



Italian Joint Reconnaissance Mission

Türkiye

May 8th – 13th 2023

In collaboration with:

TED
ÜNİVERSİTESİ



ODTÜ
METU



Daily Report
May 9th 2023

Under the auspices of the
Italian Department of Civil Protection



PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile

Daily Report, May 9th 2023

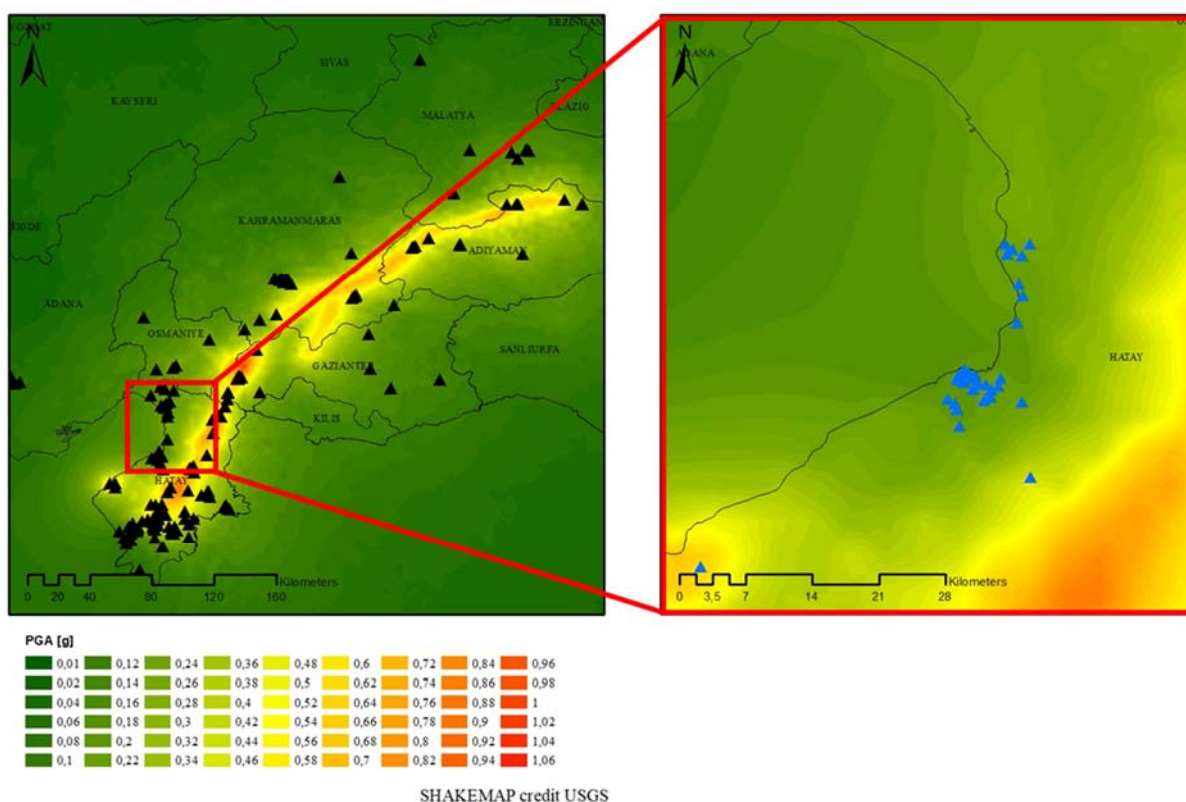
The Civil Protection Department has promoted an important technical-scientific activity in the areas affected by the earthquakes that occurred in Turkey and Syria starting from 6 February this year, with a maximum magnitude of 7.8. In this context, two missions have been organised, one aimed at investigating the effects of the earthquake from a geological and seismological point of view and one aimed at investigating the structural response of the building stock.

The two engineering competence centers RELUIS and EUCENTRE, in collaboration with METU and TEDU Universities of Ankara, are carrying out the damage reconnaissance.

The activity, agreed with the Turkish civil protection (AFAD), follows the agreements of a first mission in Ankara on April 24th-26th coordinated by the Italian Civil Protection Department, and is aimed at the evaluation of earthquake effects on public buildings (schools, barracks, municipal offices, etc...) on which reinforcement interventions were planned and/or carried out before the seismic event of 6 February.

In agreement with a delegation of researchers from the METU and TED Ankara Universities, more than 200 buildings have been selected in the provinces of Hatay, Maras, Antep and Adana.

The location of these buildings is reported on the shakemap published by the USGS following the February 6th event, as shown in Fig. 1a.



(a)

(b)

Fig. 1. Geographic localisation of buildings overlapped to Shakemap of the 6th February earthquake by USGS (a); magnification on subset of buildings inspected on May 9th (b).

On May 9th, 8 teams of technicians from various Italian Universities (Univ. degli studi di Palermo, Univ. del Salento, Univ. degli studi della Basilicata, Univ. degli studi di Napoli Federico II, Univ. di Genova, Univ.

di Bologna, Univ. degli studi di Pavia) and the EUCENTRE competence centre carried out inspections on 45 school buildings (primary and secondary schools) located in the city of Iskerenderun (Alessandretta), where maximum recorded accelerations according to the USGS ShakeMap (<https://earthquake.usgs.gov/data/shakemap/background.php>) were in the range 0.18-0.24g (see Fig. 2b). The buildings inspected were reinforced concrete (r.c.) structures characterised by two-way frames. In most cases, strengthening interventions had been carried out before the seismic event of February 6th.



Fig. 2. Group photo of the 8 teams of ReLuis, EUCENTRE, METU, TED technicians; and some of the school buildings inspected on May 9th.

The inspections showed that the buildings surveyed are characterised by a number of above-ground floors mostly between 2 and 4, regular in plan and elevation, built in most cases between the late 1950s and the late 1970s. In some cases, further structural units had been built since the 1980s, connected to the original structure by means of expansion joints. In all the buildings, seismic retrofit interventions were implemented mostly through the insertion of r.c. walls within the structural grid, in both directions, and the consolidation of foundations. The buildings inspected showed a moderate level of overall damage, mostly concentrated in the joint areas due to pounding of adjacent structural units (see Fig. 3).

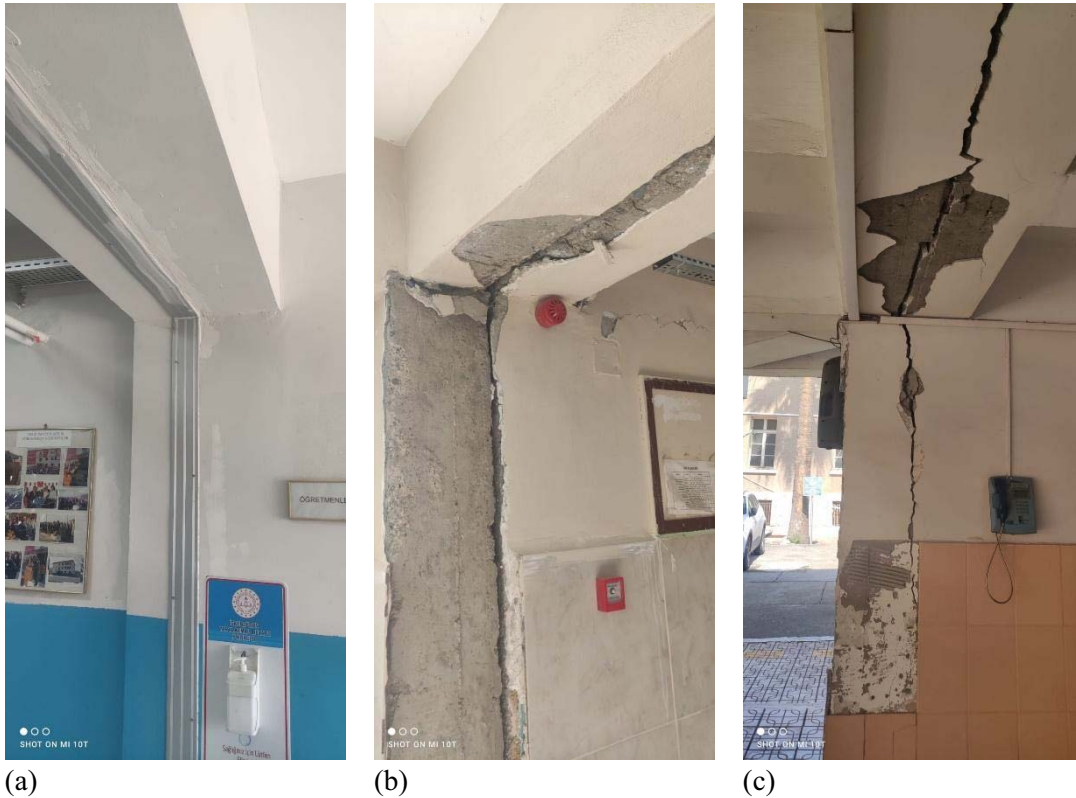


Fig. 3. Photos of damage due to pounding: slight (a), moderate (b), severe (c).

The load-bearing structures did not suffer major damage; however, in several buildings, damage was observed at the interface between the original r.c. frame and the r.c. wall adopted as the reinforcement system. It turned out that the r.c. walls were built by removing a partition/infill panel and replacing it with a r.c. wall connected to the existing frame. The anchoring of the wall to the frame was evidently ineffective as evidenced by the state of damage shown in Fig. 4.

During the inspections in the city of Iskerenderun (Alexandretta), a more severe level of damage was observed on average on residential buildings compared to the inspected school buildings, the subject of the current activity. Fig. 5 and Fig. 6 show, for two r.c. buildings, some emblematic damage cases related to the development of a soft-storey mechanism and a shear crisis due to the interaction with the infills.



Fig. 4. Detachment at the interface between the original r.c. frame and the wall adopted as strengthening system.

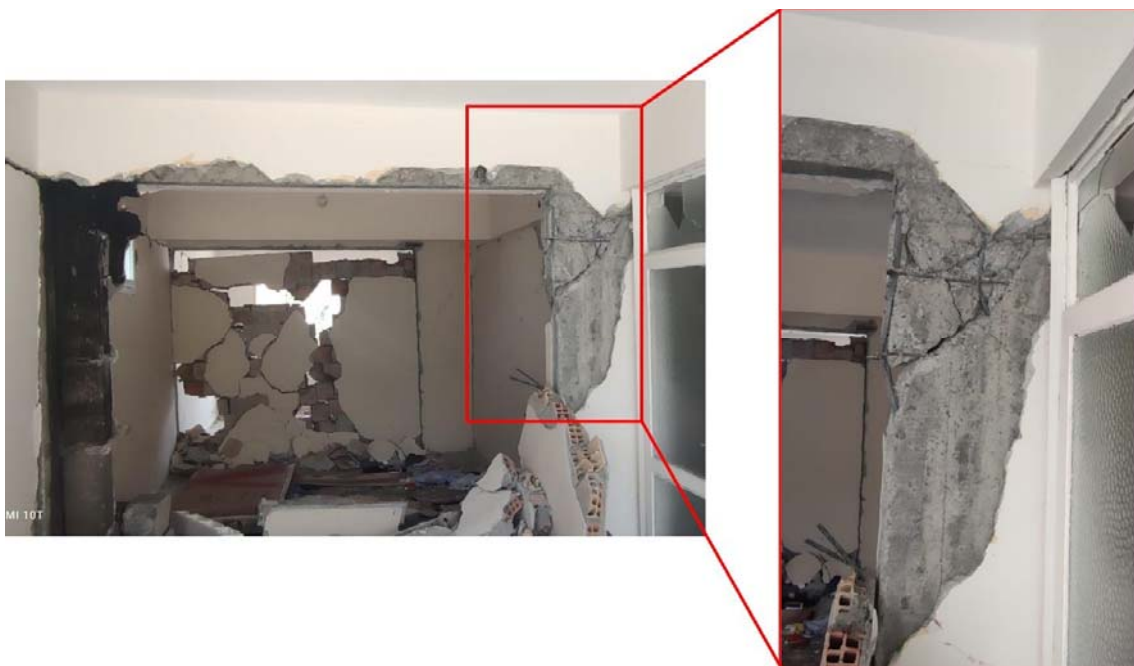


Fig. 5. Brittle shear failure of a r.c. column due to interaction with infills.



Fig. 6. Very severe damage on a r.c. building due to soft-storey mechanism.

In the following table, a summary of the inspections of May 9th is presented.

Table 1 Summary of inspections – 9 May 2023

Nr. of teams	8
Location	Alessandretta e surrounding areas
Nr. of inspected buildings	44

Tab. 1 Team

NAME	AFFILIATION
Marco DI LUDOVICO	Univ. degli Studi di Napoli Federico II
Carlo DEL GAUDIO	Univ. degli Studi di Napoli Federico II
Marta DEL ZOPPO	Univ. degli Studi di Napoli Federico II
Marco GAETANI D'ARAGONA	Univ. degli Studi di Napoli Federico II
Giorgio BALZOPOULOS	Univ. degli Studi di Napoli Federico II
Roberta APUZZO	Univ. degli Studi di Napoli Federico II
Marco GIULIVO	Univ. degli Studi di Napoli Federico II
Vincenzo MANFREDI	Univ. degli Studi della Basilicata
Romina SISTI	Univ. degli Studi di Napoli Federico II
Antonio GRELLA	Univ. degli Studi di Napoli Federico II
Luigi DI SARNO	Univ. degli Studi di Napoli Federico II
Antonio MANNELLA	CNR-ITC
Domenico NINNI LAZZARO	CNR-ITC
Francesca FERRETTI	Univ. di Bologna
Piero COLAJANNI	Univ. degli Studi di Palermo
Jennifer D'ANNA	Univ. degli Studi di Palermo
Marielisa DI LETO	Univ. degli Studi di Palermo
Gianni BLASI	Univ. of Salento
Gabriele GERRINI	Univ. degli studi di Pavia
Silvia PINASCO	Univ. di Genova
Stefano BRACCHI	Fondazione Eucentre
Davide BELOTTI	Fondazione Eucentre
Numan EREN	Fondazione Eucentre
Guney OZCEBEB	TEDU - Turkish Education Association University
Erturk TUNCER	TEDU - Turkish Education Association University
Mehmet Firat AYDIN	TEDU - Turkish Education Association University
Cem AKGUNER	TEDU - Turkish Education Association University
Ömer Can PAMUK	TEDU - Turkish Education Association University
Erdem CANBAY	METU - Middle East Technical University
Yunus IŞIKLI	METU - Middle East Technical University
Firat YURTSEVEN	METU - Middle East Technical University
Yalın ARICI	METU - Middle East Technical University
Ozan Cem ÇELİK	METU - Middle East Technical University
Norgen MUKA	METU - Middle East Technical University