BOB-CODE PROJECT

BOnefro Building - COmparison Of Damage Estimates

The recent Molise-Puglia seismic event (31 October, ML=5.4, and 1 November 2002, ML=5.3) damaged two similar, adjacent, R/C buildings, (Figure 1) located outside the historic down town of Bonefro and realised in the early '80 by Istituto Autonomo Case Popolari (IACP). Although at the time of design Bonefro was not considered seismic area, both buildings were designed according to the current seismic code. This did not avoid damage to the buildings during the first shock and a considerable increase of damage during the second shock (Figure 3 and Figure 4). The buildings, that are very similar in plan, differ in height. The most damaged one is 4 story high. Heavy damage has been observed in the infill walls and columns of the 1st story (Figure 2), while minor damage has been observed in the upper floors. The adjacent building is only 3 story high and suffered minor damage to the infill walls of the 1st story and apparently no damage to structural elements. The different behaviour of the two buildings, the damage accumulation due to repeated shocks, the high damage compared to the felt macroseismic intensity in Bonefro and the large amount of data collected, including in situ tests and recordings, are the key issues that make the two buildings suitable for a case study aimed at the validation and comparison of different assessment methodologies, including also residual capacity and retrofit strategies evaluation.

Figure 1. View of the buildings. (photo: S. Kodama)

Figure 2. Damage to the columns of the 4 story building after the 2nd shock (photo: P.Bazzurro)

Figure 3. Damage to the 4 story building after the 1st shock (photo: M. Mucciarelli)

Figure 4. Damage after 2nd shock (same column as in figure 3) (photo: A. De Sortis)

AVAILABLE DOCUMENTATION

Photographs before and after the second shake
Source: P. Bazzurro (EERI), A. De Sortis (SSN), A. Goretti (SSN), S. Kodama (EERI), J. Marrow (EERI), M. Mucciarelli (Univ. of Basilicata)

Geographic coordinates
Source: P. Bazzurro (EERI), S. Kodama (EERI), J. Marrow (EERI)

Felt macroseismic intensity
Source: National Seismic Survey, DPC

Design documents, including drawings and calculations for both buildings
Source: IACP Campobasso

Final check documents, including “Relazione del Direttore dei Lavori a struttura ultimata”, “Certificato di collaudo”, “Relazione sui materiali”, “Verbale delle prove di carico”, “Denuncia della esecuzione di opere in ca”, “Certificati prove su acciai e calcestruzzi”
Source: IACP Campobasso

In situ tests on concrete: Core and ND tests on concrete including compressive strength evaluation on 10 specimens extracted from the columns of the 1st story and microseismic tests on 10 columns, belonging to both buildings
Source: National Seismic Survey, DPC

Geotechnical and seismological parameters of soil
Map with buildings and borehole location, topography, stratigraphy, geotechnical parameters, dynamic penetration tests, water table, seismic profile
Source: Bonefro Technical Office

NASW and noise HVSR measurement on soil near the buildings
Source: M. Mucciarelli (Univ. of Basilicata)

Seismometric recordings on the buildings before, during and after the 2nd shake including ambient noise before and after the 2nd shock and strong motion during the 2nd shock on the higher, more damaged, building and ambient noise on the lower, less damaged, building.
Source: M. Mucciarelli (Univ. of Basilicata)

Different soil motion estimates at the bedrock and/or at surface

ACTIVITIES AND ORGANISATION

Organising committee

A. De Sortis & A. Goretti (National Seismic Survey, DPC)
Proff. G.M Calvi & M. Dolce

To participate

Interested researchers can e-mail to A. Goretti (agostino.goretti@protezionecivile.it) in order to have access to the collected data. Data will be available on digital format

Presentation of results and deadline

A format for the presentation of the results will be established and delivered. Results will be presented at a special workshop or a special session of the Italian Seismic Conference to be held in January 2004 in Genoa. Results should be ready for the end of December 2003

Source quotation

In any use of the collected data, the original source is expected to be quoted