1 – The seismic provisions in Italy prior to 2003

Prior to 2003 the Italian building code, established in 1974, was mostly based on working stress design. The zonation that guided its application was made up in 1981 using a semi-quantitative, mainly seismological approach; it was enforced in 1984 and left about 2/3 of the territory without seismic provisions. In 1998 a new zonation was proposed but never adopted. The 2002 Mw5.7 earthquake in Naples (Southern Italy) caused the collapse of a school and the death of 26 children. The school was built in an area where seismic provisions were not applied, although the zonation proposed in 1998 assigned it to the second zone. The earthquake triggered a process that led in a few months to a new set of seismic provisions.

2 – The new seismic provisions

The new provisions, inspired by EuroCode8 (CEN, 2004), are the result of the interaction between seismologists and engineers, which addressed many topics:

1. the general criteria supporting the definition of the seismic zones;
2. the ground-motion description in each zone in probabilistic terms and the definition of smoothed elastic and design response spectra;
3. the definition of site amplification effects by means of code coefficients;
4. the definition of advanced design rules for the assessment of existing structures and for the use of innovative technologies in seismic design, e.g. the seismic isolation.

A preliminary zonation to support the new provisions was based on the “forgotten” 1998 map. This 2003 zonation introduced a major difference: the areas not considered seismic in 1998 were put in a seismic zone of lower (but not null) seismic hazard. The whole territory now belongs to a seismic zone.

However, to accomplish the full transition to the new seismic provisions, a seismic hazard map compiled in terms of PGA was required.

It was then decided that the reference seismic hazard map must be computed as follows:

- employ recent, widely used methods;
- employ updated input data;
- employ transparent procedures: input data must be made available to public;
- results to be checked through peer review.

3 – Seismic hazard map of Italy

A first release of the reference seismic hazard map of Italy was issued in April 2004.

4 – Ongoing activity

The new building code implies a substantial change of many professional practices. For this reason a period of overlapping between old and new regulations is foreseen, to allow both the discussion of the rules and the immediate change in seismic protection for those who wanted to use the new code.

At this stage seismologists and engineers are re-evaluating some main issues such as:

1. The reliability of the anchor values of the elastic response spectrum.

As these values are greater than the maximum PGA values allowed by the code, both the discussion of the rules and the immediate change in seismic protection for those who wanted to use the new code.

2. The introduction of seismological constraints on the response spectra for the ultimate limit states and for the damage limitation states.

According to the building code the PGA 10% in 50 years can be transformed in terms of the maximum PGA 10% in 50 years multiplying respectively by 1.5 and 5 (Molino et al., 2003). The actual seismic data point to different values: 0.44 and 1.78.

These data may serve as an input to define priorities for seismic intervention on strategic buildings and relevant structures.

5 – What next?

Due to its long historical record and the early start of the macroseismic investigation, Italy has a wealth of intensity data which can be used as an independent set for calibration purposes.

In this view, the seismic hazard has been assessed in terms of intensity values for varied probabilities of exceedance in 50 years, using typical methods employed in the PGA assessment and intensity attenuation relations (Gomez Capera, 2005).

The converted map shows the same range of PGA values as the map directly computed from PGA attenuation relationships, although the shape of the areas is different because intensities decay less rapidly with distance compared to PGA.

The activities described above are apt to provide useful feedback to seismologists, engineers and end-users in general.

Seismic hazard data will be made available to public in a comprehensive seismic hazard database, accessible via internet through a WebGIS interface (Locati et al., 2006).

Summary of the results:

- values of PGA, SA, and macroseismic intensity for different exceedance probabilities;
- the corresponding values of the 16th and 84th percentiles, used as a measure of the variability of the results;
- disaggregation values;
- UHS, hazard curves.

Reference: