Urbanistica n. 132
January-April 2007

Distribution by www.planum.net

Precautionary measures against earthquake: risk representations in the Ptcp (Provincial plan)

Antonella Manicardi,
Luca Martelli

Current legislation requires Territorial administrations to issue indications for seismic risk reduction even at urban planning level. In particular, assessment of local seismic hazard is required and the latter must take into account both geological and morphological considerations.
The seismic hazard of a given area depends not only on the type, dimensions and depth of the seismic sources, energy and frequency of earthquakes, but also on the terrain and type of land forms; some types of deposits and morphologies may favour amplification of seismic movement on the surface and effects such as subsidence, landslides, liquefaction or densification ('local effects').
Territorial seismic zonation based on such effects constitutes an effective seismic risk reduction tool, especially when adopted right from the earliest urban planning stages; it enables us to identify low-risk areas, establish which more detailed surveys and tests are required and outline permissible interventions, both in urbanized areas and in areas earmarked for potential urban development.
In order to make such maps available right from preliminary planning stages, Emilia-Romagna Region proposed a quick and cost-effective method for the description of local seismic hazard to a provincial scale.
The first mapping level produces cognitive geothematic maps. A subsequent elaboration enables us to compile maps based on expected local effects; these can be used to inform planning choices and to define measures to be taken to reduce seismic hazard, in line with current regulations governing both urban planning and works planning and design.
The territorial knowledge available to us today thanks to geological maps and the relative databases, geological surveys produced for planning tools, topographic maps and digital terrain models, enables us to quickly characterize those geological and morphological elements of a territory which, in the event of an earthquake, might determine 'local effects'.
Availing of Gis technology, we are able to quickly and cost-effectively produce maps of areas subject to local effects.
- based on geological maps, mostly compiled using the criteria of lithostratigraphy, maps of outcropping lithotypes are produced.
- based on the lithological map, by selecting and including the relevant deposits we can obtain a map of deposits susceptible to local effects.
- using detailed topographic maps we can identify morphological elements of interest; selecting land forms is undoubtedly quicker when we avail of a digital terrain model to a suitable scale; based on the digital terrain model, Gis can be used to produce a slope map.
- the final cartography of areas susceptible to local effects, therefore summarises both the map of deposits and that of morphological elements
- Since the subsoil of alluvial plains may contain non-outcropping geological elements which nonetheless have the potential to alter seismic movement on the surface, it may be necessary to compile a map of buried geological elements).

These maps are useful for planning since they identify territorial characteristics which might determine "local effects". Nonetheless, as can be deduced from the legend, interpreting them also requires a certain knowledge of geological matters. Moreover, because local seismic hazard within the Apennine chain may be due to lithological and morphological factors, litho-morphological combinations with the potential to determine "local effects" are more numerous than the various classes identified. However, from analysis of these combinations we can deduce that the same effects can be expected in a number of cases; it is therefore possible to include these combinations based on the expected effects. In this way we obtain a simpler cartography which can be more readily used inasmuch as it summarizes surface and subsurface data in one map, with a lower number of classes and does not require specific geological expertise.
It is important to stress that this is not a seismic microzonation map since it is based on qualitative information and not on quantitative surveys and assessments of the behaviour of terrain in the event of an earthquake. Nonetheless, it constitutes a fundamental level of preparatory knowledge since, by identifying areas of differing seismic hazard, it provides indications for the localization and type of tests and surveys to be carried out for seismic microzonation; in this regard, it constitutes the first level of study for seismic microzonation.
Moreover, since it is derived from large-scale data, this cartography is considered useful for planning at a sovramunicipal scale. On a municipal scale, the data available may not enable the automatic elaboration of a fully documented, reliable map. At a municipal planning level, more in-depth studies must therefore verify the actual presence and extent of conditions with the potential to determine local effects.
This cartography also enables us to provide indications on measures required for the assessment of local seismic response at the planning and realization stages of works.
Lastly, it can improve the elaboration of damage scenarios for emergency planning (civil protection plans) since it allows us to consider the distribution of the effects, also taking into account the physical characteristics of the territory