

CASE STORY

Concrete Investigation
| GPR & Seismics |

► GPR structural survey in one of the first reinforced concrete buildings in Messina (Italy)

STUDY

Seismic vulnerability assessment at different scales and structural diagnostic procedures.

Davide Campo's Master of Science Thesis in Applied Geophysics.

CHALLENGE

Evaluation of seismic vulnerability of a reinforced concrete building supported by geophysical investigations. The City of Messina was hit by a destructive earthquake (Magnitude > 7) occurred in 1908, only very few buildings survived. In the following years, extensive urban redevelopment took place employing reinforced concrete construction methods. As the area is one of the most seismic in Italy, building health checks and seismic vulnerability assessment are mandatory: different non-intrusive methods were investigated for these purposes.

SOLUTION

Ground Penetrating Radar (GPR) was chosen to image the reinforced structure due to its high level of details, speed in data collection and real time imaging that allows preliminary analyses. The system used for the survey consists of a Mala GPR system with a 2.3 GHz central frequency designed for structural surveys.

RESULTS

A three-storey residential building, built in 1911, was investigated by collecting several standalone scans on floor slabs, walls, columns and beams to verify the unknown construction details, as the original design drawings were not available. Regular orthogonal grids were collected as well to allow a 3D imaging of the structures.

Sample results show a time slice and radar cross sections of data collected on a column with a peculiar reinforcing structure consisting of a braced steel frame. The details provided by the non-intrusive survey were then employed for the seismic vulnerability assessment of the building and to target intrusive works.

Acquisition parameters:

- Point/trace interval: 4 mm
- Profile spacing: 10 cm

Post Processing filters:

- Time zero correction;
- Bandpass filtering;
- Time gain
- Background removal;
- Kirchoff migration (0.12 m/ns).

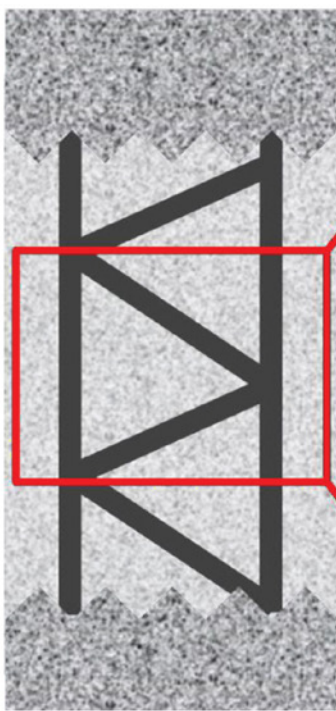
PROJECT

► Instruments: MALA Concrete Explorer, 2.3 GHz GPR antenna, ReflexW (Sandmeier K. J.) for data processing

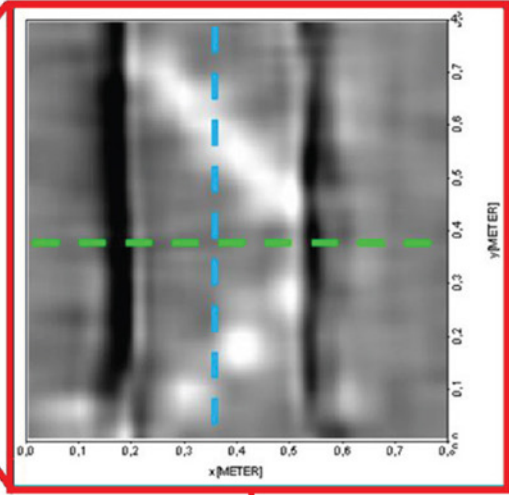
► Purpose: Evaluation of seismic vulnerability of a reinforced concrete building

MALÁ Concrete Explorer (CX) in use, Messina, Italy | Photo Davide Campo©

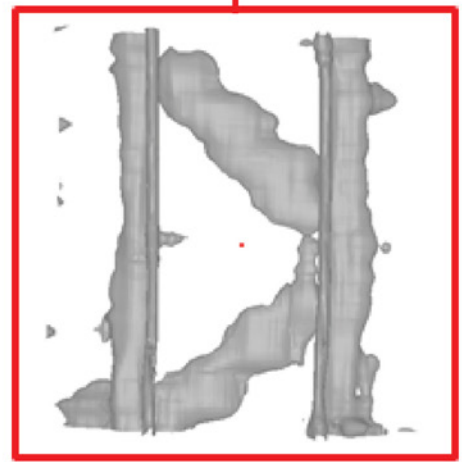
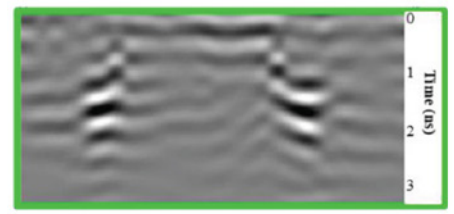
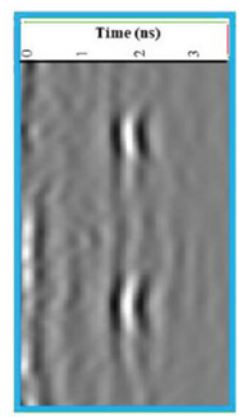




TIME SLICE



B-SCANS



INTERPOLATED ISO SURFACE