"SEISMIC SITE EFFECT ESTIMATION USING MICROTREMOR STUDIES IN THE ARCHAEOLOGICAL CITY JERASH IN JORDAN"

JORDAN SEISMOLOGICAL OBSERVATORY / Ministry of Energy and Mineral Resources

WALEED EID OLIMAT, w.olimat@gmail.com

CTBT: SCIENCE AND TECHNOLOGY 2017 CONFERENCE, 26 TO 30 JUNE

The Aims:

-This circumstance has led many to utilize measurements of microtremors to estimate the frequencies at which the soils may be amplifying the ground motions as well as to determine how much ground amplification may take place.

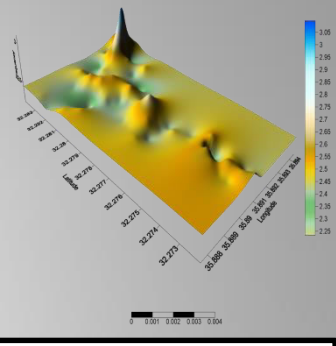
-This information can be used to determine which areas may experience the greatest strong ground motions should an earthquake of high magnitude occur nearby. This research tool is especially applicable in urban areas where the risk is highest but where the high cultural noise levels make routine recording of weak earthquake motions problematic.

Methodology :

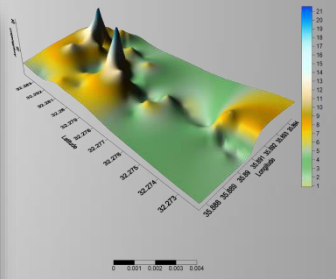
The Nakamura's technique is applied in this study in order to determine the resonance frequencies and amplification factors for each site then draw there maps which will be of a great use in the field of civil and structural engineering by enriching the building codes

Objectives of The Study:

- Performing quantitative estimates of site effects in archeological City JERASH using ground motion from ambient noise (microtremors).
- Calculate the resonance (predominant) frequency and the amplification factor of each measured site.
- Draw maps of resonance frequencies and amplification factors.



Resonance Frequency surface map for JERASH City.

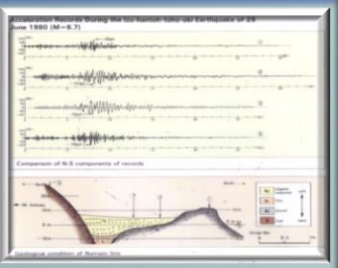


Amplification Facter surface map for JERASH City.

Definition:

❑ Background ground noise or microtremors are low amplitude motions of the ground caused by cultural, oceanic and atmospheric disturbances that act on the surface of the land or on the sea bottom

❑ Microtremors have a wide range of frequencies and complicated polarization patterns. There is uncertainty as to the types of seismic waves that make up the routine background noise (Nakamura, 1989; Fischer et al., 1995) or a combination of body waves and surface waves (Udwadia and Trifunac, 1973).

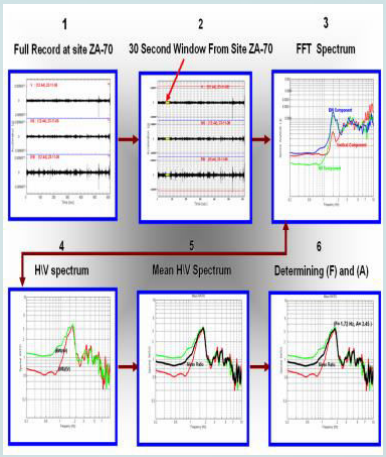


Natural Microtremors Resources

- The winds.
- Waters flow in the rivers.
- Rains falling.
- Collisions between the oceans waves and the coasts.
- Magma motion interior the earth.

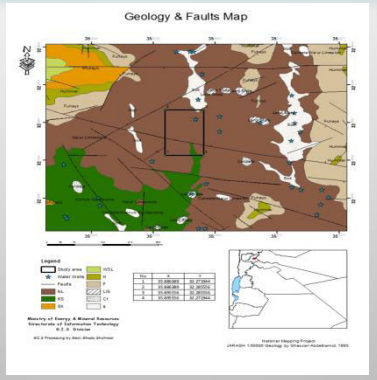
Manmade Microtremors Resources

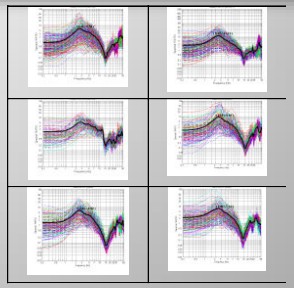
- Traffic Motion (Cars,Planes,Trains,....)
- Factories.
- Other Humen Activities.



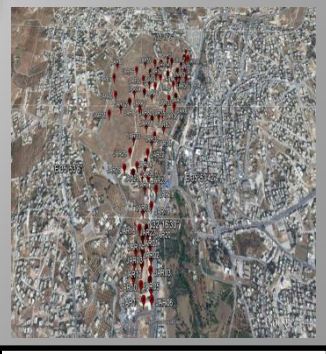
The Results:

The results of our study show that; values of resonance frequency F are not affected by the time of recording. While values of amplification factor A can vary accordingly. Results also show that the amplification factor A varies from 0.87 and 23.47 in JERASH city and the resonance frequency (F) also varies between 2.35 Hz and 3.19 Hz in JERASH city , that means some constructions in the study area, in case of a major earthquake, may experience minor damages respectively.





H/V Amplitude vs. Resonance frequency curves at different sites in the study area.



Measurements Point Location in Historical City JERASH.

Why We Study Microtremors?

The interest in microtremors arises because it is well known that seismic stations situated on soil sites detect higher amplitude microtremors than stations on bedrock sites. It is also well known that in earthquake shaking soil sites tend to exhibit higher amplitude strong ground motions than bedrock sites.

The amplitude of the wave depend on:

- Geology.
- Topography.
- Physical properties.
- Power of the noise source.
- Direction of the noise source.
- The time of recording.