RETROFIT OF
EX OSPEDALE MAZZONI – BLDG A
Ascoli Piceno, Italy
DESCRIPTION OF THE BUILDING

- BUILDING IS LOCATED IN ASCOLI PICENO, CENTRAL ITALY. MODERATE RISK AREA

- FORMERLY AN HOSPITAL

- BUILT IN THE 70s

- 5-STORY BUILDING (1 BASEMENT).

- CONCRETE MOMENT FRAME WITH CONCRETE STAIRWELL.

- NO SEISMIC JOINTS WITH ADJOINING BUILDINGS.
• NEW OCCUPANCY: HIGH SCHOOL

• CONCRETE CORE IS HIGHLY ECCENTRIC HENCE THE BUILDING IS TORSIONAL

• REDUCE THE TORSIONAL IRREGULARITY BY INSTALLING A NEW STEEL FRAME EQUIPPED WITH 6 FLUID VISCOUS DAMPERS

• CREATE NEW SEISMIC JOINT WITH THE ADJOINING BUILDING
INTENT OF THE RETROFIT
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PERFORMANCE REQUIRED BY CODE = **LIFE SAFETY**

PERFORMANCE ACHIEVED WITH RETROFIT = **IMMEDIATE OCCUPANCY**

6 FLUID VISCOUS DAMPERS:

F = 350 KN
\[ a = 0.5 \]
C = 1000 kN \((s/m)^{0.5}\)
k = 350000 kN/m
RESULTS OF THE RETROFIT:

• FVDs DIDN’T INCREASE BUILDING’S STIFFNESS

• SEISMIC ACTION WAS SIGNIFICANTLY REDUCED BY ADDING DAMPING TO THE SYSTEM

• TORSIONAL IRREGULARITY WAS SIGNIFICANTLY REDUCED

• ADDITION OF THE STEEL FRAME WITH FVDs WAS EASY AND NOT INVASIVE

• PERFORMANCE OF THE BUILDING IS NOW BEYOND THE CODE (IMMEDIATELY OPERATIONAL)
An earthquake of M6.0 (INGV) struck central Italy on August 24, 2016 at 01:36 GMT, causing many buildings to collapse near epicenter and 300 casualties.

On October 30, 2016 at 06:40 GMT, a new M6.5 (INGV) shock occurred in the same area, causing further widespread damages.

On January 18, 2017, a new M5.5 shock occurred in the same area causing avalanche (29 causalities, 11 rescued from inside hotel) and aftershocks of magnitudes from 4 to 5 continue until today.
Fig. 5.1. MCS instrumental intensity shakemaps of the three main shock of the sequence. M6.0 August 24, 2016 (left), M5.9 October 26, 2016 (center), M6.5 October 30, 2016 (right).
Epicentral NRC station response spectra vs. Italian Building Code spectra

$T_R$ = Return Period
NTC = Italian Building Code
Oct, 30th M6.5 EQ

Source: RELUIS, Italy
The nearest station to the building is ASP, which is located east of the building, opposite to the epicenter. Actual PSA at the site was higher.

Source: DPC, Italy
BEFORE RETROFIT THERE WAS EVIDENCE OF POUNDING BETWEEN BLDG A AND BLDG B, DUE TO TORSIONAL MOVEMENT OF BLDG A DURING PAST EARTHQUAKE.
AFTER 2016 EARTHQUAKES THERE'S NO EVIDENCE OF CRACKS IN THE WALLS BETWEEN BLDG A AND BLDG B, WHICH WERE NOT SEPARATED (STRUCTURES WERE SEPARATED BY A SEISMIC GAP). NO CRACKS IN PARTITIONS AND CEILINGS.
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