EDITORIAL

Safety in urban environment

by Maurizio Tira

Two are the words of English language to convey the feeling of protection against threats: *security* and *safety*. *Security* expresses the reaction to social problems, typically the fear of personal attacks. It is highly perceived as a priority for the liveability of urban environment, especially from the elderly. *Safety* is the word used in the copious literature about risk assessment and mitigation, for conveying threats related to natural and man-made hazards. Whereas security is rather a result of social structure of our societies, nevertheless ITC devices are largely used to improve the feeling of being secure, namely the video surveillance systems.

Several disciplines deal with the complex topic of safety, as it touches most of our daily activities and scientific subjects: structural design, physical planning, road design, transportation engineering, geotechnical and hydraulic engineering, etc.. Being one of the key words of our review, it is unnecessary to underline the relevance of the topic being offered to the readers.

Less evident can be the relations between natural and man-made hazards and the urban schemes. The technologically advanced societies are facing growing challenges due to the increasing complexity of communities, whereas the poor countries are always suffering from the heavy economic losses, unbearable in a low income society.

From the outcomes of natural and man-made hazards on the world economy, hence the urgency for decision makers to allocate a growing part of the ever scarcer economic resources to risk mitigation.

The Global Platform for disaster risk reduction, held in Geneva in 2013 (DRR Report), found that *the global economy's transformation over the last 40 years has led to a growing accumulation of disaster risk. Annually, economic losses already amount to hundreds of billions of dollars and they are projected to double by 2030. Countless everyday local events and chronic stresses involving multiple risks are an ongoing burden for many communities. (...) Urban risk needs to be more fully understood. The risk of failures in technical systems also poses severe consequences that have often been overlooked. The dynamic and multidimensional aspects of risk require holistic and comparable methodologies for risk assessment to enable, science-based decision-making and identification of development opportunities.* Moreover, *disasters happen locally and solutions are to be found locally. This does not relieve national governments of their responsibilities to establish a framework and enabling environment for local action. However, municipalities and local authorities are in unique positions to lead and create opportunities for local partnerships and to take risk-informed decisions that protect the continued potential for economic and social development. Sound urban development and spatial planning, including attention to informal settlements, migration, safe housing, infrastructure and social services,* are crucial. Focus was also placed by the Platform on efforts to ensure that all schools and hospitals are built to resilient standards, that all necessary school and hospital preparedness measures are in place and that attention has been given to the needs of persons with disabilities.

In other words, it is said that the perspective of the weakest (the disabled) is the best approach to ensure safer places for all!

Another evidence: the need for holistic approach and for interdisciplinary studies clearly emerge from the expert panel. That's also lowly the goal of our review, an intersection of different knowledges.

For the sake of simplification and the convenient shortness of this editorial, we will briefly introduce the safety problems of urban settlements and the potential of technical disciplines to mitigate risk.

Disaster risk reduction is a world challenge. Fatalities and economic losses due to natural catastrophic events have increased in recent decades and some communities around the world face natural hazards almost daily.

Under climate change scenarios, the distribution and severity of extreme events is expected to become increasingly uncertain and unpredictable.

From a geographical "scale" point of view we can recognize hazards by type

- regional hazards: those having the potential to produce regional disaster (floods, volcanic hazards),
- multisite hazards: related to meteorological events that can virtually occur anywhere (storms, hailstorm, earthquake),
- local hazards: they may occur in a particularly vulnerable environment and may provoke extended effects with respect to the relatively small physically damaged area, whenever systemic and functional vulnerabilities are relevant (land-

slides, avalanches).

Adding to those the so-called man-made hazards, that are mostly scattered, with only some concentrations, depicts the scenario of most urban settlements.

From a geographical "distribution" point of view, in Europe a rather clear distinction can be made between:

- northern countries: floods and meteorological related hazards represent the main threat,
- Mediterranean countries: forest fires and main geological hazards, in particular earthquakes and volcanic activities.

Even man-made hazards have an unequal distribution in the northern and southern EU Countries. For example, road safety is a higher concern in the South Eastern EU Countries, whereas technological disasters are probably most feared in the former Socialist Nations.

Anyway, the more promising approach lies in the disaggregation of risk into its three main components.

A disaster is a probabilistic event, whose effects we try to mitigate through our actions. A disaster is a sudden, unexpected variation in the normal evolution of systems; following the definition of the United Nation Office for Disaster Risk Reduction-UNISDR it is *a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources*. It may also be defined as *a non-routine event in societies or their larger subsystems (e.g. regions, communities) involving socio-economic disruption and physical harm.*

For better understanding the potential for action related to the large variety of events, it is worth reminding the overall accepted definition of risk (see VARNES and IAEG, 1984):

RISK = f (Hazard, Exposure, Vulnerability)

Where:

- *hazard* represents the physical event, phenomenon or human activity with the potential to result in harm; any event can be described in terms of probability of occurrence and magnitude/intensity;
- *exposure* describes the socially valued elements that may potentially be damaged by an hazard, first of all human lives;
- *vulnerability* describes the susceptibility of exposed elements to losses, the degree of fragility of a natural or socio-economic community or system towards hazards.

As the formula is definable only in relation to specific events, what is generally agreed is that the combination of the three elements is such that risk is zero whenever any of the variables is zero. More precisely, we may let exposure and vulnerability tend to zero, whereas hazard is hardly resettable.

Such a disaggregation is extremely promising to better understanding the chances for action when combined with a classification of typologies and origins of disasters (Tira, 1997):

Typology	Origin	Disaster
Seismic phenomena	PHYSICAL	Earthquakes, Tsunami, Volcanic eruptions
Meteorological phenomena		Cyclones, Tornadoes, Heavy fog, Drought
Geological phenomena	COMPOSED	Floods, Landslides, Avalanche
Ecological disaster		Epidemics, Forest fires, Chemical contamination, Physical contamination, Bacteriological contamination, Radiological contamination
Accidents of transport	HUMAN	Plane crashes, Train crashes, Road accidents, Maritime accidents
Technological disasters		Breaking barriers, Collapse of bridges and structures
Major industrial accidents		Explosions, Fire, Biological and chemical contamination, Mining disasters
Terrorist acts		

In the proposed taxonomy, exposure and vulnerability may always be influenced by human activities, while only human events and – partially – composed ones are those where hazard can be reduced.

A *physical disaster*, for example, is an event where the causes are mainly or only natural. The earthquake is the best example: ordinary human activities (if we exclude fuel search, heavy mining, atomic explosions and gas storage) cannot trigger a seismic event. Consequently, our actions will concentrate on exposure and vulnerability mitigation, through active or passive measures.

A *composed (or intermediate) disaster* is an event where man actions can partly influence hazard, together with exposure and vulnerability. That is particularly evident when floods and landslides are concerned. Heavy rains are the natural cause behind flooding, but long term land use choices and short term governance models can heavily influence vulnerability.

The *human (man-made) disasters* are those where human responsibilities are prevailing on natural causes. Also in that case we should exclude – for example – the influence of meteorological conditions over road crashes or fire propagation. It is clear that safety actions must be preferably devoted to the reduction of magnitude and intensity of threats, without excluding exposure and vulnerability mitigation.

Knowing the above, policies and techniques can focus on the more effective solutions, being active or passive measures.

Ordinary planning is first and foremost a pro-active approach to risk mitigation. We could probably think that erecting a river bank is the most important action against floods. Nevertheless, experience shows how the impermeabilisation of soils greatly influences the runoff and overflow development in a river basin, so land use plans are crucial. Nevertheless planning acts are rarely accepted when binding and affecting property rights, whereas works are welcomed as an explicit will of protection.

Furthermore, only plans can address the vulnerability of urban settlements, that goes beyond the fragility of single elements, involving the structure of settlements, the social and institutional organisation, that is the ability of reacting to urban failures. That's the reason why ever growing towns, increasingly complex and interrelated, are more vulnerable to external events, even if buildings and structures are well designed and properly realised.

Those are the reasons why planning in hazardous areas is at the core of planning theory and practice.
From the *epistemological* point of view, as planners are forced to rethink to urban habitat as a non-deterministic system.
From a *strategic* point of view, as taking risk into consideration entails the evaluation of the probable possible future, that is the assessment of the sustainable scenario for the future urban structure. Over the past 20 years it has become increasingly accepted that the principles and practices of sustainability must be integrated with those of risk mitigation.
From a *methodological* perspective, as in-depth analysis are indispensable to identify local hazards, vulnerabilities and exposed population and goods, so contributing to a wider and deeper understanding of the area.
From the point of view of *urban policies*, as hazards forces local communities to decide about the acceptable level of risk within the constraints of a limited budget, through participation processes.
The past experiences showed how urban *planning choices* implemented – for example – after an earthquake, can be crucial for the *economic recovery* and the social activities to restart in the affected areas. Without a proper urban governance, the earthquake tends to be a great accelerator of urban dysfunction already present, where the risk mitigation concern is almost absent and the urban system vulnerability is only partially compensated by the strengthening of the new buildings.
The role played by planning in mitigating future risk and governing development and reconstruction is then crucial as, theoretically speaking, the distinction between post and pre event planning is meaningless.
Few other active measures can be listed, referring to several disciplines. They suit more the man-made hazards, where a lot can be done to reduce the probability of man failure. Let's think to the evolution in remote control, to the safety devices in transport systems, etc..
Technological tools can help protecting also from natural hazards, when predictable: the monitoring systems, increasingly sophisticated and open to public are ever more accessible through tablets and i-phones.
Structural measures, generally referable to the retrofitting and strengthening of existing built stock, are typical passive measures, dimensioned to reduce vulnerability, so the probability and amount of damages.
A great debate can be arose about the cost of protection and the accepted level of residual risk, namely when facing several and different threats.
Geotechnical interventions, can be both active or passive measures, when preventing landslides or defending infrastructures from them.

Addressing safety includes, first and foremost, shifting from "a deterministic based tool box, routed in a deterministic view of society and personal behaviour", to the "probabilistic perspective of natural phenomena" (Imbesi, 1997) and their consequences.
Anyway several events are approached through the simplification of the scenario.
In other words, we try to depict one or more possible futures through static descriptions. Giving scenarios a rate of possibility, stochastic events may be described through deterministic representations (that is the case, for example, of seismic maps and classification).
The scenario should guide decision makers to acting. Nevertheless and paradoxically, as far as more the action is far from the expected event, so less it is perceived as crucial. Being probably rooted in human psychology, the fear of disaster prompts human beings to forget it and so negatively influences prevention.
With the same approach, most assessment of disaster impacts only focus on quantifying immediate direct damages and only in financial terms. The economic costs consist mainly of immediate damage assessment in order to provide governments and aid donors with estimates of the amount of funds required to address emergency and reconstruction needs, as well by insurance companies.
Long-term indirect costs in the flows of goods and services, reduced levels of production and non market impacts, such as environmental damage and psychosocial effects, are frequently omitted from such assessment.
The reliability and safety of urban systems must be an inalienable objective of ordinary planning activity. The need to plan the development of a specific region, also in terms of the potential risk to which it is exposed, is more and more evident since experience teaches that close attention to forecasting and prevention is as important as managing effectively the emergency under way.
The duty of correct regional planning is to provide the direction for growth that guarantees, in case of disaster, maintenance of a level of functionality and, therefore, of acceptable standards.
Ultimately, the problem is the definition of a urban response spectrum to the event, by borrowing the similar concept developed in the field of seismic engineering. A response spectrum is a scenario that allow decision makers to foster the next asset of urban environment. It is a way to be prepared, as disaster specialists have increasingly emphasized the importance of a proactive policy that can prevent or lessen losses, rather than a crisis-reactive approach taken when disaster strikes.

Traditionally Governments have attempted to tackle disasters after they have occurred, by means of measures aimed to mitigating the effects that future events might have on society.

But such measures have proved to be inadequate for bringing risk levels down to socially acceptable levels.
Roughly we could state that 1 € spent in mitigation activities is equal to 7-10 € spent in response!
The idea of realising safer cities, where people feel safe, has been rife for some time and occupied the minds of town planners and designers, but maybe not enough the agenda of decision makers.
That's probably the reason why United Nations have set up several decades of action to face disasters.
The General Assembly designated the 1990s as the *International Decade for Natural Disaster Reduction*. Its basic objective was to decrease the loss of life, property destruction and social and economic disruption caused by natural disasters, such as earthquakes, tsunamis, floods, landslides, volcanic eruptions, droughts, locust infestations, and other disasters of natural origin.
The 2005-2015 decade is devoted to *Water for life*.
The decade 2006-2016 is the Decade of *Recovery and Sustainable Development of the Affected Regions* (third decade after the Chernobyl disaster).
The decade 2010-2020, has been declared the United Nations *Decade for Deserts and the fight against desertification* and also devoted to *Action for Road safety*.
A countless number of resolutions and programmes are devoted to the topic, but interdisciplinary research still needs a step further.
We hope that the review could contribute to the discussion about risk mitigation, and moreover to the birth of a new environmental ethics, which is rooted in the consciousness that technological innovations are not preventing us from ever searching the balance between human activities, people and nature.

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