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PUBLIC URBAN SPACE AS SECURITY PLACES. HOW TO GET AN ANTISEISMIC CITY

Abstract: The urban public spaces are often used as relational spaces. Until the past, roads and squares were the feature of a city. The medieval urban plan was a result of the local geomorphological conditions characterized by "spontaneous growth". Indeed, the towns were mostly perched with street curved and irregular and building development piled followed the natural shape of the land. The destruction of many cities' after many earthquakes occurred in Italy changed the urban project. In particular, after the earthquake of the year 1783, it was activated a new way to make planning. The new urban project becomes a tool for seismic risk mitigation and defines the anti-seismic characters of the urban systems. Today, in Italy, the anti-seismic urban plans, uses the urban public spaces as safety areas for the seismic prevention.

This paper focuses on the connection between urban public spaces and emergency with particular attention to the safety and quality requirements definition.
Key words: Security, seismic risk, urban planning, public spaces, antiseismic city.

Introduction

The interest of the planners about the seismic risk, begins in Italy during the '80 years after the Irpinia's earthquake when it had been observed that the main cause of the collapse of the buildings had been caused by the wrong building site of the cities (on the hillsides, or crests).

After this observation the planners have studied the seismic risk theme in an integrated way, considering both the seismic hazard and urban aspects, to arrive to the first studies of the "urban vulnerability" [Imbesi 1991].

Until the second part of '70 years, to the general *seismic risk theme* were ascribed a partial vision concerned to the emergency theme. Also the seismic engineering subject, responsible for the enforcement of antiseismic regulations, focused just on building seismic behaviour and not to the consequences of buildings interactions included in a urban context.

However, the contribute of urban planner to improve the *seismic risk theme* clashed with two difficulties:

- earthquake engineering legislation did not take into consideration the suggestions of planners;
- the town planning regulations that needed a renewal related to the new problems of territory defence.

In fact, the vulnerability's idea understood as a traditional way that concerns the single building is insufficient to describe the real condition of urban vulnerability because in a urban system interact endless variable of factors that contribute to determine the total damage after a seismic event. Today, the integration of these factors is called "urban vulnerability" that represents the planner's way to define analysis for seismic risk mitigation.

In Italy, mitigation seismic risk only recently has been considered among the management and planning of territory, because it was always considered in a restricted way and not in an integrated way. Instead, mitigation seismic risk theme involves many aspects: from geological, to engineering including emergency aspect. This signifies that the planning approach represents, probably, the correct way to consider mitigation risk seismic theme. In fact, the planning gives to the mitigation risk seismic theme a global overview that is necessary for formulating multidisciplinary interventions. In brief, in the recent past the global approach was not taken into consideration and territory was not managed with the mitigation seismic risk [De Paoli 2008].

1. The mitigation seismic risk in urban planning: toward an aseismic city

The Italian territory has been involved many times in earthquakes that destroyed their towns, this way they have changed the urban projects. Indeed, the earthquake of the year 1783, 8.5° degrees of Mercalli scale (Calabria region), has activated a new way to make planning [Fera 1991]. The new urban project become a tool for seismic risk mitigation, it defines the anti-seismic characters of the urban systems:

- correct localisation;
- correct designs.

In particular, the attention focused on regular urban plant and it established the first antiseismic city's rules: the "chess board" urban plant characterized with wide rectilinear and perpendicular roads, open areas as squares and markets localized along the longitudinal roads, buildings with a regular and right angle plant. It suggested wide and straight roads in a way that the buildings were constructed in a regular plant with large spaces to utilized as security spaces in case of earthquakes as Vivenzio wrote "*per servir di scampo ai tremuoti*" [Vivenzio 1783].

The first *Buildings codes* has been formulated after the earthquake of the year 1783 to rule the reconstruction of the urban systems:

- the elevation of the building was settled in relationship with the width of the roads;

- the number of the buildings floors were proportioned to the number of citizens;
- simple façades with the prohibition to build large balconies but small and light ones distant from the building angles;
- to promote the ligneous structure system building;
- outer walls in bricks and mortar for increasing the resistance of the buildings (constructive system introduced after the earthquake of the year 1755 for the Lisbon's reconstruction.) [Principe 1985].

The urban projects realized after the 1783's earthquake are characterized both by the elegance and the monumentality typical of the urbanism of the XVII century and the new antiseismic requirements.

The earthquake and the tsunami of 8 December 1908, XI° degree Mercalli scale, represents the biggest earthquake which occurred in Italy. The city of Messina and Reggio Calabria were destroyed, indeed this catastrophe has erased every building testimony of the past with 90.000 victims.

In Italy, the born of the mitigation seismic risk in activity legislative dates from the 1909 when was emanated the Regio decreto n. 193 that included technical and hygienic rules after this terrible earthquake of Reggio Calabria and Messina.

After this seismic event the first antiseismic rules were promulgated, the Regio Decreto (18 april 1909) represented the first example of territorial microzoning, in which they listed the towns damaged by the earthquake and they established the technical and sanitary rules for the reconstruction. These rules controlled the heights of the buildings (maximum 2 floors, allowed height max 10 mt) in relation to the width of the road (least 10 mt). To defend the cities from the tsunami have been prohibited buildings close to the railroad within distance between the 30 meters.

In Calabria region, many cities destroyed after the earthquakes of 1783 and of 1908 were projected following a *chess board plant* as Seminara, Palmi, Mileto, Bianco and so on, and above all Reggio Calabria (Figure 1).

The Reggio Calabria's plan of reconstruction has been projected by engineer Pietro De Nava, Alderman of Public works of the Reggio Calabria's Municipality, with local technicians. The plan of reconstruction was approved with Regio Decreto the 5th on March 1911 including the rebuilding of the city in the original center, fixing the perimeter of the urban area among two torrents (Calopinace's torrent and Annunziata's torrent). The De Nava's plan extended the "chess board" urban plant to locate the camps for the homeless [Baratta 1910].

In many cases, the chess board plant of these cities today represented the historical centres contained within the modern needed of the urban growth made without Aseismic rules.

The first law concerning planning for seismic mitigation dates back 1974, the law n. 64 "Regulation for buildings with particular rules for the seismic areas" where the rules for buildings in seismic areas concerning also the local hazard. This law, in fact, forced the municipalities to acquire, during the formation of the plans, a pre-

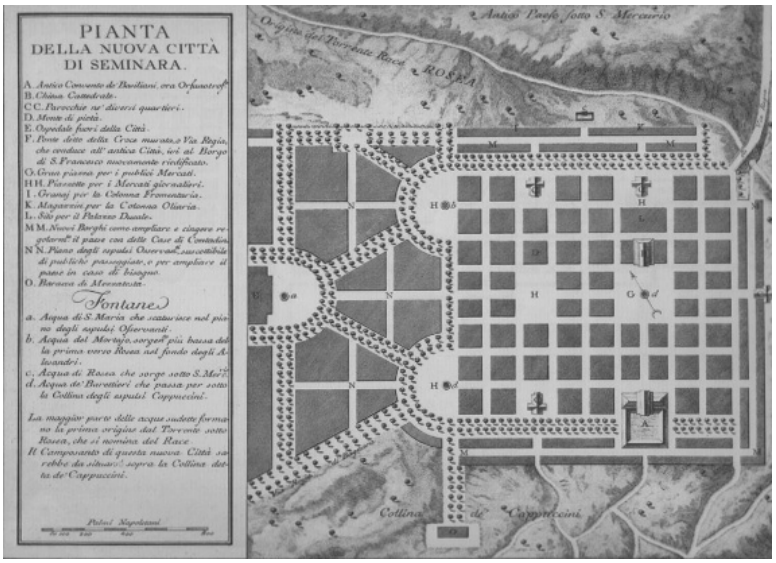

Figure 1. The *chess board plan* after the 1783's earthquake
Source: [Vivenzio 1783] (Figures 1, 2).

ventive opinion of compatibility between planning conditions and geomorphology conditions of the territory. From this date the conviction that the seismic risk must be considered inside the territorial planning especially in terms of strategies of mitigation has been strengthened (Figure 2).

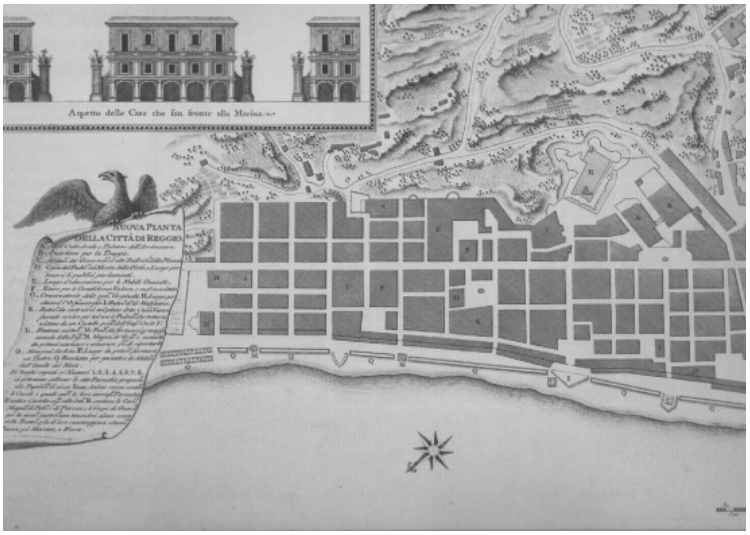

Figure 2. The first antiseismic plan of Reggio Calabria's city after the 1783's earthquake

2. The seismic prevention in Italy: the disaster management, the planning tools, the planning researches

2.1. The disaster management

The theme of mitigation risk is recognized, today, among one of the great themes that belong to the planning debate. In such an important way as to develop both the normative and applicative plan, with an ample choice of norms and measures of intervention. In Italy, besides, the theme of mitigation risks has been incremented with financial measures.

In Italy, the direct principal tools to the mitigation of risks are the Civil Protection Plans founded by the law 225/92, even if not a planning law. The Civil Protection Plans competences distribution is stated by law as follows:

- regional guidelines;
- forecast and prevention risks to the Provinces;
- intervention to the Municipalities.

In Italy, however, the Civil Protection Plans have not been applied first of all because the municipalities are not enforced by the law, and also because the Civil Protection Plans is only applied after a disaster and not as prevention of disaster.

Actually these Plans have a fundamental role for mitigation of risks, through:

- the localization of the risks on the territory;
- the formulation of sceneries for typology of risk;
- the identification of the interventions for the mitigation.

The Method Augustus has been realized by the Department of the Civil Protection, is a type of guideline in which you use to make reference for the elaboration of Civil Protection Plans. This method marks two forms of activity:

- the programming;
- the planning.

The activity of programming concerns both the forecast of the event, and the prevention as activity destined to the mitigation of the risks. Instead, the planning activity concerns the preparation of procedures of intervention to be activated in case of event. All the levels, from municipal to national level concerning programming activity depends on risks extension with definition of the sceneries. The planning activity is also included in the emergency plan, which are elaborated by all level from national to municipal.

Therefore, the Civil Protection Plans, even if concurring to the knowledge of the territory, are not incisive to the normative level because they are not connected with urban planning tools.

At the local level, the Augustus Method[1] distinguishes different areas for the emergency:

- meeting points;
- areas for the installation of materials and structures;
- gathering areas.

The *meeting points* of the population when a disaster occurs. These areas, are usually identified in squares, parking lots, public gardens, *etc.* and have to be easily attainable with secure streets. The population must know the place of their meeting point and the way to arrive there [Galanti 1997]. The meeting points are the urban places in which are concentrated the most social and economic activities that suggests new considerations about seismic urban renewal theme.

The *areas for the installation of materials and structures* suitable to ensure housing assistance of the populations affected. In these areas there are emergency lodgings constructed to accommodate the homeless population.

The *gathering areas* that the civil protection use to set up equipment to help to deal with the event. These areas are situated close to an exit road to allow the arrival of rescuers.

Therefore, before an event seismic People must to know the exact location of this areas of emergency. For the above reason the Department of Civil Protection (local and National) civil protection plan practical and publish and distribution leaflets.

2.2. The planning tools

The regional planning tool is the Regional Territorial Plan (R.T.P.) that maps the hazards of the Calabrian territory with the Regional Paper Sights to which all the planning tools must make reference to. The R.T.P. must recognize and classify the seismic areas, identifying the different hazard areas, and stimulating advanced methodologies of seismic microzonation to integrate in planning tools. Besides, it establishes the layouts of the lifelines for avoiding the seismic or landslide areas. Sometimes it suggests the underground of the lifelines depending on the geological condition.

The Provincial Co-ordination Plan (P.C.P.), which is a provincial planning tool, must identify the civil protection areas that will have to submit to special measures of preservation. Such predispositions are necessary for seismic mitigation to preserve part of the territory for emergency areas. The P.C.P. predispose the "Cognitive Framework of the Risks" for identifying:

- hydrogeological risk areas;
- risk and damage sceneries, related to urban settlement, infrastructures, lifelines, *etc.* Besides, for setting the sceneries, it suggests procedures and methodologies that involve the parameters of hazard and vulnerability;

[1] The Augustus method has been checked by the National Department of Civil Protection as guide for the Municipality Administration of emergency in different levels of planning.

- mitigation and prevention risks interventions.

In this way, the existing risks on the territory becomes the principal condition for identifying the areas for realizing urban settlements. In areas already urbanized the P.C.P. suggests innovative methodologies for mitigation risk, in particular directly involved with urban vulnerability research. Such decision constitutes a great innovation concerning the seismic risk mitigation theme because recommend research on urban vulnerability was before absent in the planning tools.

The municipal planning level elaborates the Urban Master Plan (U.M.P.) that represents the planning tool through which, mostly in comparison to the other planning tools, the mitigation and the prevention risks happens. The U.M.P., concerning the safety and improvement of the quality of life, recognize:

- use of the territory in relationship to the assessment of the conditions of hydrogeological and seismic risk;
- expand on the research of environmental risks areas;
- the areas for Civil Protection Plan.

The risks mitigation is also essential for measuring the urban capacity, in fact the existing risks can limit urban expansion. The U.M.P. bases the planning choices on the Urban Cognitive Framework which represents the morphological, functional, and social economy conditions of the territory. The Cognitive framework identifies and assesses natural and anthropic risks present, in particular the seismic and the hydrogeological risk. The U.M.P. set rules for improving and reinforcing buildings not only for historical centres but also for new urban sites.

The law assigns particular attention to the preservation and enhancement of historic centres of Calabria region, which are mostly in a state of neglect. Interventions for renewal and enhancement must be preceded by identification of risks, of course, the earthquake, which is considered a major cause of degradation, in some cases, it is the reason of the abandonment of historic centres.

2.3. The planning researches

Recently in Italy, the urban planning research about mitigation seismic risk involves on two fronts:

- the *urban renewal*, through specific interventions for reinforced the part "vital" of cities (the Methodology of Minimum Urban Structure - M.U.S.).
- the *urban project* of public spaces as security place (the Methodology of the Safety Minimum Requirements).

The M.U.S. is the most important part of an urban centre, or the vital system that must survive a seismic event. The M.U.S. allows the methodology to orient the vulnerability analysis and the mitigation actions towards all the elements that are a part of it, and to leave out (at least initially) the rest of the urban area [Fabietti 1999].

The first time that was applied the Minimum Urban Structure was on the Urban Antiseismic Plan for historical centre of Rosarno and Melicucco (seismic areas in the southern Italian region of Calabria) in the year 2000 [De Paoli 2001]. These plans are becoming important just for having made this new method of urban vulnerability assessment.

The M.U.S. involved the following general strategies:

- to integrate historical heritage conservation requirements and environmental values with aseismic finality. To this purpose, to identification and implementation the M.U.S., represents, as we shall see, the right strategy able to integrate improvement and conservation;
- to develop integrated strategies able to introduce social and economic opportunities which are the necessary assumption for conservation and rehabilitation of the historical heritage;
- to promote public – private co-operation as conditions for the activation of all existing resource potentials.

From the above general strategies two ambitious objectives derive:

- the first one, give to the theme " rehabilitation " a broader meaning compared to the traditional Italian urban debate usually involves; *i.e.* the recovery of a role inside the wide territorial system where Rosarno is located (Piana di Gioia Tauro, south of Italy); and the recovery of socio-economic functions inside the historical centre;
- the second, gives to the historical centre, the "lost" value of "quality" urban space.

Therefore, the Urban Aseismic Plan of Rosarno pursues the following specific aims:

- improvement of the strategic role of the historical centre concerning both the urban context and the broader territory with functions, facilities and services, as well as improving the accessibility, the mobility, and parking facilities, inside the historical centre;
- urban and environmental regeneration, through integrated actions concerning urban areas and primary and secondary urbanization facilities;
- improvement of historical heritage and degraded urban structure, with particular reference to the historical and distributive characteristics of the buildings, through actions directed to introduce reuse of the built heritage, and through tools directed to mitigations the seismic vulnerability of the built heritage itself and to removing the building superfetations;
- mitigation of urban vulnerability, *i.e.* the seismic protection of buildings, but above all the functions and social relationships that characterize the historical centre with regard to urban context.

From the aims above mentioned, the experimental nature of the Plan derive, which an integrated approach involving different expertises and requirements is expected:

- disaster and post-disaster management;
- rehabilitation both of formal-architectural and structural characters of buildings;

- social and economic revitalisation.

In pursuing such aims, the methodological answer, therefore originates precisely town planning field, which is required to provide new approaches and analysis actions for improvement of the historical centres. The M.U.S., is one of the new integrated planning tools.

Public space carry out an essential role in case of emergencies, in fact, citizen can use its as safety spaces after an earthquake. In Italy, the Civil Protection Department classify these areas relating to their use after the earthquake.

Since public spaces represent both a safety site and an important historical and social area, it must be preserved and safeguarded. The aim of this research developed at the Mediterranean University of Reggio Calabria, is to identify the minimum safety and urban quality requirements of public spaces to improve both the functionality in case of emergency and the urban quality[2].

The research identifies all urban spaces typologies (squares, open air markets, public parks, *etc.*) distinguishing physical, functional and safety properties. For this purpose a check-list has been drafted to assess urban levels vulnerabilities. This methodology has been applied in Reggio Calabria's urban structure where the historical centre was rebuilt with anti-seismic rules after the 1908's earthquake.

The Department of Civil Protection in Italy has not defined the safety requirements of the emergency areas. This encurages new studies about the urban vulnerability of public spaces. In fact the law no. 225/92 that founds the Departement of the Civil Protection establishes that the emergency areas are individualized inside the urban despite to the vulnerability problems.

Public spaces, that are usually open urban areas, are identified by the National Civil Protection Department as *meeting points* of the population when a disaster occurs. This suggests new ideas, and new urban projects that have been originated from the first urban plans realized in Italy after the earthquake of 1783. Indeed, these antiseismic urban plans established the first antiseismic city's rules: the "chess board" urban plant characterized with wide rectilinear and perpendicular roads, open areas as squares and markets localized along the longitudinal roads, buildings with a regular and right angle plant. Today, in the modern cities these rules, usually, are not respected but they are absolutely necessary for urban vulnerability mitigation and they stimulate reflextion for new definitions of the safety requirements of public spaces.

This contribution individualizes the minimum requirements that every emergency's area should have for being able manage emergency. In this research the individualization of the safety minimum requirements of public places has been realized through the Assessment Record "Safety Minimum Requirements" for the vulnerability assessment. The Assessment record is based on the choice of indicators and parameters able to determine the levels of vulnerability. The Assessment Record allows to determine:

[2] This research was made from A. De Paola (Architect), R. G. De Paoli (tutors) and prof. G. Fera (supervisor).

- the level of vulnerability of every meeting points;
- the parameter that mostly determines the vulnerability;
- the typologies and the priorities of the interventions to be realized for the urban vulnerability mitigation.

To define the Assessment Record it has been individualized the following requirements of the emergency areas that could increase or decrease the global area vulnerability:

- the dimension in relation to the citizen;
- the morphological characteristics;
- the accessibility and the availability;

SCHEDA		REQUISITI DI IDONEITA' DEI LIOGHI SICURI								
	Dati generali	N° Scheda ..... Data ..... Squadra ..... Regione ..... Provincia ..... Codice Istat Provincia								
		Comune ..... Codice Istat Comune ..... Frazione ..... Circoscrizione n° ..... Zona Censuaria n°								
		Denominazione dello spazio aperto ..... Indirizzo: Via/Piazza/altro								
		Dati dimensionali: Lungheza mt. ..... Larghezza mt. ..... Superficie totale mq. ..... Superficie calpestabile mq.								
	Caratteri degli spazi di relazione	Dimensionamento delle aree rispetto alla popolazione effettiva	INDICATORE DI VULERABILITA'	PARAMETRI DI VALUTAZIONE E INDICI DI INFLUENZA					Dato rilevato	Peso %	Valore ponderato
			Rapporto mq./abitanti	≥ 1	≥ 0,5 < 1			< 0,5			
				0	5			10		6	
		Caratteristiche morfologiche	Pendenza del terreno	0-9%	10-29%		30-50% o presenza di salti di quota di media entità	Maggiore del 50% o presenza di forti salti di quota			
				0	6		8	10		10	
		Accessibilità efruibilità	N° Accessi carrabili all'area con larghezza superiore a 6,6 mt,	> di 3	3	2	1	0			
				0	3	5	7	10		10	
			N° Accessi pedonali all'area	> di 4	4	3	2	1			
				0	3	5	7	10		10	
			Barriere fisiche	Assenza di barriere	Con barriere						
				0	10					6	
			Presenza di reti di distribuzione (elettrica – idrica)	Presenti	In parte			Assenti			
				0	5			10		5	
		Rapporto con l'edificato	Fronti edifecati sullo spazio	Senza fronti edifecati	Fronti parzialmente edifecati			Edificato so tutti i fronti			
				0	5			10			
			Strade con larghezza inferiore all'altezza dei fabbricati prospicienti (Rapporto h/l)	Nessuna	1 strada con h/l ≥ 1	2 strade con h/l ≥ 1	3 strade con h/l ≥ 1	4 o più strade con h/l ≥ 1			
				0	3	5	7	10		10	
			Vulnerabilita degli edifici prospicienti	Bassa	Media			Alta			
				2	6			10		25	
		Elementi di amplificazione della vulnerabilità	Presenza di elementi di criticità	Bassa	Media			Alta			
				2	6			10		8	
		LIVELLO DI VUNERABILITA'									

Figure 3. The Vulnerability Assessment Record

- the building typologies.

Every requirement has identified the following Indicators of vulnerability:

1) the square meters-citizen ratio;
2) the inclination of the ground;
3) the number of roads that access to the area with a width more than six metres;
4) the physical barriers;
5) the presence of networks of distribution;
6) the fronts built on the space;
7) the roads with inferior width to the height of the overlooking buildings;
8) the vulnerability of the buildings;
9) the presence of elements that increase the vulnerability;
10) the number of pedestrian accessing to the area.

Every Indicator of vulnerability has been expressed through Parameters of Assessment and Indexes of Influence that varies according to the incidence on the assessment of the vulnerability.

The levels of vulnerability have been gathered in three categories:

- 0-3 identify a low level of vulnerability
- 4-6 identify a medium level of vulnerability
- 7-10 identify a high level of vulnerability.

The town is the result of the society that lives inside. In the last decade, the social change process caused strong transformations the demand of public space, in particular in its use and in its morphology. For this purpose the role and the significance of public space has changed. In southern Italy, the use of public spaces as safety sites it is important both for a better management of emergency and to improve the urban quality. This research develops an interesting theory about the individualization of safety minimum requirements that every public space should have. The methodology, that was been applied in Reggio Calabria's city, can be applied in every city with seismic problems. Besides, this methodology, through the Assessment Records, allows to define the typologies and the priority of interventions that should be realized to improving the safety conditions of urban systems.

Conclusions

In the last years, urban planning tries to fill a normative and practical gap about natural and seismic risk mitigation, in particular. The "run-up" of urban planning theme is clear on normative area, in fact many Italian regions has renewal their rules to make in safe their cities. Also the applied researcher has tested in urbanistic area new surveys and interventions methods in order to apply more incisive solutions for urban renewal than past. The needed to intervene in an integrate way with the build and socio-economic renewal general aim, has suggested innovative researches re-

garding the risk and vulnerability seismic assessment, that the identification and reinforced of the "Minimum Urban Structure". Others researches were directed for increasing security of public spaces usually used as related space and for improving the urban quality to obtain the maxim functionality in case of emergency.

The disaster management, the planning tools, the aseismic rules, the planning researches are oriented to reduce the damages after the seismic event. In the past, the Italian territory was devastated from government negligence and uncontrolled interventions people, therefore the way to put in security their cities is just begun.

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