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The cover image shows a sea glacier ice that melts away.

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Evergreen section

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Trigger urban and regional planning to cope with seismic risks: management, evaluation and mitigation

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Evergreen section
This article - published in Italian in 1995 with the title "Verso un progetto mirato all'organizzazione e alla gestione di un piano di mitigazione dei rischi sismici" in E.D.Sanfilippo e P. La Greca (eds) Piano e Progetto nelle aree a rischio sismico/Planning and design in seismic risk areas, Gangheri Editore, ISBN 88-7448-520-4, Roma – is published again in this new section of TeMA Journal, Evergreen, in its literal English translation. This section aims at drawing the attention of the international scientific community to papers that, despite the passing of time, still present elements of significative scientific interest – insights, anticipations and reflections – enough to deserve careful read back.

Abstract
Earthquakes account for the most relevant natural risks with a high index of unpredictability that afflict many countries in the world, in many of which the level of development and socio-economic conditions do not allow an adequate response to the effects caused by catastrophes. The unsuitability of public structures and the lack of awareness and consciousness within public opinion towards seismic risk, which is already severely disregarded in industrialised countries, is accentuated in developing countries where populations are daily harassed by the struggle to satisfy the most basic needs.

Keywords
Seismic risk areas; Urban planning techniques; Prevention; Mitigation.

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1. Priorities in the hazard mitigation project

Earthquakes represent the most significant among natural hazards, afflicting many countries in the world, especially for their high index of unpredictability. In most of these countries, the deficiency of development and socioeconomic conditions does not allow an adequate response to the effects caused by such catastrophic events. If the inadequacy of public facilities and the lack of both awareness and consciousness toward seismic risk related issues are already greatly disregarded in industrialized countries, these become even more accentuated in developing countries, where local population is daily overwhelmed by the constant struggle of meeting basic needs.

In those nations whose territories are particularly exposed to seismic risk, any single event, especially those of quite high intensity, should be treated as a wake-up call, to induce central and peripheral administrations, public opinion, and the scientific community to intensify actions aimed at risk mitigation[1], with the hope of preventing more violent happenings.

The complexity underlying the problem of dealing with seismic emergency should not be underestimated. Its portion is measured in consideration of the damage caused by an earthquake: firstly, the (often very high) number of victims and injuries that fatally accompany its occurrence, secondly the catastrophic disruption to buildings and lands. We all must be prepared to face the severe direct or indirect damage to lifelines, industries, commerce, cultural heritage and ultimately the socioeconomic effects, which – especially in the above mentioned less developed countries – might have consequences on the level of social upheavals, frequently resulting in real local uprisings.

Therefore, in the face of such complexity there is a phenomenon that would deserve an in-depth studying on both sociological and anthropological levels. I am referring to the gradual increase in the community's indifference towards prevention as soon as the distance from the date of the disaster increases.

This constant inconsistency prompted Tobriner[2] to query about some worrying issues: *"Do people really learn from earthquake disasters? How long after a seismic event do they remain aware of the threat to their safety and well-being?"*

As recently seen, urban life is constantly threatened by endless factors – fires, rising crime, economic downturns, air disasters, pandemics – that constantly induce serious concerns for one's safety, including physical safety, so here is that the issue of earthquake prevention is toned down over time.

Hence, it becomes essential to have an appropriate organization focused to manage disaster control and risk mitigation. An organization that is efficient, economically viable and, above all, planned systematically rather than been based on the emotional waves of events.

This involves a systematic research, verification, planning, and informative work, aimed to prioritize the creation at national, regional, and local levels of an efficient body, in strict adherence to precise rules, promulgating codes and their application even to the level of the workforce[3], implementing training programs at all levels (including those professionals who directly or indirectly will have responsibilities to prevent and carry on the task of disaster response)[4].

Both Touliatos[5] and Tobriner have, correctly, observed how the vulnerability of a built-up area depends less than commonly believed on factors related to building resistance and dynamic loads, and way more on elements due to organizational and management capacity. Among these, the responsiveness of primary public services, such as hospitals, civil defense agencies, fire brigades and all those bodies proactively contributing after any seismic events occur, as well as the preparedness and efficiency of the community ready to cope when the disaster aftermath becomes relevant. Equally relevant are the degree of preparation in which people are ready to respond to the disaster, avoiding panic or despair and enhancing their ability to repair by resuming in the shortest amount of time the normal levels of life and economic activities that a seismic event might affect.

In Italy, the distant outcomes of the Belice Valley earthquakes in Sicily and the one in Friuli, while profoundly diverse in their nature both proved how vital the population level of responsiveness was in overcoming the effects of the events.

For what above mentioned, an overall effort is required to identify, manage, control, and verify potential actions to be undertaken in the territory, with the help of information systems and experts, what falls within the specific discipline of regional and urban planning and which represents a challenge that must be accepted by our generation of urban planners, having as its objective the safety of cities and with them that of society[6]. Defeating risks does not lead to any certainty but it indeed opens new possibilities keeping hope alive. The likelihood of occurring is linked to the possibility of achieving, through instruments of renewed urban planning, sufficient levels of urban quality in its broadest sense[7].

2. The management of the "project" as an opportunity for a new plan strategy

It is worth clarifying that within this paper, by the term "project" we refer to that complex of interrelated actions aimed to achieve a specific goal within a certain time frame. This definition goes beyond the mere association that links project to construction,

The urban planning project, reviewed in the more general sense of promoting the urban development of a given area, must be characterized by a high possibility of modification in the course of its implementation.

In fact, in an urban planning project, as well as in the more general socioeconomic development projects, there is an absolute steadiness between design and implementation: feedback, any possible alternative solutions that flow from the feedback are continuous. Within this perspective, an adequate planning process must provide that important knowledge, decisive for the final success of the process itself, will be acquired during implementation and leave those vital margins of flexibility, consequent to the actions taken, that can be used during implementation itself[8].

In the light of this learning by doing approach[9], risks can be appraised as unforeseen variables added to the many others in the complex, continuous, dynamic, in a word "processual," (to use the Astengo statement) development of the urban plan. In order to be able to manage these additional variables, arising from the likelihood of catastrophic events, the tools for managing the plan process must be adapted in a completely innovative method, away from the conventional tradition.

Earthquakes are responsible for a high number of casualties and injuries due not only to the partial or total collapse of buildings and infrastructure works, but also to fires or explosions, pollution caused by the release of toxic substances, tidal waves, landslides up to accidents caused by the lack of control over the traffic system as a whole. Therefore, it is not accidental to want to refer to this parameter to exemplify the complexity embedded to the topic.

The probability and incidence of each of the elements mentioned before in the formation of the total number of probable victims is related to a great number of parameters whose mutual relations depend on the systematic interaction between the physical elements of the settlement structure, which comprises the sphere of vulnerability assessment, and the activities and behavior of the inhabitants of a specified urban area, which pertains to the assessment of exposure to seismic risk.

The number of casualties (DR) can be expressed by a relationship of the type:

$$DR = f(I, Q, T, S, W, H, M, ...) \quad (1)$$

In which the Death rate is expressed as a function of:

- Earthquake intensity (I);
- Quality of building resistance (Q);
- Time of day at which the calamitous event occurs (T)[10];

- Season of the year (S);
- Degree of warning or warning efficiency received by the population (W);
- Local habits (H);
- Quantity and quality of relief and medical services taking care of all those affected by the disaster (M); and numerous other variables, depending on the specifics of different countries, which cannot be rationally predicted.

The interconnections between different variables established by taking into account all the different components it is necessary, for example, to predict related risks such as tsunamis, fires, explosions, landslides, dam collapses and the complex of secondary variables and it is of utmost importance to fully define the set of these additional risks.

A function of this type could be governed by a law ranging from an elementary checklist to a complex relationship with "n" variables, in order to properly set up and resolve what require the use of advanced multi-criteria analysis techniques.

Peter Nijkamp[11] points out how uncertainty, one of the fundamental components of the decision-making process, has led to new fields of scientific research and in particular to the complex issue of risk assessment not only on traditional fields, such as engineering, but also on social sciences, recently attracting particular attention.

"Disaster management" addresses the identification of actions and strategies to be pursued to deal with unexpected events. Similar concepts are "surprise management" or "emergency management." Disaster management has the specific task of activating "effects mitigation" policies following the significant damage caused by an unforeseen phenomenon.

According to Nijkamp, a new field of research, developed simultaneously to the previously mentioned ones, is "contingency analysis," that has taken on relevance in this direction. It deals with the choices of consequent preventive actions, as well as scenarios for intervention following a disaster event and can be reviewed as a "what if then" type of tool, capable of focusing on worst-case scenarios. Contingency analysis not only addresses issues of choices regarding the most expedient actions after a disaster has occurred, but also deals *ex ante* with possible scenarios related to prevention.

Furthermore, contingency analysis helps to identify the spectrum of possible events and any potential consequences arising from them, specifically investigating combinations of favorable and unfavorable events as well as favorable and unfavorable effects caused by these events.

This analytical tool makes it possible, within the variation of options between minimum-minimum and max-max combinations, to identify all intermediate positions by classifying appropriate strategic policies for each natural state.

For this reason, "contingency analysis" is a useful tool to provide solutions in risky areas – such as earthquake-prone areas – by proactively formulating a rational scope of decision-making built in a cyclical nature within which experience acquisition and adaptation strategies are basic features[12].

Manuel Da Costa Lobo[13] points out that the latter is a specific task of urban and regional planning. For this reason planning could make a fundamental contribution to disaster mitigation through appropriate plans to respond to different possible scenarios[14]. In my opinion, a deep urban planning, research and experimentation in this direction will be an opportunity for new gains.

A new strategy needs to be developed. Urban planning will increasingly have to look at game theory, in which players decide without knowing all the problem data – some of which being determinant, some of which being random and some of which being undefinable.

It is necessary to develop a notion of the city as a place of discontinuity of heterogeneity, fragmentation and uninterrupted transformation. Planning the city of the present, the city of complex conurbations, of boundless official and informal suburbs, must aim to achieve the "safe city"[15] as prime goal. In this perspective, urbanism

must overcome the rationalist certainties of functionalism that proposed absolute control: the elimination of the unexpected, and the imposition of perfect order. The complexity, the randomness, of the variables involved, such as those generated by hazards in general and earthquake risk in particular, are new and relevant aspects. They must accustom the planner to confronting scenarios that are less and less certain and increasingly mutable. The task proves to be particularly tough for the need to conceive simultaneously order and disorder, a goal that can only be pursued by the notions of organization and management that match the traditional notions of plan and design.

A radical paradigm shift is needed to conceive of a process that simultaneously tolerates, produces and deal with disorder, to adapt the planning process to the discontinuity and variability of the urban phenomenon[16].

3. Emergency aid and the organization of civil defense

The first response following an earthquake can only be oriented toward finding survivors in the rubble and assisting the injured.

The experiences, known in literature, of the Tangshan earthquakes of 1976 and Armenia of 1988 showed that the earthquake victims survival ration dramatically depends on the time passing between the earthquake and the finding of survivors. In Tangshan, the missing and injured rescued within the first 30 minutes had a 99% chance of survival; a value that reduced to 34% for those found on the second day and only 7% for those on the fifth day.

The examination of the Erzincan earthquake dated March 1992, addressed in the Alatan[17] case study, highlighted once again, the importance of planned timeline in the recovery phase of those missing. During the first day, military troops and ordinary people rescued about 300 people over a total number of 653 victims.

This circumstance obliges to detail as much as possible the programs of the first intervention also to take into account unforeseen events due to the human factor. It is well known that a human subjected to particularly stressful conditions can react in unexpected ways, and this is especially true for civil defense volunteers. In Erzincan, for example, they incurred in the peculiar circumstance that members of the local "Aid and Rescue Group" were not available prior to 48 hours after the event, due to the fact that several of them or their immediate family perished or were seriously injured by the disaster itself[18].

One of the objectives of the first emergency, to which precise civil defense actions must correspond, is a complete survey of the area and an assessment of the situation and priority actions, followed by a precise plan, in parallel with the first emergency response. In this framework, the dissemination of information to raise the morale of the affected populations takes priority, but also the reopening of access routes with the possible construction of temporary passages. The demolition of parts of unsafe buildings must be considered, taking special care in the assessment of the damaged parts especially for buildings of singular historical-architectural value. Equally important are vigilance services to prevent theft and vandalism and social assistance services and the provision of means, materials, and shelters[19]. Both the first level of intervention and the subsequent management of disasters cannot be possible without an adequate civil defense organization, whose programs and services – as Da Costa Lobo correctly suggests – must be organized and managed at both state and local level.

Especially the local level that must be prioritized, not only with respect to emergency and civil defense aid, but also for matters pertaining to the implementation of programs more specifically aimed at the adaptation of the built environment, which will be discussed at length below. Achieving the primary goal of local population involvement is by far the overriding objective for proper earthquake prevention.

Some particularly important issues, in the context of emergency and prevention and civil protection actions, include:

- having full risk awareness and interacting with research centers and experienced professionals;
- assessing risks and becoming aware of the actual weights of risk forecasts;

- plan the different scenarios and simulate alternatives, choosing the most congruent ones;
- store all necessary materials (large boards, cables, pipes, machines, tools, ….) in safe storage areas that are easily accessible and ready for immediate use. In particular, for SAR (Search and Rescue teams): gloves, masks, two-way radios, tools and implements etc.
- maintain a standing force for first response and a list of workers, companies, and experts available immediately when they are needed;
- prevent the risks of possible epidemics;
- plan in advance a time schedule and a responsibilities chart organizational chart of any involved party (and their deputies) for coordinating rescue operations and the person(s) responsible for assuming public authority outside the normal bureaucratic structures.

4. Urban planning skills and methods for preparedness and earthquake prevention

Numerous indications at the level of elementary norms and practices of urban planning techniques establish a correct approach for planning oriented to prevention and intervention following disasters and deserve to be dealt with in this paper even if it is too reductive to address and discuss them at length within this brief reflection.

In numerous historical cases of ex post intervention, the urban planning aspect has correctly been privileged as a key moment for future prevention.

The case, well known in the literature[20] , of the Borzì plan for Messina established a series of regulations issued following the 1908 earthquake and banned, among other suggestions, the possibility of building on steep or swampy terrain and placed a series of precise indications between the heights of buildings and the dimensions of roadways, together with an allowance for building density[21]. Significant as a case study is the experience of the disastrous Erzincan earthquake in Turkey in 1939 (Magnitude of 7.9 Richter scale; approximately 33,000 deaths).

The disasters caused on urban areas were so significant that it suggested the establishment of a standing committee to study interventions on cities affected by earthquake events and to address the problems associated with the possible change of site of destroyed cities. The committee was made up of experts from Universities, the Ministries of Public Works, Health and Social Security, and Agriculture under the direct supervision of the Prime Minister. At the same time, work began on a new Plan for the city. The fundamentals of the reconstruction plan were:

- elimination of all narrow and cul de sac streets characteristic of the pre-existing urban layout;
- reduction of building densities;
- development directions in the west, north, east directions in view of the major geological problems presented by the southern part of the area where the city stood;
- adequate width of roads but within 10 m;
- road network characterized by secondary arteries parallel to the main ones to always allow an alternative traffic flow system;
- large squares at the intersections of the main arteries and at the directions of connection with neighboring towns where the main directional and administrative facilities were deemed to be located;
- heavy limitations in the height of buildings.

It is not coincidental, unfortunately, that both in Messina and Erzincan as time passed the regulations for urban safety devices had to bend, until they were cancelled, to the irrational laws of land rent. This is further evidence of that phenomenon referred to earlier, of people's progressive disinterest in the issue of prevention, the greater the more time elapses since the calamitous event.

In contrast, criteria for suitable planning coping with earthquake issue should be part – as acquired concepts – of the basic urban planning lexicon in any intervention in areas at risk. Da Costa Lobo provides some milestones for an "earthquake-proof planning approach." These are general indications that can be more easily implemented in newly developed neighborhoods but should nevertheless be pursued, even in built up areas of the city as part of overall rehabilitation and adaptation operations.

Cul de sac streets must be eliminated, and, within the urban fabric, alternative accessible routes must always be offered. Provision should be made for green areas, open areas, and large empty spaces of soft ground to be used to place emergency housing or tents in areas close to collapsed houses. In fact, it is extremely useful to locate emergency housing in the vicinity of each disaster area both for the self-confidence of the affected populations and to prevent vandalism. It has been shown that keeping, where possible, people in their usual place of living increases the tendency for greater cooperation and considerably stimulates "self-help", as well as being more cost-effective. Such spaces of appropriate size can be regularly used, on a normal daily basis, as sports fields, market areas, parking areas, etc. They need to be adequately equipped to be prepared to offer shelter and the provision of essential services for those who might need to find refuge. A regular, sufficiently wide road grid, with adequate equipped buffer strips, fulfills the dual function of allowing uninterrupted circulation in case of disasters and erecting emergency shelter along the roads, in appropriately defiladed spaces.

This particularly facilitates supplies, and support services after the earthquake. Appropriate storage areas for goods recovered from among the rubble should be provided.

Parking, in moderately sized streets, should be prohibited to prevent hindrances in the immediacy of search operations for those missing. A number of open spaces that can be reached on foot should be identified and frequent trials should be conducted to instruct the inhabitants of a given area on how to reach them under different inaccessibility scenarios.

The construction features of buildings from a formal and compositional point of view have to meet certain general standards such as the elimination of large spans between structural elements, particularly on ground floors, and large glazing facade. A high number of casualties are due to the collapse of structural elements that give way in the immediacy of the shock dragged by their own weight as a result of increased disruption. The possibility of rational and reliable escape routes from buildings to safe outdoor spaces and areas should not be underestimated.

The economic means to finance programs aimed at prevention can be found, in addition to the national sphere, also with aid from international bodies and in particular, for Mediterranean countries belonging to the European Union, within the framework of PIMs (integrated Mediterranean programs).

The case study presented by Touliatos for the city of Arkhanes in Crete, which falls within this typology, highlighted how the participation of the local community and its sensitivity to the problem of prevention enabled the implementation of a "project" aimed at organizing and coordinating a prevention and protection program for the urban community[22].

One of the peculiarities of this project was that it was perfectly adherent to the concepts expressed so far on the importance of adapting to the local specific a set of related actions to achieve the goal of prevention. In addition to the financial support of the local community, all technical support was provided by the municipality itself in close cooperation with the departments of the National Technical University of Athens. Any codified pyramid-type methodology was overcome by working horizontally in three different directions: the promotion of studies aimed at repairing and retrofitting the built environment; the urban, social and environmental quality renewal of the central areas of the city; and specific studies on the overall earthquake policy of the local community.

With regard to the first point, the main activities have been aimed at seismic microzoning and specific research and studies on local architectural listed building with special emphasis on monitoring any instability due to

actions of seismic origin, highlighting any structural weaknesses and all construction deficiencies[23]. Training and guidance seminars and widespread distribution of publications prepared under the supervision of consultants were promoted, directed to technical operators at all levels and professionals, with programs aimed at the widespread dissemination of knowledge of intervention techniques.

Parallel to this action the second activity was carried out, mainly oriented to the renovation of degraded parts of the urban fabric by improving their sanitary conditions; to the preservation and/or restoration of the city's traditional and cultural features.

A third phase led to issue a specific code for interventions on historic buildings as well as the classification of each building within an appropriate number of categories according to its resistance to dynamic stresses. At the same time, possible gathering places following disasters were identified and equipped. Finally, further outreach and development of the degree of earthquake preparedness was promoted at all levels and for all social and age groups.

Author's profile

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1 The works of Italian authors on the subject are legion and in many of them some of the most significant research carried on so far has been compared such as in the four volumes resulting from the ponderous CNR research conducted by the GNDT (National Group for Earthquake Defense), Vol. 3, which contains the results of research line 2 "Prevention of Damage to Buildings (resp. Carlo Gavarini), and, in particular, section 2.4 summarizing the work of the research coordinated by Giuseppe lmbesi: Valutazione dell'esposizione urbanistica al terremoto, Ed. Ambiente, Bologna, 1992. In addition, look up the thematic contributions:
- Giuffrè., A. (1993) (Ed), *Sicurezza Conservazione dei centri storici*, Laterza, Roma-Bari.
- Fera, G. (1992), *La città antisismica*, Gangemi, Roma.
- Fabietti V. (1993), *Progetti mirati e pianificazione strategica*, Gangemi, Roma.
- DHA Department of Humanitarian Affaires (1993), Egyptian Earthquake of 12 October 1992, Case study Anaysis, United Nations, Geneva.

2 Tobriner S. (1995), Seismic safety in the S. Francisco Bay Area four years after, in Sanfilippo E.D. & La Greca P. (Eds), *Planning and Design in Seismic Risk Areas*, Gangemi, Roma.

3 We refences to the widespread dissemination of practical manuals addressed to the less skilled workforce. Especially in those, many, countries where the practice of self-construction is particularly widespread such an action would be justifiably effective. It is an example, albeit in a different field, the manual: *Road Maintenance Handbook - Pratical guidelines far road maintenance in Africa*, edited by United Nations Economic Mission for Africa, 1982.

4 A useful work documenting a relevant experience in this field is: Gulkan, P., Ergunay, O. (1992) *Case study of Erzican earthquake of 13 March 1992*, UNDP – United Nations Development Programme – UNDRO – United Nations Disaster Relief Organization, Disaster management training programme Turkey country course, Ankara.

5 Touliatos P. (1995), Seismic Precautionary Measures in Greece: Arkhnes case study, in Sanfilippo E.D. & La Greca P. (Eds), *Planning and Design in Seismic Risk Areas*, Gangemi, Roma.

6 The complexity of the role and the multiplicity of definitions for the figure of the planner and urban planner on the threshold of the new century is addressed with particular sagacity in Udy, Malcom J. (1992), Describing the planner for the new age, in *Cultural identities in unity*, Final Report of 28th Congress of ISoCARP – International Society of City and Regional Planners, Cordoba.

7 This is a concept borrowed from an assumption by Edoardo Salzano in his book: Salzano E. (1983), *La città sostenibile*, Ed. delle Autonomie, Roma.

[8] See more generally on the concept of project and evaluation the book: Cappuggi, L. (1992), *Monitoraggio dei progetti di investimento*, Franco Angeli, Milano.

[9] This is a concept that is taken up in detail in endnote 12 below.

[10] A reflection on this one variable alone is enough to show how complex an operation, certainly apt to coagulate diversity of views, is that which aims at the acquisition of certain parameters in the operation of disaster prediction. Some argue, on the basis of analysis and evaluation, that the worst condition is during daylight hours when the effects of the earthquake hit a densely populated urban area (cfr. Campo G. et Alii). By contrast, the earthquake that devastated the city of Agadir in 1960, which occurred in the middle of the night, caused more than 15,000 deaths, precisely because of the collapse of numerous dwelling buildings crammed with people sleeping in them.

[11] Nijkamp P. (1995), Evaluation Methodology and case studies on Conservation Planning in Areas at Risk, in Sanfilippo E.D. & La Greca P. (Eds), *Planning and Design in Seismic Risk Areas*, Gangemi, Roma.

[12] Nijkamp's remarks also build on models and methods for impact assessment: from "systems of pattern analysis" to "models of catastrophes" to "chaos theory" to "nonlinear dynamics" to "scenario analysis," emphasizing how the latter aims to configure possible futures for a complex system with a focus on "learning by doing" principles for policy decision-making.

[13] Da Costa Lobo M. (1995), Planning Experiences facing Seismic Risks in Portugal, in Sanfilippo E.D. & La Greca P. (Eds), *Planning and Design in Seismic Risk Areas*, Gangemi, Roma.

[14] The observations that have emerged through the contribution of Gaku Yamada in this book are quite relevant. [Sanfilippo E.D. & La Greca P. (Eds), *Planning and Design in Seismic Risk Areas*, Gangemi, Roma. NdR]. He poposes a matrix relating prevention, mitigation and recovery actions, suggesting spatial planning measures to coexist with earthquakes.

[15] Beguinot C. (1995), La Città sicura, in Sanfilippo E.D. & La Greca P. (Eds), *Planning and Design in Seismic Risk Areas*, Gangemi, Roma.

[16] See in this regard the brilliant essay Corboz A. (1990) *L'Urbanistica del XX secolo: un bilancio*, in "Urbanistica", n.101, dicembre 1990, and in particularly where he quotes the seminal book of Edgar Morin, Pour la penseé complexe

[17] Alatan H. (1995), Reconstruction and Physical Planning after Earthquake in Erzican, 1992 (Turkey), in Sanfilippo E.D. & La Greca P. (Eds), *Planning and Design in Seismic Risk Areas*, Gangemi, Roma.

[18] In particular, the contributions of groups and/or organizations with specific aptitudes must be valued. The 1985 Mexico City earthquake proved, for example and once again, the taken-for-granted ability of mine workers in recovery actions, thanks to the invaluable action conducted by Monterey miners in drilling and finding. For the latter action, moreover, the ability of the dogs in sniffing out the missing presupposes the need to know exactly how and where to find them in adequate quantities and to facilitate their turnout at disaster sites.

[19] In this regard, the needs and means of the first emergency from established experience, evidenced by the case studies presented, can be summarized as: field kitchens; food aid; tents; bedding and blankets; prefabricated hygiene units both equipped with toilets and showers; water distribution tankers and immediately after the disaster prefabricated housing units.

[20] See for an extensive discussion the aforementioned volume by Fera G., as well as the contribution in the book by CNR, Bologna, 1992 (cfr. footnote 1): Fera, G et Alii, *Esposizione, vulnerabilità e rischio in un comune di grandi dimensioni e con forti presenze funzionali: il caso di Messina*

[21] Dato G. (1995), Pianificazione antisismica per i centri storici, in Sanfilippo E.D. & La Greca P. (Eds), *Planning and Design in Seismic Risk Areas, Gangemi*, Roma.

[22] The total project cost of about 9 M ECU was financed by the EEC at the rate of 70%. The remaining 30%, as a local component, was borne by the inhabitants themselves through the local Administration. Avoiding the usual cumbersome bureaucratic-administrative steps, the EEC contribution was awarded directly to the local Administration promoting interest and enthusiasm among the population. Started in the second half of 1992, the project saw the conclusion of the first phase at the end of 1993 and will be further continued later this year with the start of the third phase.

[23] The importance of timely response at the local level in terms of technical construction solutions aimed at seismic prevention is demonstrated by exemplary historical achievements. The Lisbon earthquake of 1755, as recalled by Da Cosca Lobo was accompanied by a devastating fire that prompted the Marquis of Pombal to request his technicians to experiment with an ad hoc construction system resistant to fire and earthquakes. Thus, it was born the "gaiola" system with a kind of structural wooden cage placed inside a fire-resistant masonry structure that became a model, compulsory by law, in new buildings. Similar case is the later case of the so-called "shanty house" built by engineers of the Bourbon government after the 1783 Calabria earthquake. (See the quoted paper by Tobriner S.).