings and cities are charged with values and meaning even though obsolescence, rather than decay, seems to reign.

These conditions constitute an ancient balance resulting from necessity and are often evoked today when discussing eco-compatibility and impact mitigation. They testify to a form of autarky frequently sought by locutions, such as "short supply chain", "kilometer zero", etc. [38]. The regeneration of small municipalities can benefit the territory as a whole, as a new act of rebalancing would allow inhabiting and caring for it again, as well as the larger cities, which can be decongested.

Italy's 2021/2027 strategic planning cycle is central to local development and land policies in inner areas. Within the framework of the National Strategy for Inner Areas (NSIA), the Sicily Region [39] has dedicated an Operational Program on the European Regional Development Fund (ERDF) to the Island's areas characterized by a higher and more differentiated degree of marginality and disadvantage.

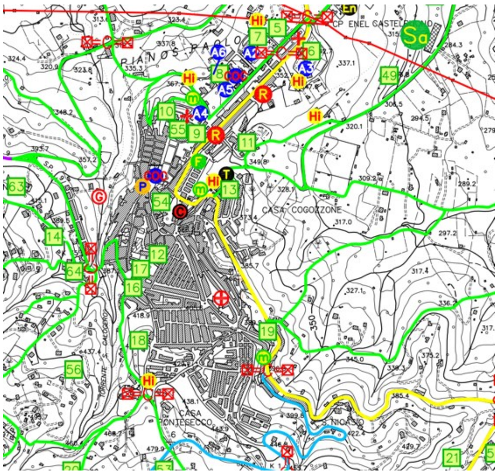
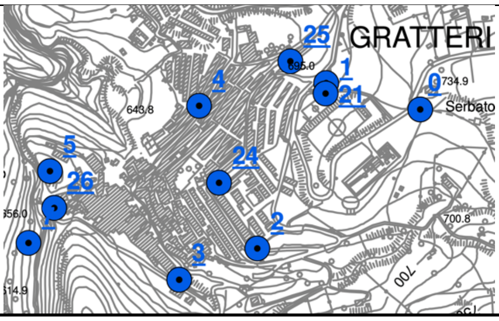
The region has identified five areas based on their high distance from the centers of basic service provision, aggregating municipalities defined as intermediate, suburban, and ultra-peripheral.

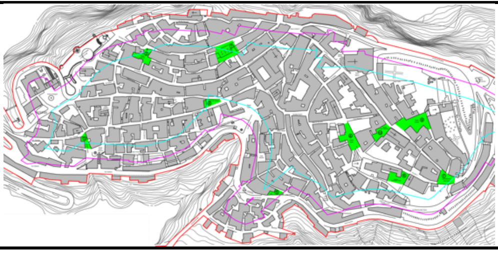
The selected areas have difficulties guaranteeing their residents' "citizenship" rights. They also have high territorial (hydrogeological instability, loss of utilized agricultural area) and demographic (depopulation, aging) criticalities. Despite this, their contexts are rich in exclusive natural and cultural resources; if appropriately valorized, they could trigger new paths of growth and development.

As early as 2014, actions aimed at increasing the quantity and quality of essential services for the population and local development projects were planned in these areas.

The experimental case study described in this contribution falls in one of the five areas, namely in the territory of the "Madonie", which stretches between the provinces of Palermo and Caltanissetta and includes the municipalities of Castelbuono, Collesano, Gratteri, Isnello, Pollina, San Mauro Castelverde, Alimena, Blufi, Bompietro, Castellana Sicula, Gangi, Geraci Siculo, Petralia Soprana, Petralia Sottana, Polizzi Generosa, Aliminusa, Caccamo, Caltavuturo, Montemaggiore Belsito, Scillato, and Sclafani Bagni [40]. Only a few of these have drafted a PEC or PPCC (Castelbuono, Collesano, Gratteri, Polizzi Generosa) (synthesized in Table 1); most municipalities have adopted a Municipal Civil Protection Regulation that establishes the tasks of the service bodies and the Municipal Operations Center and lists the activation procedures in cases of emergency. The few most comprehensive examples of emergency planning in such municipalities are shown in the table below.

Table 1. Examples of PECs in smaller Sicilian centers with strong historical connotations.

Plan	Year	Technological Actions Affecting the Morphology of Urban Space	
PPCC of Castelbuono [41]	2019	Mapping of strategic and sensitive buildings. 1 Identification of the place designated for P.M.A. (Punto Medico Assistito, Attended Medical Point with field tent) for medical first aid and an indoor alternative solution. + Verification and monitoring of the road system: identification of roadblocks (gates) ⊠=C=⊠ Identification of escape routes (in yellow), optimization of traffic flows (in green), inspection and verification of road fitness, identification of preferential routes for rescue (in light blue), and endangered and alternative routes. ━ Identification of reception and stacking areas and sizing their storage capacity and network services. A1 Sa	
PEC of Collesano [42]	2017	Analysis of the building by identifying the average seismic risk class for individual buildings (image opposite). Identification of sensitive, tactical, and strategic buildings for civil protection purposes. Identification of areas potentially suitable for organizing civil protection operations (waiting and assisting the population). Planning the multifunctionality of the identified areas and buildings, including an ordinary function (weekly market, fair, or sports activities) and rapid use for the population's reception in an emergency.	
PPCC for interface fire risk of Gratteri [43]	2008	Identification of "exposed assets" falling in higher-risk areas. Identification of depots and storage areas for flammable materials (gas, gasoline, etc.). Identification of waiting, reception, and stacking areas. Emergency road planning: main arterial roads reserved for priority transit of emergency vehicles with alternative routes for the public, and gates. Identification of reception areas/facilities. Mapping firefighting water resources (side image).	

PEC of Polizzi Generosa [43]	2013	Waiting area for the initial reception 🟩 Population center perimeter — 25 m buffer perimeter. — 50 m buffer perimeter. — 

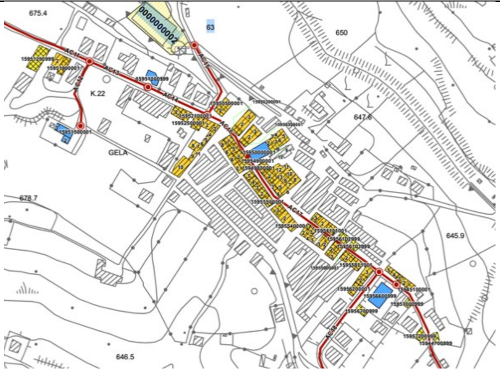
The Sicily Region has adopted national guidelines for seismic prevention. These guidelines, developed after the Abruzzo earthquake of 6 April 2009, provide the multi-year planning of interventions through the seismic micro-zoning of the territory. By Resolution 20 March 2017, no. 138, the Sicily Region planned to initiate level 1 (MS1) and level 3 seismic micro-zoning (MS3) studies in all municipalities in the regional territory with ag > 0.125 g (peak horizontal ground acceleration, with a 10% probability of exceedance in 50 years), accompanied by the CLE analysis [44].

These studies are aimed at seismic micro-zoning; the planning of local reinforcement, seismic improvement, or the demolition and reconstruction of buildings and public works of strategic interest for civil protection purposes; the structural interventions of local reinforcement or seismic improvement or demolition and reconstruction of private buildings; and other urgent and non-deferrable interventions for seismic risk mitigation, with particular reference to situations of high vulnerability and exposure.

This is aimed at the municipal-scale or sub-municipal-scale recognition of the site conditions that can significantly change the characteristics of the expected seismic motion (reference seismic motion). This refers to characteristics that can produce relevant co-seismic effects (fractures, landslides, liquefaction, densification, differential movements, permanent deformations, etc.) in buildings and infrastructures. This information is necessary for planning and programming activities for land development.

Some virtuous municipalities in inland areas have already planned CLE; the example of Santa Cristina Gela is given below (Table 2) [45].

Table 2. Technological actions provided for by the PEC of Santa Cristina Gela.

Plan	Year	Technological Actions Affecting the Morphology of Urban Space
PEC of Santa Cristina Gela [45]	2021	Identification of strategic buildings housing strategic functions for emergency management 🟦 Identification of shelter areas for the population □ Identification of resource and/or vehicle stacking areas ▨ Verification of accessibility/connection: land access roads and connection between strategic elements. ●—● Structural aggregate mapping: building complexes interfering with the roadway or areas 🟨 Mapping buildings interfering with the road system ▩ 

Case Studies: Discussion

Only 4 of the 21 Sicilian municipalities in the area have drafted a PEC; thus, this issue must definitely be addressed, as a lack of PECs in Sicily leads to reflection. The structure of the existing PECs examined shows overall consistency: all include the recognition of the characteristic elements of the urban territory and the survey of those considered useful in cases of emergency.

However, these plans only have a concept of sectorial resilience: the Municipality of Collesano exclusively considers seismic risk, while Gratteri focuses on the fire risk, and

Polizzi Generosa lists four potential risks without specifying their criticalities. Unlike the others, only the Municipal Civil Protection Plan of Castelbuono (PA) evaluates multiple criticalities (hydraulic, hydrological, and hydrogeological, wind gusts and tornadoes, heat wave, snow or frost, seismic risk, wood fire risk) and defines operational procedures for each of them. For example, the following critical issues on the territory related to landslide phenomena affecting slopes are examined: collapse landslides, mud and debris flows, earth and rock slides, complex landslides, and surface runoff; mixed hydrogeological–hydraulic phenomena affect the minor hill–mountain hydrographic network with rapid rises in hydrometric levels (flash floods) in torrential streams with short runoff times, surface water runoff, and overbank erosion; and flooding related to the water disposal inability of urban sewer networks.

Regarding the relationship between resilience and sustainability, the former entangles territorial care, yet it is limited to specific individuated risk. Sustainability is oriented toward the optimization of available resources, valorized according to their functions for urban safety. Each case requires focus on specific territorial elements, such as the hydrographic structure and water resources (a network of watercourses, basins, wells, springs, tanks, reservoirs, and hydrants for use by the civil protection in case of emergency); infrastructural equipment related to territorial accessibility and internal viability (state roads, provincial roads, highways, primary municipal roads), as well as characterizing elements, such as tunnels, bridges, viaducts; relevant buildings in the municipal territory, "targets" and/or "resources" of civil protection (generally municipal buildings, schools, social-health and welfare facilities, pharmacies, places of worship, historical-cultural assets, accommodation facilities, sports facilities, etc.), as well as their state of preservation and the vulnerability of the resistant structural system; industrial production facilities, farms and public places, gas stations and other commercial activities that may represent local resources in the event of an emergency; and technological networks (gas, water supply and disposal, electrical, telecommunications).

In general, all plans require additional knowledge. For example, since these centers are in mountainous territories, it is necessary to study road profiles and mobility. In almost all cases, risks are individuated according to the history of natural hazards. However, this cannot be the only criterion, as data should be related to investigations and the current urban planning tools. No or partial studies are performed on built heritage; analysis related to building typologies, in-use destinations, building vulnerability, and the state of conservation should be at the base of emergency plans, as much as geological, geomorphological studies, etc.

Thus, the method described in Section 2 is considered to be more complete and can provide a more exhaustive overview, ensuring greater safety for Municipalities when drafting a PEC. In the following paragraph, the method is applied to a case study similar to the examined Municipalities. Hopefully, this method can be repeated in similar contexts and support municipal administrations.

5. Experimentation: Technological Design for Safety Improvement in an Urban Center with a Strong Historical Value

Regarding urban safety, this work investigates a small town in the Sicilian hinterland in the broader Madonie Mountains Park territory, preserving relevant peculiarities in the historic urban landscape: San Mauro Castelverde, where an analysis aimed at drafting a PPCC was conducted [46]. The present work has a methodological purpose for structuring a town center valorization path to be repeated in towns with similar characteristics. The limited size of the investigated area provides concrete foundations for the Plan's feasibility. Indeed, it allows for the easy acquisition of in-depth knowledge of the vulnerability aspects of the studied area, the active participation of the inhabitants, and effective awareness-raising of risk knowledge. The town of San Mauro Castelverde stretches from the Madonie Mountains toward the Nebrodi Mountains, which are mountain ranges in northern Sicily with an elevation of up to 1100 m above sea level. The historical quality of the urban center of San Mauro Castelverde derives from the ancient origins of its construction, evidenced by numerous clay fragments found and dated to the 7th–6th centuries BC. A sequence of dominations contributed to the evolution of the center: the castle erected on its summit is believed to have been built by the Byzantines in the 8th century B.C.; the Saracen domination left various testimonies in the neighborhood known as Rabbato and in the names of some localities; the Normans contributed to the building of the Matrice church. The greatest expansion of the town occurred in the 18th century, during which new squares and several patrician mansions sprang up.

Analyzing the urban expansion of the built-up area and the built-up and urban heritage, with special reference to historical-constructive events and building size (Figure 1), building types and uses (Figure 2), along with an analysis of the overall morphology by surveying urban profiles (Figure 3), helps identify possible vulnerable points to plan material safety, use safety, and emergency management in a complex area, considering its nature of historic center and geomorphological conditions.

Figure 1. Building stock size and construction techniques (Image prepared by Arch. P. Di Bella).

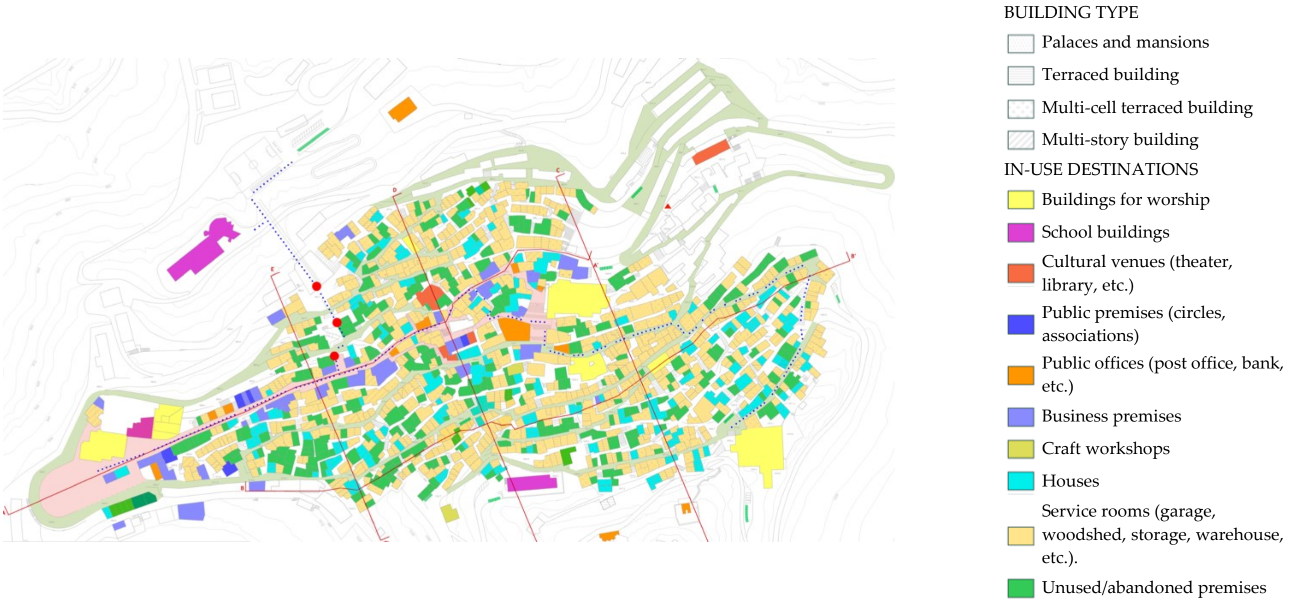


Figure 2. Building types and ground floor uses (Image prepared by Arch. P. Di Bella).

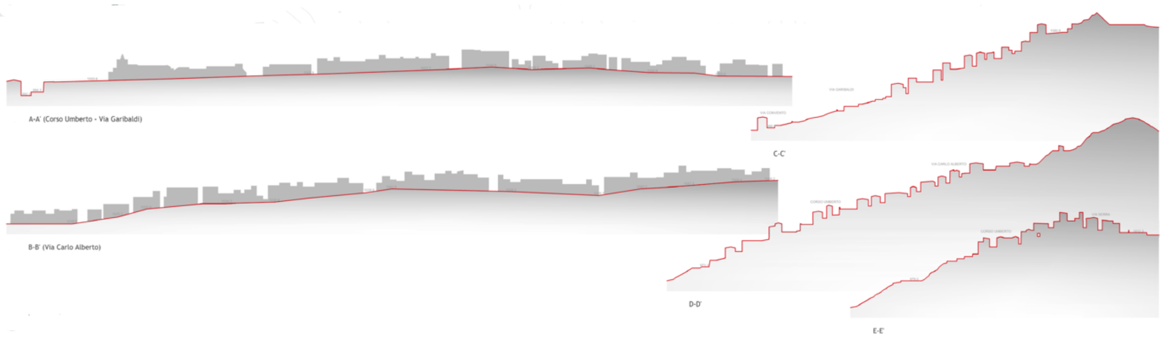


Figure 3. Road profiles (image prepared by Arch. P. Di Bella).

Vulnerability mapping has been summarized in the Instability Map, the Interface Fire Risk Zone Identification Map (Figure 4), the Seismic Hazard Map (Figure 5), and the Hydrogeological Hazard and Landslide Risk Map (Figure 6). The thematic maps realized consider the results of the analysis aimed at drafting a PPCC that would not be limited to the Emergency Plan (ex art.108 of Legislative Decree 112/98), which is an important but not exhaustive part of it.

The areas affected by fire and hydrogeological risk were mostly suburban and urban center perimeter areas. Meanwhile, the urban area is affected almost exclusively by seismic risk. The hydrographic network and the borders of the main basin and sub-basins were identified, and an initial characterization of the river's courses was carried out. At the same time, all cognitive elements helpful in identifying potentially floodable areas were acquired through historical data and territorial analysis. Only a moderate hydrogeological hazard zone located on the northwestern outskirts of the township fell within the town. This area is related to a quiescent complex instability (6SM-071) involving several town center buildings and an escape route section. For these elements, medium-grade geomorphological hazard conditions appeared. Indeed, two complex instability conditions were immediately north of the built-up area, implying a medium hazard condition. Concerning instability 6SM-069, the access road to the village, which is also an escape route, is subjected to high risk, while an isolated building is subjected to medium risk; for instability 6SM-070, on the other hand, the same escape route, as well as a sports facility, are subjected to high risk.

Interface fire risk affects the places—areas or belts of contiguity—where the contact between anthropic structures (with particular reference to dwellings) and natural areas occurs. In this situation, fire can spread rapidly from the natural area to urban structures. The territory's high seismic risk depends not only on the frequency and intensity of earthquakes that periodically strike it but on the high vulnerability of the built heritage in particular. This is because many old buildings do not guarantee seismic resistance (Figure 7). The vulnerability of the building stock allows for catastrophic events of enormous magnitude to occur in the future. In the face of this situation, preventive action against earthquakes is to carry out systematic preventive measures on "old" buildings, that is, buildings built before seismic classification, to strengthen their structure and prevent them from collapsing in the event of an earthquake.

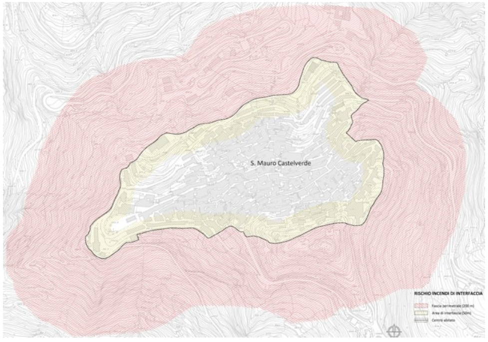


Figure 4. Interface fire risk. Red is the 500 m perimeter strip, and yellow is the 50 m interface area near the built-up area (image prepared by Arch. A. Arangio).

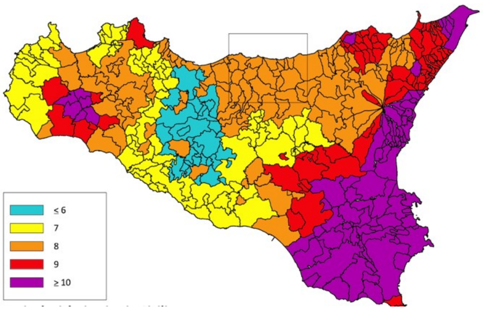


Figure 5. Seismic hazard in Sicily—maximum macro-seismic intensities (Mercalli scale). (Source: National Institute of Geophysics and Volcanology).

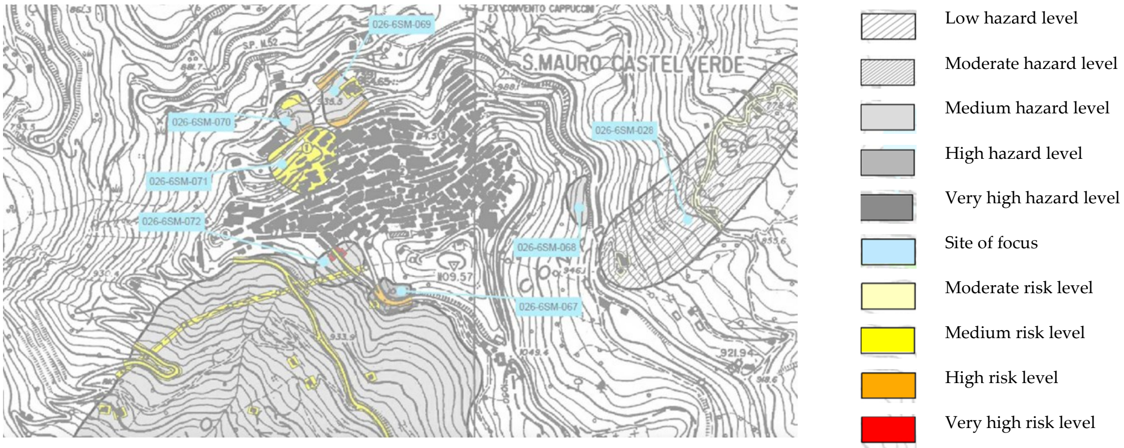
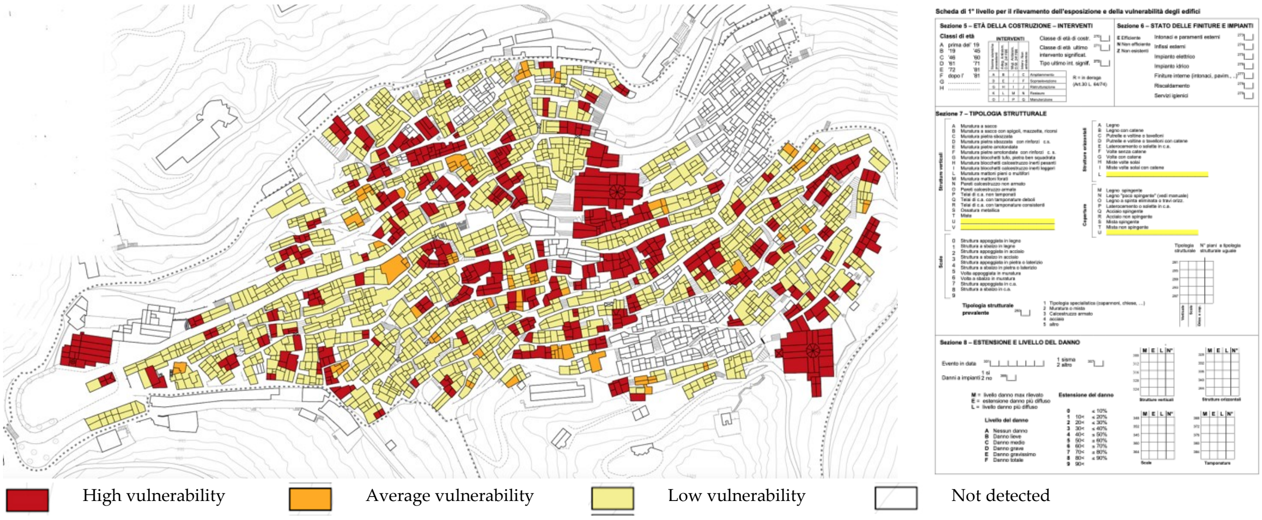


Figure 6. Hydrogeological structure basin plan. Hydrogeological hazard map (Source: Sicily Region—Department of Land and Environment).



Scheda di 1° livello per il rilevamento dell'esposizione e della vulnerabilità degli edifici

Sezione 5 – ETÀ DELLA COSTRUZIONE – INTERVENTI

Classi di età

A prima del' 19
B '19 '45
C '46 '60
D '61 '71
E '72 '81
F dopo l' '81
G ....
H ....

INTERVENTI

A	B	/	C	Ampliamento
D	E	/	F	Sopraelevazione
G	H	I	J	Ristrutturazione
K	L	M	N	Restauro
O	/	P	Q	Manutenzione

Classe di età di costr. ☐
Classe di età ultimo intervento significat. ☐
Tipo ultimo int. signif. ☐

R = in deroga (Art.30 L. 64/74)

Sezione 6 – STATO DELLE FINITURE E IMPIANTI

E Efficiente
N Non efficiente
Z Non esistenti

Intonaci e paramenti esterni ☐
Infissi esterni ☐
Impianto elettrico ☐
Impianto idrico ☐
Finiture interne (intonaci, pavim., ..) ☐
Riscaldamento ☐
Servizi igienici ☐

Sezione 7 – TIPOLOGIA STRUTTURALE

Strutture verticali

A Muratura a sacco
B Muratura a sacco con spigoli, mazzette, ricorsi
C Muratura pietra sbozzata
D Muratura pietra sbozzata con rinforzi c.a.
E Muratura pietre arrotondate
F Muratura pietre arrotondate con rinforzi c.a.
G Muratura blocchetti tufo, pietra ben squadrata
H Muratura blocchetti calcestruzzo inerti pesanti
I Muratura blocchetti calcestruzzo inerti leggeri
L Muratura mattoni pieni o multifori
M Muratura mattoni forati
N Pareti calcestruzzo non armato
O Pareti calcestruzzo armato
P Telai di c.a. non tamponati
Q Telai di c.a. con tamponature deboli
R Telai di c.a. con tamponature consistenti
S Ossatura metallica
T Mista
U
V

Strutture orizzontali

A Legno
B Legno con catene
C Putrelle e voltine o tavelloni
D Putrelle e voltine o tavelloni con catene
E Laterocemento o solette in c.a.
F Volte senza catene
G Volte con catene
H Miste volte solai
I Miste volte solai con catene
L

Coperture

M Legno spingente
N Legno "poco spingente" (vedi manuale)
O Legno a spinta eliminata o travi orizz.
P Laterocemento o solette in c.a.
Q Acciaio spingente
R Acciaio non spingente
S Mista spingente
T Mista non spingente
U

Scale

0 Struttura appoggiata in legno
1 Struttura a sbalzo in legno
2 Struttura appoggiata in acciaio
3 Struttura a sbalzo in acciaio
4 Struttura appoggiata in pietra o laterizio
5 Struttura a sbalzo in pietra o laterizio
6 Volta appoggiata in muratura
6 Volta a sbalzo in muratura
7 Struttura appoggiata in c.a.
8 Struttura a sbalzo in c.a.
9

Tipologia strutturale | N° piani a tipologia strutturale uguale

Verticale | Scale | Oriz. e cop.

Tipologia strutturale prevalente ☐

1 Tipologia specialistica (capannoni, chiese, ...)
2 Muratura o mista
3 Calcestruzzo armato
4 acciaio
5 altro

Sezione 8 – ESTENSIONE E LIVELLO DEL DANNO

Evento in data ☐☐☐☐☐☐
1 sisma
2 altro ☐
Danni a impianti 1 si
2 no ☐

M = livello danno max rilevato
E = estensione danno più diffuso
L = livello danno più diffuso

Livello del danno

A Nessun danno
B Danno lieve
C Danno medio
D Danno grave
E Danno gravissimo
F Danno totale

Estensione del danno

0		≤ 10%
1	10<	≤ 20%
2	20<	≤ 30%
3	30<	≤ 40%
4	40<	≤ 50%
5	50<	≤ 60%
6	60<	≤ 70%
7	70<	≤ 80%
8	80<	≤ 90%
9	90<	

M E L N° — Strutture verticali
M E L N° — Strutture orizzontali
M E L N° — Scale
M E L N° — Tamponature

Figure 7. Building vulnerability (Source: P.R.G. di S. Mauro Castelverde, graph 8.4) and 1st level sheet for the survey of building exposure and vulnerability Source: National Earthquake Protection Group (G.N.D.T.)—C.N.R. https://emidius.mi.ingv.it/GNDT2/Pubblicazioni/Lsu_96/vol_1/schede.pdf accessed on 10 May 2024).

Along with building vulnerability, studies on the built heritage and notable architectures have included analyzing the state of preservation of building units (Figure 8), analyzing building types and construction techniques (Figure 9), and identifying notable architectures.

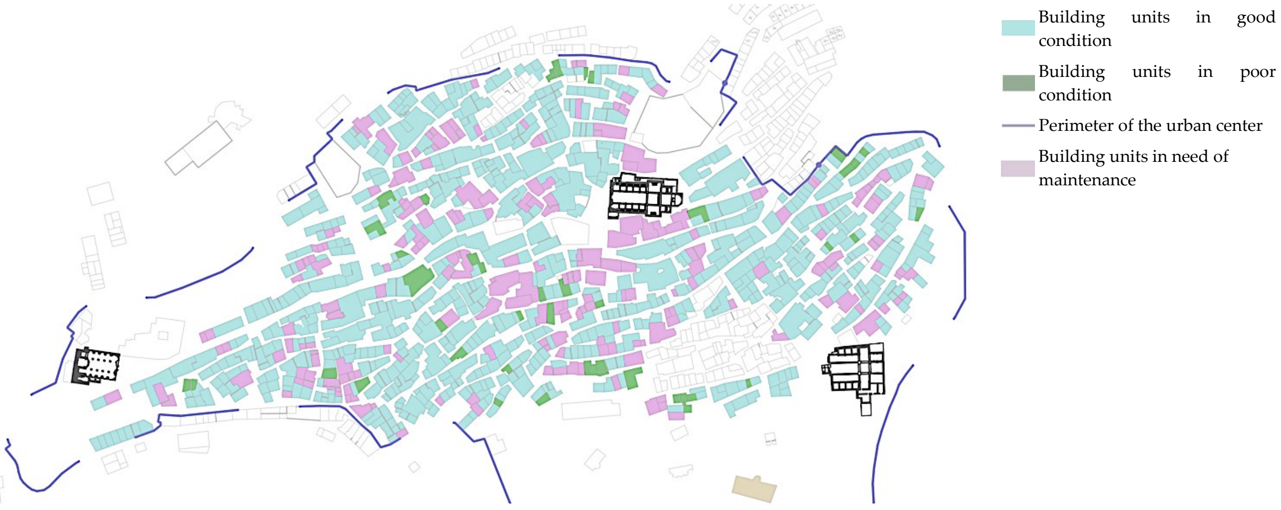


Figure 8. Analysis of the state of preservation of buildings (image prepared by Arch. A. Guglielmo).

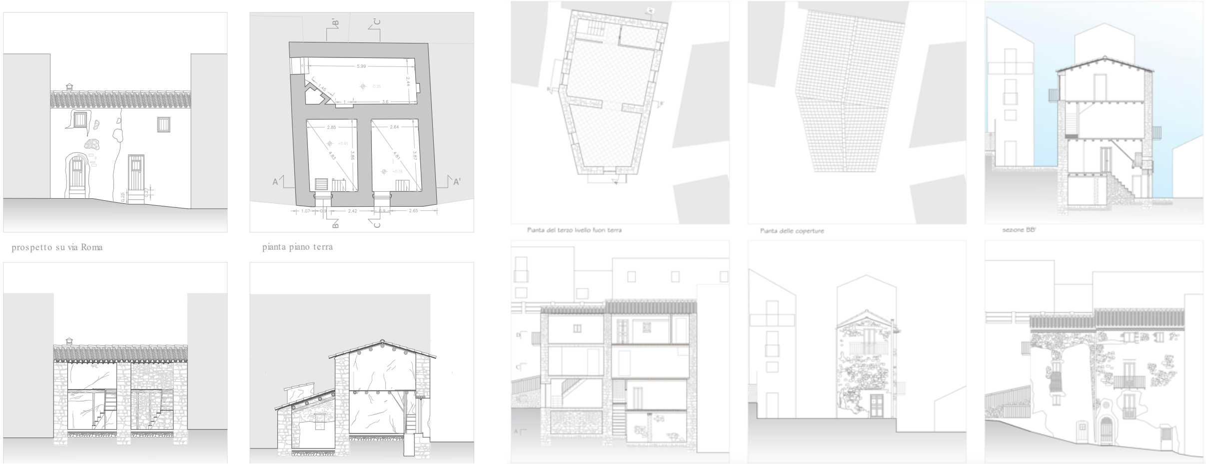


Figure 9. Analysis of building types and state of preservation (image prepared by Arch. A. Guglielmo).

Following the analysis, risk scenarios were predicted, and the road fabric's suitability for ordinary and emergency mobility (stationary and transit users, weak users) was verified (Figures 10 and 11) to confirm the compactness of infrastructural service networks for intercepting security lines (safe escape routes) and for locating and measuring waiting areas (stacking, reception) (Figure 12) for the identification of sensitive, tactical, and strategic buildings and the development of emergency management measures (Figures 13 and 14). It must be remembered that the fruition depends on the routes' dimensional (e.g., width) and morphological (e.g., slope) characteristics, related to the orography of the terrain, but also based on technical aspects (e.g., brightness) that affect safety and the risk of falling. Concerning road safety, risk scenarios are associated with the interferences between the roadway, bicycle, and pedestrian traffic.

Several maps were produced, respectively, representing the analysis of urban accessibility and mobility (streets, squares, sloping paths, alleys, stairways, with a focus on sections and travel options); the analysis of road hazard and vulnerability; analysis of building functions and typologies; and analysis of the building stock size (planivolumetric development and number of floors). The analysis also included inspecting the pavement's state of use and preservation. Any unevenness could have indeed been made exodus and dangerous. Pathways with obstructive elements, neglect, and lack of maintenance constitute an architectural barrier. In addition, height differences, the type of road pavements, and the shape of routes often clash with modern requirements for fast travel, representing a physical barrier, particularly for weak users.

Figure 10. Mobility analysis (image prepared by Arch. S. Venezia).

Figure 11. Example of urban profile analysis (image prepared by Arch. S. Venezia).

The study of the vulnerability of the arteries of the urban road network during a seismic emergency aims to ensure and identify less vulnerable road routes to reach the areas equipped for first aid. In this case, the evaluation is performed on urban arterial roads; these arterial roads must have no internal intersections and homogeneous characteristics. The road vulnerability index represents the residual width that would be available for transit in the arterial road if—in the worst case—the tallest buildings could completely overturn onto the road.

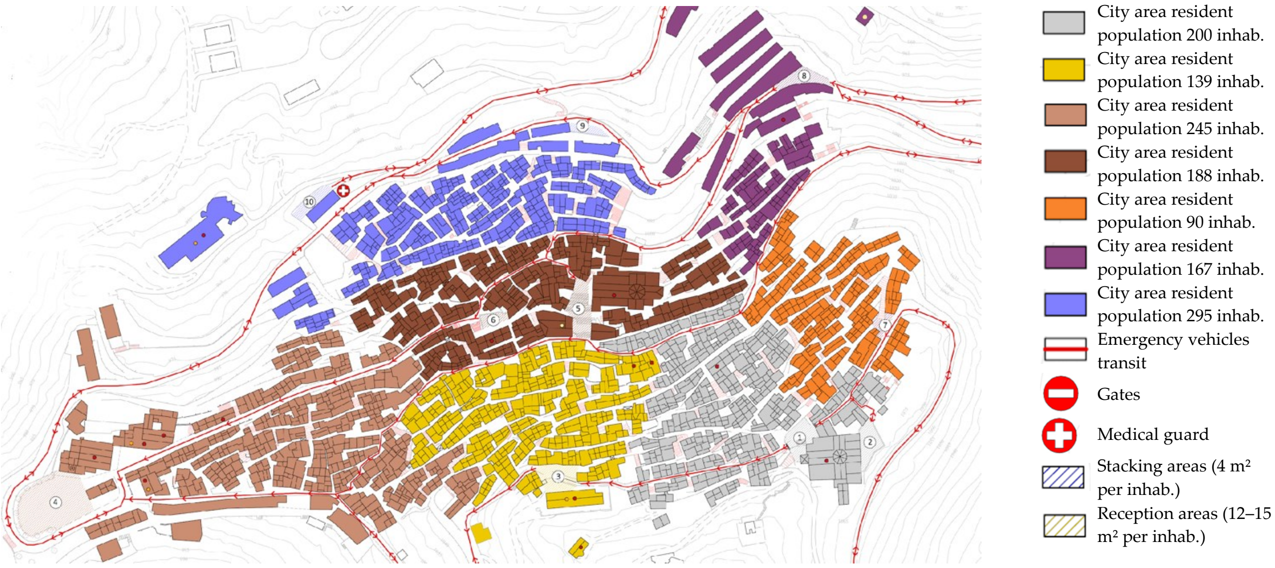


Figure 12. Stacking areas, reception areas, medical guard, gates, roads, and building fabric density (image prepared by Arch. A. Arangio).

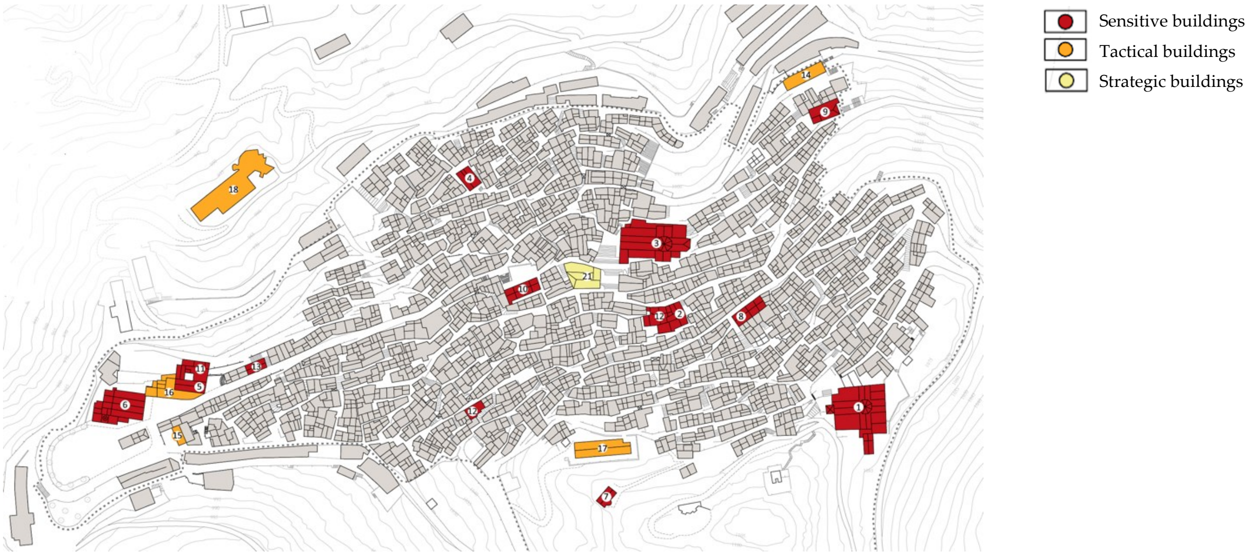


Figure 13. Sensitive, tactical, and strategic buildings (Image prepared by Arch. A. Arangio).

The PEC for S. Mauro Castelverde was drafted by elaborating all the information related to the knowledge of the area and its risks. The objectives to meet for providing adequate civil protection in emergency responses have been identified.

The plan identified the security line, gates, and areas for civil protection activities: stacking and reception areas. The security line is intended for the transit of emergency vehicles: it outlines a fast and safe route that connects waiting areas with reception areas and major thoroughfares, leading to the closest medical facilities. During emergencies, gates allow for managing traffic in and out of the entire territory or areas affected by the event, organizing a surveillance system to prevent access to areas that are potentially still at risk, and avoiding looting.

Civil protection areas	**Waiting area**	**4**
Name	Plan S. Mauro	
Address	Via Centimoli	
Surface area sqm	Uncovered—1760 sq. m.	
Morphology	Flat	
Current Use	Public square	
Main access road	Via Centimoli	
Accessibility of collective means of transportation	Yes	
Characteristics of the area	Public	
Pavement type	Pressed concrete bricks	

Sensitive buildings	**City Hall**	**21**
Name	St. Mauro Church	
Address	Corso Umberto	
Surface area sqm	Covered—650 sq. m.	
Facility manager	Pastor	
Current Use	Religious activity	
Main access road	Corso Umberto	
Works of artistic–cultural value to be preserved	Yes—Statue depicting St. Mauro	
Emergency generator	Yes	
Fire-fighting system	Yes	
Services	Yes	

Strategic buildings	**City Hall**	**21**
Name	Municipal Palace	
Address	Town Hall Square	
Surface area sqm	Covered—800 square meters	
Facility manager	Mayor	
Current Use	Public activity	
Main access road	Town Hall Square	
Works of artistic–cultural value to be preserved	Yes	
Emergency generator	Yes	
Fire-fighting system	Yes	
Services	Yes	

Figure 14. Example of civil protection areas, and sensitive and strategic building filings. (Image elaborated by Arch. A. Arangio and by Prof. E. Nicolini).

The stacking areas are those for channeling the materials, vehicles, and men who intervene to carry out the functions of direction, coordination, rescue operations, and assistance to the population in an emergency. Examining the territory of S. Mauro Castelverde led to identifying an ample space as a stacking area for vehicles and rescuers in a location with strategic value for the entire area that is easily accessible. Reception areas are intended as areas equipped with facilities that can provide shelter for those who have had to leave their homes. For the City of S. Mauro Castelverde, the reception area identified included a ratio of more than 15 square meters/inhabitant. It is surrounded by buildings from which electricity, water, and sewerage can be connected and is also on a main vehicular thoroughfare.

Next, the study aimed at vulnerability mitigation, securing escape routes, and urban redevelopment focuses on the historic core, which often coincides with the most vulnerable part of the city. Therefore, the PPCC is part of an integrated planning process and is essential on small and large scales. Risk mitigation represents its main objective in the definition of an urban plan and also with earthquake-proof values.

San Mauro fully exemplifies medieval urban layouts characterized by the castle's location on a mountain for strategic defensive purposes and an articulated street fabric with winding patterns of narrow streets, alleys, and stairs. This morphology and a series of amalgamations and increases from different eras have produced structural inhomogeneity in the built environment and exacerbated urban vulnerability.

The urban structure, consolidated around the original core while preserving the foundational settlement principle, seems to ward off hydrogeological hazards and possible intra-moenia flooding outcomes altogether.

Concerning the built heritage in all its components, buildings of historical and architectural value (Churches, Convents, Public Buildings, and Noble Mansions), current historical buildings, and works in public spaces, an expeditious analysis of the possible failure mechanisms was carried out to identify structural retrofit interventions and possible foreseeable damage to roadways due to the collapse of parts of masonry and secondary structures (such as balconies, etc.) caused by earthquakes.

The buildings and their construction and structural concept and development were analyzed. Thus, compatible and permissible seismic improvement interventions were identified, aimed at improving the joints of the structural system rather than consolidating and/or strengthening individual elements. Maintenance or retrofit interventions aim for more effective distributions (e.g., with connection curbs on the top), better connections between primary structures (e.g., between the elements of masonry structures), and secondary structures facing public streets or squares.

Including new functions for regenerating abandoned buildings with the potential of direct interventions to trigger built environment reuse processes and design solutions for safety, also aimed at eliminating later additions.

In some cases, interventions involving the structural improvement of single buildings for their use were avoided. Instead, it was preferable to consider actions to benefit both the overall resilience of the buildings, averting collapse up to a given threshold of seismic stress, and the safety of roads interpreted as security lines of exodus in the case of disaster. However, because of their functions, sensitive, tactical, and strategic buildings were considered in their overall capacity of response.

6. Findings and Conclusions

This study strategically aimed to implement resilience, sustainability, and smartness in the urban center. Thus, its characteristic tactical actions concern the center as a whole and consider its functions and architectural heritage. This was supported by the conviction that it is necessary to transition from reactive to proactive policies that work on prediction/prevention and predictivity.

In addition, it has been observed that coping capacities and especially the capacity of response are strongly reassuring when the urban system and architectural heritage reinterpretations have kept the sense of the original settlement principle clear, congruent, and perceptible and when episodic and continuous transformations of the historic built environment have occurred in response to evolutions and calamities. One more reassuring factor is the frequent redundancy of historic buildings.

This theme lays the groundwork for making a city safer against disastrous events that could endanger human life and the assets humans seek to safeguard. Drafting a Municipal Emergency Plan means preparing to recognize hazards and monitor them by mitigating danger and minimizing harm. In the analyzed case, the Civil Protection Plan adapts to the urban center's needs, responding to the possible occurrence of potential risks. One of its sections is the Anti-Seismic Recovery Plan, which also considers the social context's complex objectives for the historic center's revitalization. Thus, it is provided for the inclusion of new functions and interventions that improve accessibility and safety. The urban history of a center consists of as much large-scale architecture as it does of small dwellings, which contribute to the harmony of the entire historic fabric together with the former. Thus, the vulnerability analysis allows for establishing a program of preservation and, where needed, regenerating these architectures. On the one hand, the PEC has a preventive function aimed only at vulnerability mitigation. On the other hand, it aims to revalue places in terms of quality, redevelopment, and urban valorization. Thus, the PEC represents an opportunity for the economic revitalization of historic centers, as in these places, it also serves as a Detailed Earthquake Recovery Plan.

This article outlines the concept of sustainability in the studied case, aiming at the valorization of the built heritage of the urban center with high historical value. The gamble of working in the historic city proved to be very interesting and foundational. There has been a growing conviction that preserving and maintaining historic centers requires starting from the resources, identities, constraints, and problems. This can allow for performing sustainable system choices involving relationships and flows, imagining adaptive and flexible systems, and using the most advanced techniques for urban regeneration with minimal physical interventions.

This also means intervening in the built environment with limited and compatible actions where the qualitative benefit is not proportionally related to the quantitative amount of intervention. The reappropriation of urban heritages scattered throughout the territory is a key objective. In addition to the decongestion of larger cities, it provides reconnection with productive territories, leads to rediscovering identities, and harnesses the all-round physiological resilience of small communities and territorial systems. In many urban centers, both medium and small, scattered throughout the rural and inland areas, the city unsurprisingly coincides almost entirely with the historic center. Thus, the problems of the city and the historic center almost asymptotically coincide.

Understanding these inherent characteristics, correlated with an evolutionary smartness that renews and confers desirability, could open up spaces of effective possibilities for the reuse and repopulation of inner areas. On the other hand, the resilience of the historic city is a time-tested measure where it has manifested as an adaptive capacity against vulnerability and developed along natural disasters and emergency phenomena. The multidisciplinary experience undertaken started in a town that can be considered an icon of such conditions: San Mauro Castelverde, between the Madonie Park and the Nebrodi Park, about twenty-two kilometers by road from the coast, in an area straddling the provinces of Palermo, Messina, and Enna. Over history, these centers have represented resilient alternatives in times of calamity and stress (e.g., war events). In some cases, they still represent this today.

Due to the economic deficit of these areas—associated with their demographic degrowth—the technological and infrastructural recommendations in this document can be implemented gradually. First, with no economic expense, Municipality specialists could: (1) perform a survey of waiting, reception, and stacking areas; (2) individuate sensitive, tactical, and strategical buildings by checking network services; (3) identify the main urban routes and trace security lines; (4) foster safety works on public and private buildings along the security line; (5) draft a complete outline of movable property to be secured, guaranteeing their fast retrieval; and (6) forbid "building renovation," intended as demolition and reconstruction in the historic center. Plan interventions can be subdivided according to their costs. Small-cost interventions include the following: the unification of some vehicular directions; (7) pedestrianization of some areas; (8) regulation and surveillance of business activities' supply time; and (9) timetable regularization for schools, offices, shops, etc. Medium-cost interventions include the following: (10) the elimination of fuel deposits in cities; introduction of mobility-supporting technologies (moving stairs, multimodal parking lots, elevators, etc.); (11) new technologies for efficient communication; and (12) technologies to prepare the population for emergencies. Among high-cost interventions are the following: (13) the diffuse distribution of equipment; (14) improvement and upgrading of public and private facilities, infrastructures, and network services; and (15) the guarantee of escape routes and access to cities in case of calamities through safety works on bridges, viaducts, etc.

This study aims to stand as an example for minor centers' administration; the proposed methodology can be used both to draft a new Emergency Plan to individuate and define strategies, routes, areas, and buildings to use in the case of emergency and to revise the existing Plans. This article results from an iterative process, which included preparing several scenarios until reaching the most convincing one, which is the one presented here. It is an early result of research, and the intended method can be applied in similar contexts.

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Conflicts of Interest: The author declares no conflict of interest.

Abbreviations

PEC:	Municipal Emergency Plan
PPCC:	Municipal Civil Protection Plan

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