SEISMIC NOISE MEASUREMENTS IN THE CITY OF TRIESTE IN ORDER TO PLAN AN URBAN SEISMIC NETWORK

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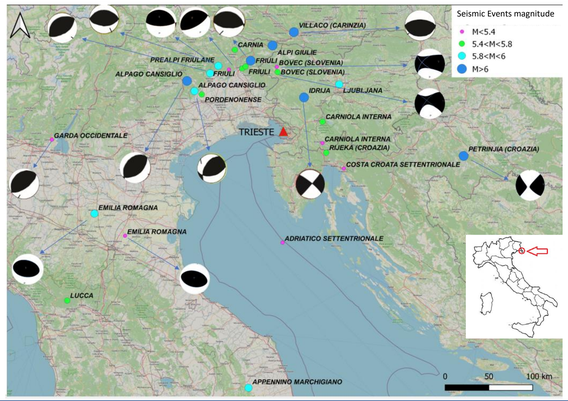
INTRODUCTION

The seismic shaking of an area is strongly affected by the geology and local soil conditions. Seismic Microzonation (SM) is the process aimed at identifying and mapping the subsoil local response. For the city of Trieste only the first level of microzonation has been completed, and only the MOPS chart is available. This map divides the municipality of Trieste into areas (micro-zones) that could have a similar behaviour in case of a seismic event.
In different micro-zones around the city, ambient noise field measurements were carried out to obtain soil amplification frequencies.
This work had multiple purpose. The first was to verify if the micro-zones defined for the city of Trieste were really homogeneous. The second was to obtain an estimation of the sediment thickness. The third was to verify possible resonance phenomena between soil and buildings. Finally, the main purpose was the selection of sites for a new seismic network in the city of Trieste, utilizing the university buildings.

STUDY AREA

The study area is the municipality of ***Trieste*** in the Friuli Venezia Giulia (FVG) Region (North-East Italy), shown in the figure as a red triangle. This area corresponds to the North-Eastern portion of the ***Adria's microplate*** margin. Its structural context is complex, with a northern part (***Alpine Chain***) characterized mainly by thrust due to ***compressional forces***, and an eastern part (***Dinaric system***) dominated by ***strike slip faults*** due to escape tectonic mechanisms.



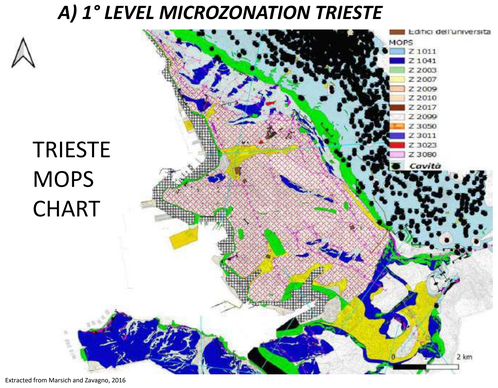
Coloured markers indicate the historical ***earthquakes with magnitude between 5 and 8 from 1000 A.C. and 2000 A.C. in the Trieste area*** (related beach balls are reported). The city is surrounded by active tectonic areas. Data were extracted by Tiberi at al. 2014.

The base of the work is the ***1st level microzonation MOPS*** of the city (an extract is shown in the figure A in the panel below), defined by Marsich and Zavagno (2016), that separate stable zones (in sky blue, e.g. the karst plateau), the areas prone to amplification (indicated with different characteristic colours), and zones prone to instability (e.g. the gridded is used to indicate liquefaction phenomena).

Furthermore, the Classic Karst geology chart (Jurkovšek B. et al. 2016), the limit conditions of emergency CLE (Bramerini and Castelletto, 2016) and the positions of University buildings were available for the noise measurements sites selection.

METHODS AND WORK-FLOW

A) 1° LEVEL MICROZONATION TRIESTE



TRIESTE MOPS CHART

Extracted from Marsich and Zavagno, 2016

B) KARST GEOLOGICAL CHART

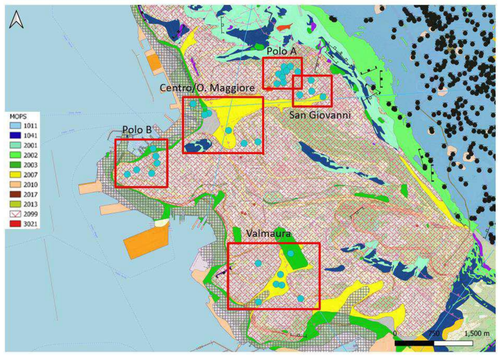
C) TRIESTE UNIVERSITY BUILDINGS MAP

D) LIMIT CONDITIONS OF EMERGENCY (CLE)

SELECTION OF SITES TO INVESTIGATE

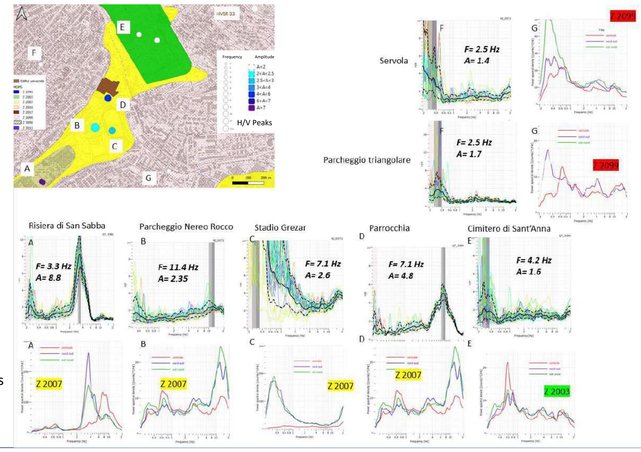
Overlap of all available information (A-B-C-D) to select areas where perform the analysis to study the behaviours of the different micro-zones

Trieste 2022 environmental noise measurements campaign

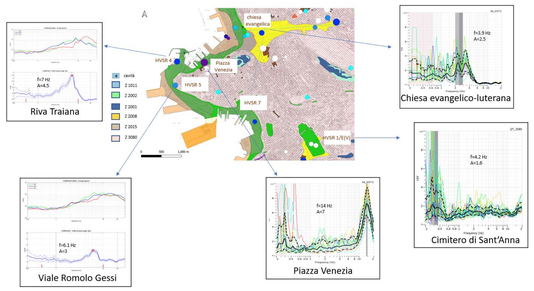


32 H/V DIAGRAMS

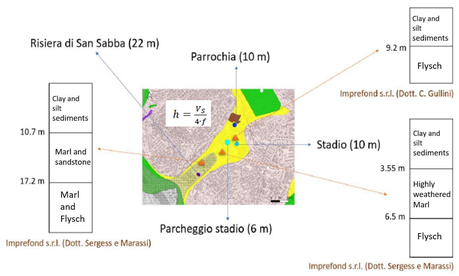
Selection of five different areas:
Campus A (9 measurements)
Campus San Giovanni (4 measurements)
Campus B (6 measurements)
Hospital and City center (6 measurements)
Valmaura (7 measurements)-This area is reported as example on the right.



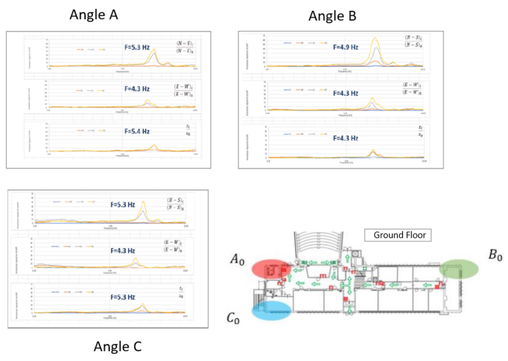
RESULTS AND DISCUSSIONS



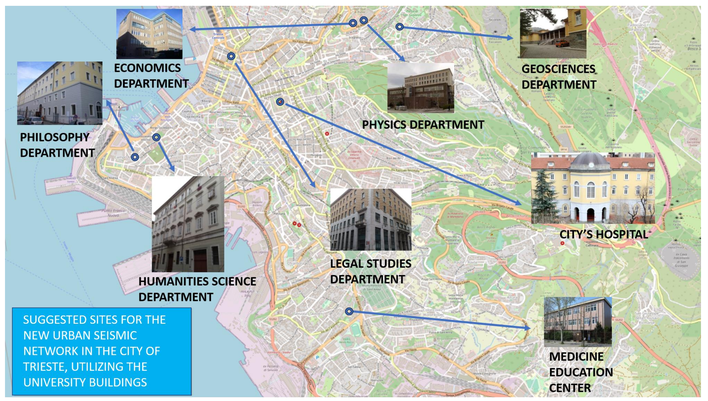
ARE MOPS REALLY HOMOGENEOUS?
(Some examples from micro-zone Z 2003 are reported)



CALCULATION OF THE SEDIMENT THICKNESS
(Estimation using the calculated H/V peak frequencies and V_S MASW values)



RESONANCE PHENOMENA BETWEEN THE GROUND AND THE UNIVERSITY BUILDINGS ***(e.g. physics department natural frequency, using ambient noise measurements)***



FIND SUITABLE SITES TO INSTALL A NEW URBAN SEISMIC NETWORK

- Bramerini F., Castenetto S., 2016: Manuale per l'analisi della Condizione Limite per l'Emergenza (CLE) dell'insediamento urbano
-Marsich P., Zavagno E., 2016: Microzonazione sismica relazione illustrativa: Regione autonoma Friuli-Venezia Giulia comune di Trieste
- Jurkovšek B., Biolchi S., Furlani S., Kolar-Jurkovšek T., Zini L., Jež J., Tunis G., Bavec M., Cucchi F., 2016: Geology of the Classical Karst Region (SW Slovenia–NE Italy): Journal of Maps
-Tiberi L., Costa G., Suhadolc P., 2014: Source parameter estimates for some historical earthquake in the south-eastern Alps ground shaking scenarios: Bollettino di Geofisica Teorica e Applicata, vol.55, no.3, p.641-664