BUCHAREST - RISK AND URBAN STRATEGY

Cristina Olga Gociman
University of Architecture and Urbanism, Bucharest, Romania
criba_proiectare@yahoo.com

Motto:
Nowhere in the world exists compressing of people so exposed at earthquakes proceeding from the same source. (Richter, Ch., 2005)

ABSTRACT

Bucharest - capital of Romania is one of the European towns exposed to earthquakes. With an area of 228 km^2 and a population of 2.021.000 people, a great density in the central area, high buildings built between the 2 world wars, Bucharest had during the earthquake from March 1977 over 1.500 dead and damages of over $ 1.000.000.

In this context, the efforts of the specialists and central administrative authorities are focused on the implementation of a risk reduction management regarding disasters, by direct methods – consolidation, as well as by indirect methods – of legal type, for developing and urban strategy.

The analytical mapping of the disaster sources, of the exposed elements and vulnerabilities of those, finding zones of maximum risk can lead to a direction of the urban development, to a strategy for projection of territory planning and to generating new organizing administrative policies on security zones. For the proposal of a multi-level security system building, vicinity, zone, town, the intervention and protection competences have a territory on hierarchy and known criteria. Organizing and dissipating of a poly-centric system of secure zone centres – shelter implies a considerable financial effort, but they will generate system to support the logistic, a psychological support for the population and the specialized intervention units. Also, they can become the structure generating the reconstruction.

BUCHAREST – A CAPITAL EXPOSED TO DISASTER

Considering the number of persons that have lost their lives during the earthquakes in the last century, Romania is situated among the first countries in Europe, and Bucharest is the European capital known as the most sensitive to earthquakes, mainly because of its:

- *Geographicaal position,* approximately 100-170 km from the epicentral area of Vrancea, distance that can be compared to the depth of Vrancea's focal points;
- *Terrain conditions,* characterized by the manifestation of re-accruing long periods of land movement, at medium and high magnitudes;
- *Type of structure building,* existence in the central area of a number of several hundred tall buildings with pillars and reinforced concrete girders, most of them built before 1945;
- *Structure technical norms, lack of knowledge*, in the period of time surrounding the construction of such buildings, as far as technical norms necessary to the realization of reinforced concrete structures that can resist earthquakes.

	INTERMEDIATE EARTHQUAKES	SUPERFICIAL EARTHQUAKES
Depths:	100-150 km	5km
Magnitude:	M=7.0 on the Richter Scale	6.0
Affected zone:	Half of Romania's territory	Banat, Craiova, Maramures

Figure 1. Romanian Earthquakes Zone (Normativ, 1992,100)

Table 1. Losses Caused by Strong Earthquakes in Romania During 20. Century
(Georgescu, 1993)

NO.	DATE	TIME (UT)	M RICHTER	DEAD INJURED	DAMAGES AND ECONOMIC LOSSES
VRANCEA ZONE – INTERMEDIATE EARTHQUAKES					
1.	1940, Nov. 10	01:39	7.4	5.000 dead many injured	- serious damages to low buildings especially in epicenter area; - high modern buildings damaged and 1 crashed in Bucharest (Carlton block – 14 floors) - $ 10 million damages
2.	1977, Mar. 4	19:21	7.2	1.570 dead 11.300 injured	- 32.900 buildings crashed and seriously damaged - 28 buildings before 1940 and 3 after 1940 partially crashed, other serious damages - $ 2 billion damages
3.	1986, Aug. 30	21:28	7.0	2 dead 558 injured	- 55000 buildings were damaged in different stages
4.	1990, May 30	10:40	6.7	7 dead 100 injured	- serious damages in epicenter area - non-structural damages are the majority
5.	1990, May 31	00:17	6.1		Moderate damages added to those before
BANAT ZONE – SUPERFICIAL EARTHQUAKES					
1.	1991, Jul. 12	10:42	5.7	2 dead 30 injured	- serious damages in epicenter area (Banloc) - rural buildings destroyed in an area rarely affected by earthquakes - thousands of disaster victims in some villages - local damages
2.	1991, Jul. 18	11:56	5.6	Few injured	At least 615 houses damaged in Orsova zone
3.	1991, Dec. 2	08:49	5.6	Few injured	- serious damages in Voiteg - 4500 disaster victims and 5000 houses damaged

RISK MANAGEMENT BY THE FUNDAMENTAL PRINCIPAL OF DURABLE DEVELOPMENT

The two contemporary crises, of the environment and of the development are converted to a new ethics of ecology, economy and culture, opening the legal premises for a new socio-political dialogue.

The need for a different kind of development, capable to ensure, on the long run, economic growth, the betterment of the environment and the conservation of nat-

ural resources, defined as a development that responds to their own need was named Durable Development in the Brundtland Report. The definition of durable development is followed, in the Brundtland Report by its explanation through two integrated notions:

- the concept of need - in particular the essential needs of the least favored who need to have priority;
- the concept of limits, imposed by the current state of technology and social organization over the ability of the environment to respond to our current and future needs.

The *six components of sustainability* are respected in order of:

- maintain and enhance quality of life;
- enhance economic vitality;
- ensure social and intergenerational equity;
- maintain and enhance environmental quality;
- incorporate disaster resilience and mitigation into actions and decisions;
- use of a consensus-building, participatory process when making decisions.

THE ECOSYSTEM STRUCTURE OF THE ENVIRONMENT – THE DURABLE APPROACH

The Principles of The Durable Development

The Brundtland Report proposed, in one of its annexes, a summary comprising 22 legal principles proposed to the Commission by a group of legal experts, grouped in 4 chapters: general principles, rights and responsibilities; principles, rights and obligations regarding the natural resources and surrounding trans-frontal interferences; responsibility of the states and peaceful solution of the disputes. In order to facilitate the wished approach, a regrouping of all theoretical principles was intended, with formulations of the same kind. The result is a number of 10 general principles, and these are: prudence principle; principle of request administration; solidarity principle; subsidiary principle; principle of environment efficiency (or eco-efficiency); principle of social-economic efficiency; honesty principle; equity principle; principle of eco-system approach; principle of "global thinking – global action". Many of them are taken from the economic-political sphere; the order of their presentation is not a hierarchy.

The ecosystemic approach within the lasting development implies, on the one hand, the understanding of the natural environment which we should respect based on the understanding of its component ecosystems, and, on the other hand,

the understanding of other unnatural systems included in the natural environment by the assimilation of the said as ecosystems. The lasting development specialists frequently use this approach for the events that take place at various territorial levels, especially towns and the urban environment.

Ecosystem - Definition

The ecosystem is a tropic relation between alive (biomass-different species) and non-alive (biotope-supporting space). (Budeanu & Cãlinescu, 1980)

The Characteristics of Ecosystems:

- *Integrality*- the result of functionally and structurally defining components;
- *Informational*- the capacity to receive information, the quantity of information stocked depending on the degree of evolution of the ecosystem;
- *Historicity*- the capacity to store information, the quantity of information stored depending on the degree of evolution of the ecosystem;
- *Fluent Balancing*- dynamic, with the constant turnover of the elements.

The four characteristics of the ecosystems - integrity, information ability, historic character and fluent - dynamic balancing allowed for a slow anthropisation, in time, of the said.

Entropic Ecosystem – Definitions:

The relationship between man and the implacable laws of the nature which can not be conjured away drove to the mythic concept of the all-powerful destiny, to whom all existence is obedient and from whom not even gods can divert.

There is an obvious casual tie between the deterioration of the environment and the growth of the disaster risks. There's also another paradox phenomenon, the developed countries have became disaster vulnerable. The technological forcing attacks environment, which entropic reacts.

The costs, of the disasters affect 5% of the globe population: between 1900-1976, 60.000 people died annually and 3 million residents were affected. The daily cost of disasters was evaluated at more than $18,8 million. Considering the number of persons that have lost their lives during earthquakes in the last century, Romania is situated among the first countries in Europe, and Bucharest is the European capital the most sensitive to earthquakes.

The Ecosystemic Disasters are defined by the introduction of turbulences or strong aggressions in and around the biotope provoking changes, which in turn destroy the ecosystem's equilibrium, forming an entropic ecosystem.

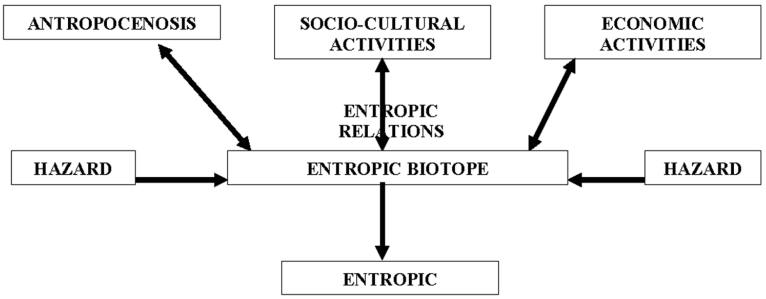

Figure 2. Entropic Ecosystem - Specific Concepts for Risk Management (Gociman, 1999)

Entropic Causes

Hazard is defined as the probability (waiting) of existence, in a given area, and in a given amount of time, of a certain event characterized by a given value of a certain parameter (i.e: magnitude, macro seismic intensity, peak acceleration of land moving in case of earthquakes, wind velocity in case of storm, wave debit of the flash flood in case of flood)

- *Classification from the point of view of the succession of effects*: primary and secondary hazards; natural and atrophic hazards.
- *Classification after source of disaster*: the hazard at source; the hazard at the emplacement (hazard at source x the attenuation);
- *The maps of hazard* – maps of the expected values in the emplacement.

Exposed Elements (EE) or *Risk Elements* (RE) represent the material or spiritual values that can be negatively affected, directly or indirectly, by generating a major event.

Classifying in order of Importance of Risk Elements

The main categories of exposed elements to be taken in view when evaluating risk in a locality are: population; buildings and emplacements (including plumbing, equipment, and material as well as spiritual goods that are sheltered by them); the vital systems, communication means, and vital networks; environment.

The Map of Risk Elements: Identifying quality and quantity wise, as well as the positioning-mapping of exposed elements is an essential stage in determining risk areas in a locality.

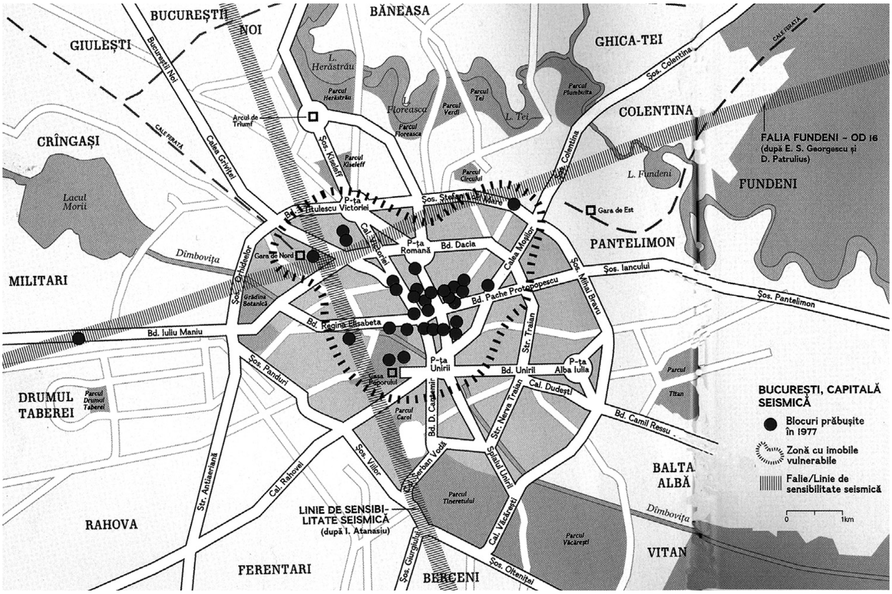

Figure 3. Bucharest – Seismic Capital (National Geographic, 2005)

Vulnerability

The vulnerability of exposed elements is defined as the possibility of such elements as being negatively affected (damages, losses) by such an event.

- *Generalities:* by extension, when a seism is analyzed, one can also discuss: functional vulnerability, economic activities vulnerability and social life vulnerability;
- *Classification of Vulnerability:* expected – through direct expertise and observed – through statistical analysis;
- *Vulnerability Maps:* they map the degree of vulnerability of exposed elements, having a previously established scale (the proportion of building destruction, of wounded, or dead amidst the population).

Looking at Bucharest as to a functional system, from the urban point of view, it presents vulnerability characteristics due to the compression of vulnerable high buildings (generally before 1940) into the central zone, of other buildings dated before 1977 from the first central collar (structures with flexible ground floor) and of the negative effects which can arise by the damage of industrial buildings, utilities network, engineering works. Into these high buildings leaves an important percentage from the capital population.

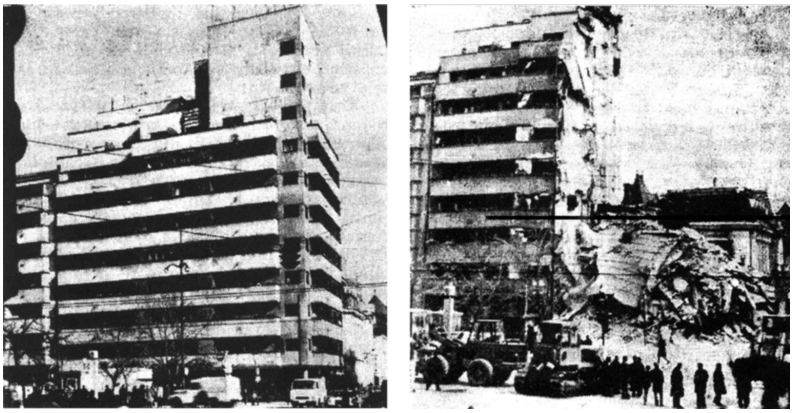

Figure 4. Casata Building, Magheru Bulevard, Bucharest, 1977

Describing Urbanism in Seismic Vulnerability Terms of Bucharest

Bucharest has to be understood as a system with a specific topology and interactions between urban cells, being necessary to be taken into consideration the differences of behaviour due to different types of buildings, stress and damage as well as urban characteristics.

At the Bucharest level there are 22.800 ha of administrative territory from which about 15.900 ha (67.7%) is designated for residences. Due to this fact, the framework conditions of Bucharest residences are classified by the town-planners in: urban residence with natural evolution; urban residence with planned evolution as parcel type and urban residence with planned evolution as an ensemble of collective houses and plating (1950-1990).

Risk (R) is defined as the expectation, in the sense of probability, of unfavorable consequences of future disasters, in a given period of time. According to their specific character these consequences can be classified as follows: human consequences: loss of human lives, or injuries; ecological consequences: the long lasting or irreversible affect of the nearby environment; and economic consequences: direct or indirect loss of material goods.

Risk Evaluation – the scale of expected losses is determined, on a given area, in a given amount of time, including statistical and process-related data.

Earthquake scenario for a short earthquake, the minimum amount of time for reconstruction is 50 years (INCERC) indicates:

the number of buildings depending on the damage rate is:

undamaged:	5.449
first degree of damage:	24.152

second degree of damage:	54.998
3rd degree of damage:	18.009
4th degree of damage:	4.096
5th degree of damage:	906

*the effects concerning the inhabitants,*as a result of earthquake scenario examined, is (earthquake scenario during the night at 21.00 o'clock)

evacuated inhabitants and victims of disaster from the damaged buildings at 3rd, 4th and 5th degree:	455.235
evacuated inhabitants and victims of disaster from the damaged buildings at 3rd degree:	52.344
inhabitants in a danger position of risk from the damaged buildings at 4th and 5th degree:	106.268
inhabitants in a danger position of risk from the damaged buildings at first degree:	86.799
inhabitants captive in buildings:	94.542
inhabitants slightly wounded:	13.021
inhabitants wounded and hospitalized:	10.467
inhabitants seriously wounded :	16.267
deceases:	6.554

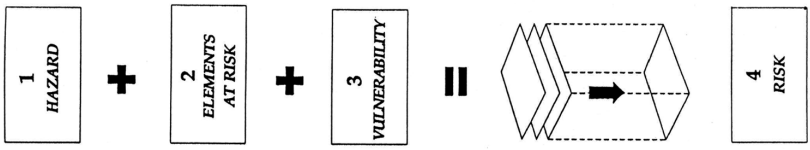

Figure 5. An Overview of Disaster Management (UNDRO, 1992)

The effects on inhabitants are reduced to 54% from those during night earthquake (21.00 o'clock), the signification being determined by the movement of producing/registering place to other places, which can't be measured.

Risk Maps – analytical: They map (quantity or percent-wise) areas at risks of seism, floods, chemical accidents and nuclear accidents.

- *global:* juxtapose the data of the analytical maps, determining danger zones in juxtaposing areas.

Establishing Accepted Risk: The analysis is done based on a financial calculus, the result of which is the degree of disaster endurance as percentage of IBP, as well as by taking into consideration other financial indicators, considered as being representative (value of exports, value of annual investment.)

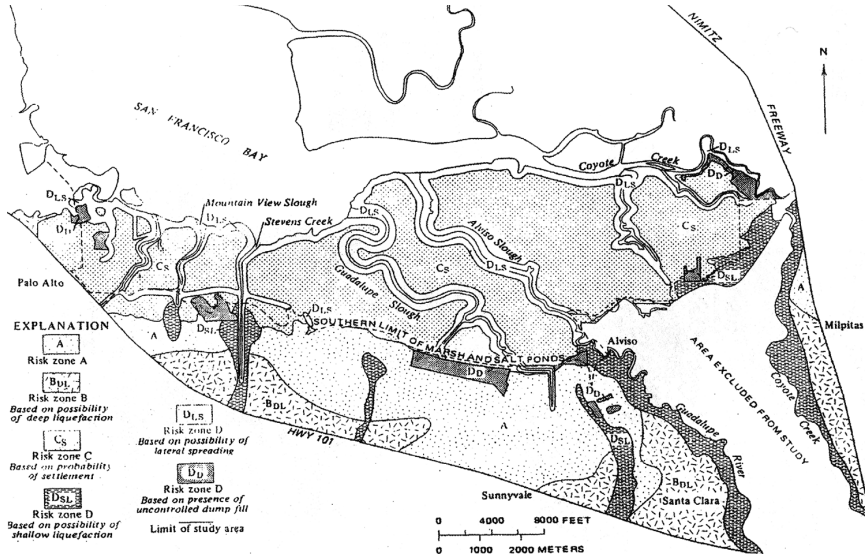

Figure 6. Map of The Risk Zones – Santa Clara – Planning Policy Committee, 1972 (Petrovici, 1995)

GLOBAL STAGES OF THE DISASTER MANAGEMENT – APPROACH PROPOSALS

Previous Approaches

Delimiting the stages of disaster management is reported in all the documents starting with the impact moment. *In DMTP* program Disaster Management Training Program substantiated by UNDP – UNDRO – the actions are classified in two stages: prior to disaster stage and after disaster stage.

The prior to disaster stage includes the activities related to prevention of a disaster effects and preparing of intervention.

The after disaster stage includes activities actually related to intervention for rehabilitation and reconstruction, stages which according to chapter 3, part I are different depending on disaster type – sudden or slow. In conformity with the institution position or involved element in disaster management more landing types have been explained. Thus, the civil protection unities use the term of cri-

sis in stead of disaster, delimitating it as a social defection zone and splitting the landing of disaster management in two stages: prior to crisis and during crisis.

The prior to crisis stage has two phases: preventing the crisis and preventing the crisis in interventions preparing. Stage II *during crisis* has three phases: Phase 3 – detection – alarming; Phase 4 – intervention – restoring; Phase 5 – evaluation – losses. Lohman proposes a three stages approach of the disaster management. Stage I – risk evaluation for determining the type of expected disaster; stage II – planning and intervention – necessary for organizing the respond to risk and stage III – implementation, as in putting the plan and decisions in actions.

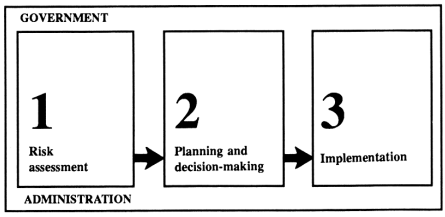

Figure 7. Policy Framework Diagram Summarizing The Context and The Phases for The Effective Mitigation of Disaster (Undro, 1992)

"The disaster is a dynamic and unpredictable process", says the same author (Lohman), and therefore the fight for the reduction of its effects has to be also dynamic and in the closest way, anticipative.

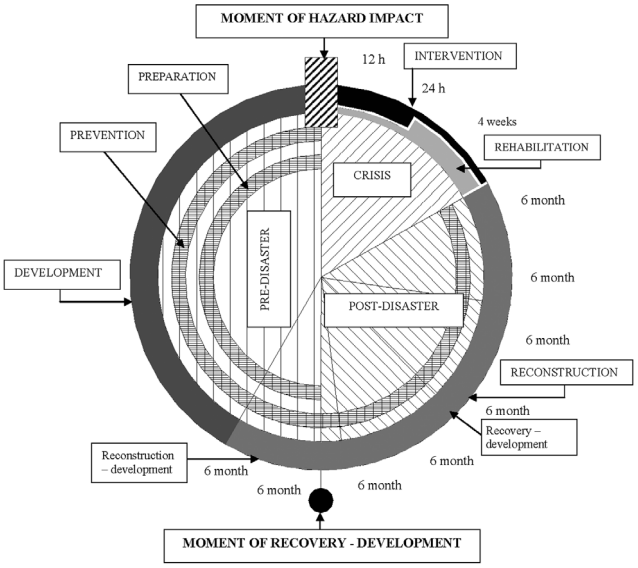

Figure 8. Formulation of a New Pattern of Global Approach (Gociman, 1999)

Formulation of a new pattern of global approach: Stages. Time and succession elements and Impact hazard – disaster starting.

- *Intervention 48 hours:* alarming; emergency 0 – fire department, ambulance; monitoring – information processing, primary disaster evaluation; establishing the intervention pattern; intervention decisions – according to predictions pattern; activating direct intervention;
- *Rehabilitation (minimum 1 month):* monitoring rehabilitation needs; information processing – secondary evaluation of the rehabilitation needs; pattern establishing; rehabilitation decisions; rehabilitation activation;
- *Reconstruction (minimum 2 years):* monitoring of the general direct and direct losses, reconstruction necessities, needs for pre-disaster preparation; information processing – needs evaluation; setting up reconstruction ways – developing: program for risk reduction (nonstructural – structural); activation of the reconstruction and durable development – structural measures for risk reduction; recovery moment – is the moment when the society has recovered the majority of the losses, especially the direct losses, as a result of the physical destructions and a good part of the indirect ones;
- *Carrying out – development:* continued reconstruction with the implication of the durable development in implementing the measures for disaster risk reduction; durable developing programs.

The disaster management has to create out of reconstruction development opportunities by involving the risk reduction measures in all the components of the economic and social life. The reconstruction period and the developing period are also components of the pre-disaster stage (preparation for the disaster).

The correct representation is tightly connected to a spatial view because, considering that the impact occurs on a certain plan of development of the company, the losses lower the society and the reconstruction brings it to a partial recovery and initial balance point. The management of the disaster must create, based on reconstruction, development opportunities involving the risk reduction measures in all the segments of the economic and social life.

This program is dynamic and continuous and it must be permanently improved and tested. The programs must not be considered just as immediate helpers, but as development opportunities.

The Implementation of New Urban Security Systems – Multilevel Safety System

The development of the concept of the assured city has to implicate society as a whole, the authorities, private and juridical persons, for the implementation of a

multilevel safety system plan, including: local, family, and workplace security; neighborhood, and building security; nearby zone security; territorial security.

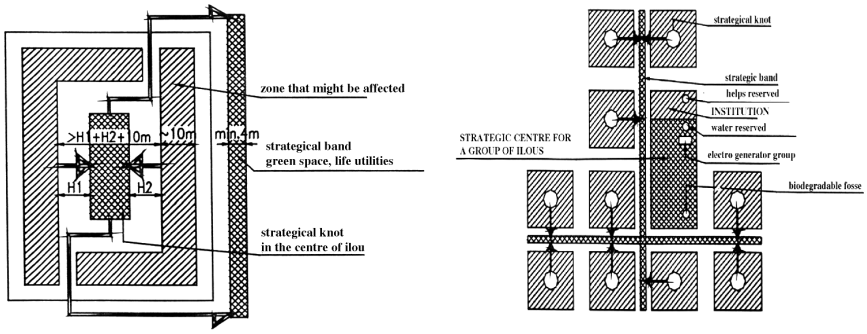

Figure 9. Organization Scheme of a Ilou – Strategic Knot (Gociman, 1999)

Safety Building

a) more technologically apt norms at seism (ductile structures)

b) Application of new technology

The Interaction of An Ensemble of Safety Buildings which will drive to: the analysis of the risk of the zone; the calculus of the behavior of an heterogenic ensemble of buildings during a seism; the stabilization of the strategic area in case of the buildings falling; the establishment of the Coefficient of Urban Utilization (CUL) based on the risk level and not based on neigh boring buildings density.

The poly-nuclear urban system, zoning the territory of the city by security criteria: in strategic areas, the dimensioning of the area depending on the level of the risks and especially depending on the possible number of the affected population susceptible to evacuation. It can be created to take into account the various possible risk scenarios and the available accommodation variants, and it would involve the following *action and organization stages***:**

- inventory of the lands, spaces and available buildings in those areas, associated to some public functions – that might accommodate the evacuated persons (gyms, schools and other public endowments, but also other units especially assembled or built on free locations);
- declaration of evacuation areas / localization of pilot security centres, preferably in an area not very far from the risk area, of permanent inhabitation;
- evaluations of the buildings meat to the security and consolidation centers;

- legal regulation of the operation of security centers – reception centers within an urban security area for first degree emergency locations, in case of earthquake disaster;
- minimal pre-event endowment and preparation in order to receive the relocated persons.

The critical problems are both the identification/evaluation ones, and those related to the inventory of a sufficient number of locations, of assessment of the safety, of technical consolidation and endowment. From the available data, the section regarding the relocation in the Disaster defence plan at the level of the Defence Commission of the Bucharest Prefecture establishes a number of 36.888 accommodation places and 20.064 feeding places in: hotels, student houses, high schools, school groups, schools, helping schools, orphanages, restaurants, inns, wine cellars, canteens.

Safety City - is a concept extended at the urban organism level that contains: urbanism laws that deal with the reduction of the risk based on the global risk maps that will introduce conditions of limiting POT, CUL, or of not allowing construction; the establishment of minimal distances between buildings; land reserves for temporary living (such as for people affected by destruction); land reserves for development, cemeteries, garbage disposal ground. The interdiction of construction in zones at high risk. Zones that are at high seismic risks will be limited only for parks, gardens, and recreation.

THE TEMPORARY HABITAT OF THE POPULATION DURING THE RECONSTRUCTION OF THE AREAS AFFECTED BY DISASTER – LOCATION OF TEMPORARY HABITAT IN BUCHAREST

In the crisis period following immediately after the disaster, one of the main problems that arise is the assurance of a shelter. At Kobe, after the great earthquake, more than 38000 persons were relocated in publicity spaces, then in temporary houses, built on 320 ha of land offered by the State. Two ships were also used to temporarily accommodate 80 persons.

Also, in Turkey, many of the temporary habitations became permanent. The composition of the temporary environment location (post-disaster duration) becomes, in the case of an area having a high global risk, a strategic structural component of diminution of indirect loss.

In the case of Bucharest, according to the disaster scenario elaborated by INCERC, more than 10000 persons would have to be relocated, which imposes a very serious approach of this subject, as the emergency shelters – by rearranging some institutions – can only cover 10% at most.

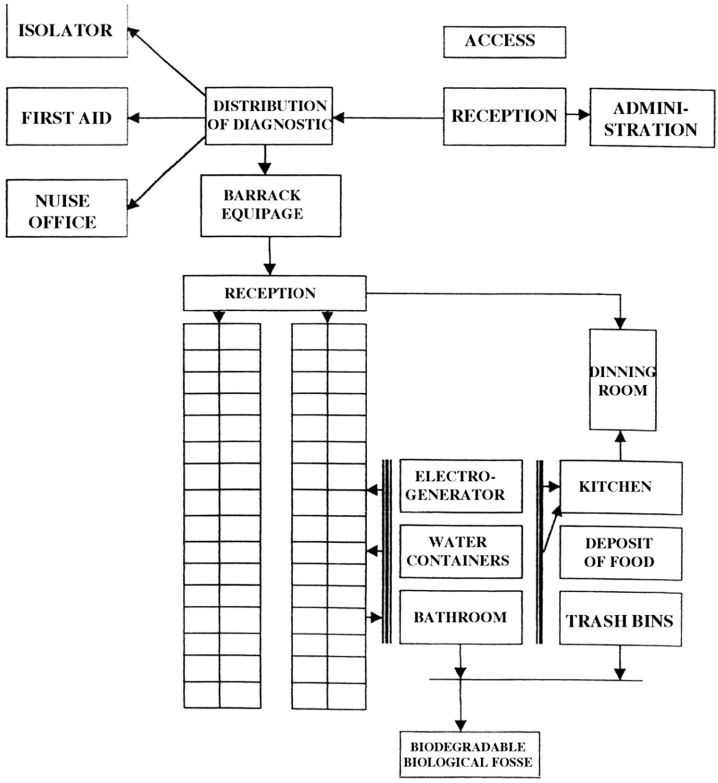

Figure 10. Emergency Habitat – Organization (Gociman, 1999)

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