



## Changes in codes following structural failures: an Italian perspective on mitigation of structural vulnerability

**Fabrizio Palmisano, Amedeo Vitone**

*Politecnico di Bari, Bari, Italy*

**Contact:** fabrizio.palmisano@poliba.it

### Abstract

In the last twenty years, forensic investigations of failures occurred in Italy have clearly highlighted that the increasing demand in society for economic growth has favoured the blooming of less conservative and even hazardous design and construction works.

After a short review of the Italian codes of practice dealing with structural vulnerability, some examples of structural vulnerability assessment in Italy is given in the article, with reference to both the large scale (i.e. the scale of the building) and the small (territorial/regional) scale.

**Keywords:** forensic structural engineering; collapse; failure; structural vulnerability assessment.

### 1 The revision of the Italian code of practice

Up to 2003, Italian Codes of practice did not include obligatory protocols for the assessment of structural vulnerability of existing constructions, but only very few indications. The first important revision of the Italian technical standards was stimulated by the collapse of a school in San Giuliano di Puglia (CB, South of Italy) in which 27 children and a teacher lost their lives. Although it occurred during the Molise Earthquake (South of Italy) in 2002, forensic investigations proved that the earthquake was only the triggering factor, since the building had strong internal structural weaknesses. One year after, there was an important revision of the Italian technical standards [1] which opened the way, for the first time in Italy, to a Eurocode-based approach for both the design of new structures and the assessment of existing structures. Moreover, this code introduced some cases in which the vulnerability assessment and the structural

retrofitting were mandatory.

Even though this code was applicable only for 'seismic zones' (i.e. where seismic design is mandatory), it became the starting point for the complete revision of the codes of practice.

The 2008 code ([2]; in force at present) is an evolution of the 2003 one. Firstly a complete revision of the Italian seismic map has been made and all the Italian territory was declared 'seismic zone'. Secondly this code deals with the assessment and retrofitting of existing buildings also for actions different from the seismic ones (e.g. gravitational, wind, accidental actions).

According to the 2008 code, the structural vulnerability assessment of an existing construction is mandatory in case of:

- evident reduction of resistant and/or deformation capacity of a structure or of a part of it due to: environmental actions (earthquake, wind, snow, temperature), significant degradation of the mechanical characteristics of materials, accidental