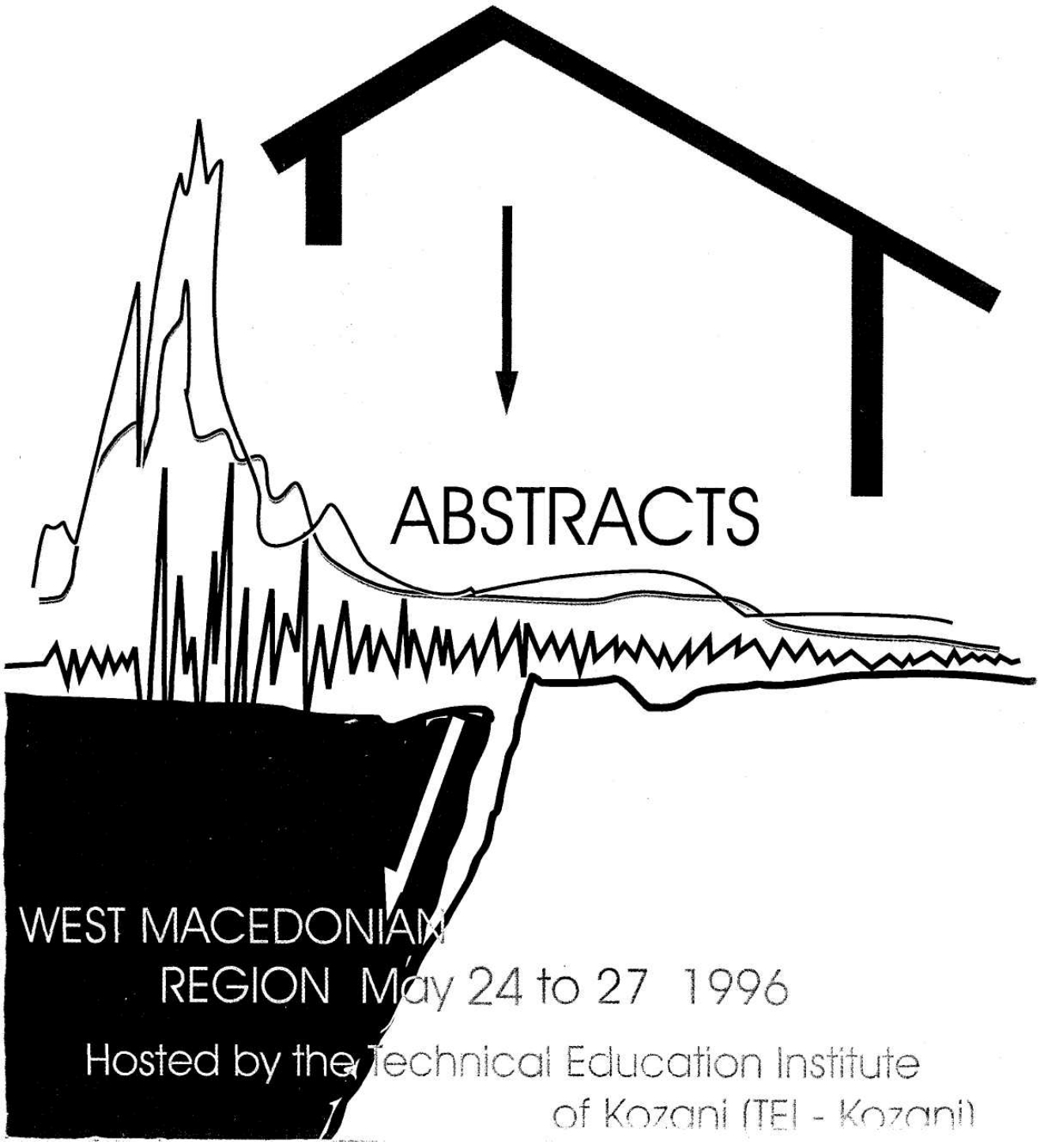
INTERNATIONAL MEETING

On results of the May 13, 1995 earthquake of West Macedonia: One Year After



ABSTRACTS

WEST MACEDONIAN REGION May 24 to 27 1996

Hosted by the Technical Education Institute of Kozani (TEI - Kozani)

ΔΙΕΘΝΕΣ ΕΠΙΣΤΗΜΟΝΙΚΟ ΣΥΝΕΔΡΙΟ

«Ο ΣΕΙΣΜΟΣ ΤΗΣ 13ης ΜΑΪΟΥ 1995
(ΚΟΖΑΝΗ - ΓΡΕΒΕΝΑ)
ΕΠΙΣΤΗΜΟΝΙΚΗ ΚΑΙ ΚΟΙΝΩΝΙΚΗ ΠΡΟΣΕΓΓΙΣΗ»

ΚΟΖΑΝΗ
24 - 28 ΜΑΪΟΥ 1996
ΤΕΙ ΚΟΖΑΝΗΣ

ΠΕΡΙΛΗΨΕΙΣ

ABSTRACTS

INTERNATIONAL MEETING

"ON THE RESULTS OF THE MAY 13, 1995 KOZANI-GREVENA EARTHQUAKE: ONE YEAR AFTER"

KOZANI
24 - 28 MAY, 1996
TEI KOZANI

Combined Geophysical investications for site soil characterization of Grevena-Kozani meizoseismal area

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A combined geophysical investigation was conducted in the badly damaged areas soon after the Grevena-Kozani of 13 May 1995 earthquake occurrence. The question of keeping the population in rural areas or moving it into more urban areas had to be answered in a short time and in an unambiguously way. Besides the huge amount of seismological data coming in continuously and the geological information obtained from surface mapping, for a direct estimation of the soil conditions the elaboration of geophysical methods was proposed to give a quick and reliable solution. High peaks of strong ground acceleration, estimated seismic intensities, surface geology and other macroseismic observations showed that the upper surface layers played a crucial role in the distribution of damages. The distribution and the percentage of damages are shown in figure 1.

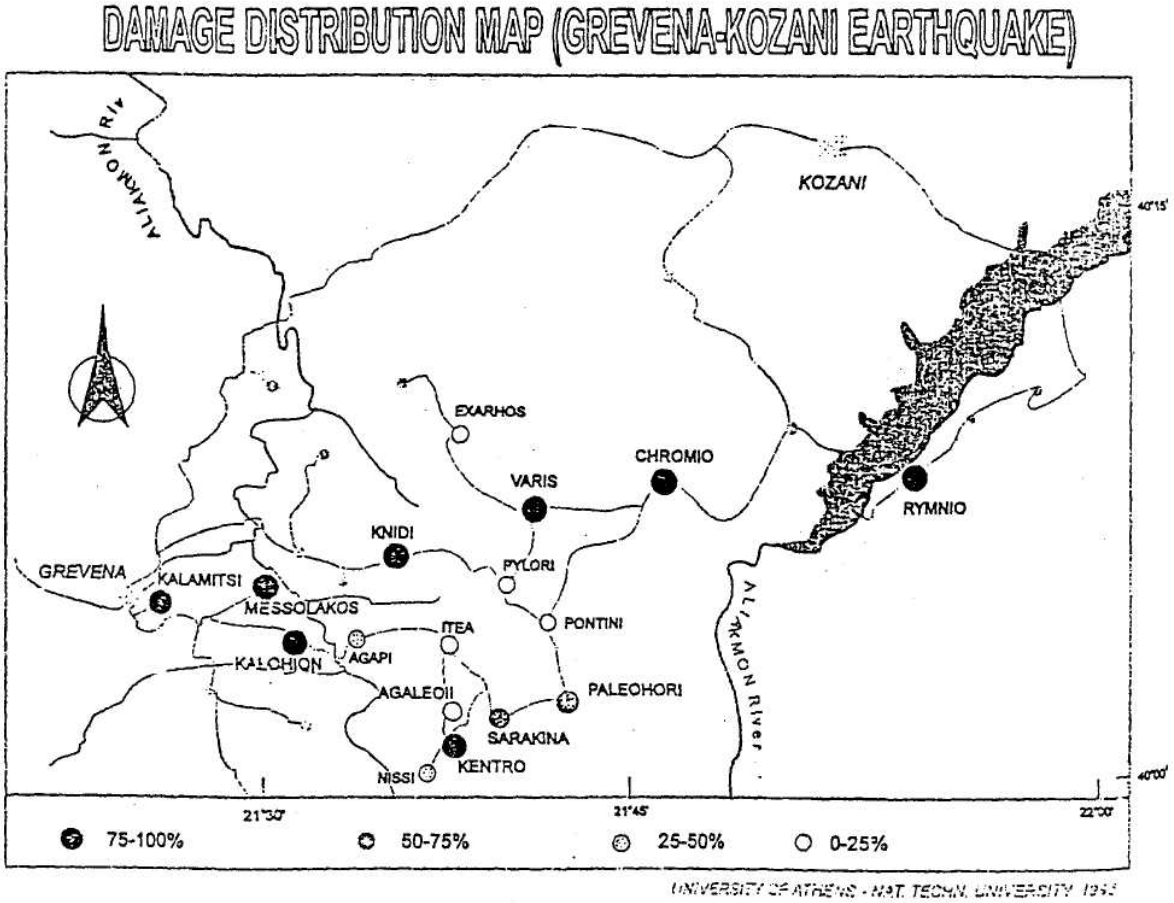

Figure 1

The geophysical investigation aimed to delineate the subsurface geological structure of the badly damaged areas and estimate the elastic parameters for soil characterization and further engineering consideration of the shallow geological formations.

The geophysical survey was conducted by applying two methods, e.g., geoelectrical soundings and seismic refraction profiles. Special attention was given in the estimation of the average seismic velocity of the surface layers by using the full GRM method. According to this method an average velocity represents the replacement of the individual layer velocities with a constant value. Therefore the relations of time-depth, the optimum XY value and the incident angle incorporating an average velocity can be written in the following manner

$$T_G = \frac{\cos i}{\overline{V}} \sum_{j=1}^{n-1} Z_{jG}$$

$$xy = 2\tan i \sum_{j=1}^{n-1} Z_{jG} \qquad \text{and}$$

$$\sin i = \frac{\overline{V}}{V_n'}$$

These equations can be readily combined, by eliminating the summation term, to obtain an equation for the average velocity.

In figure 2 it is shown the subsurface seismic structure along profiles of selected areas that were badly damaged during the 13 May 1995 earthquake. The seismic velocity of the upper and surface layers range among 550 and 900 m/s. The corresponding elastic modulus Ed ranges among 0.29-0.91 Nt/m^2

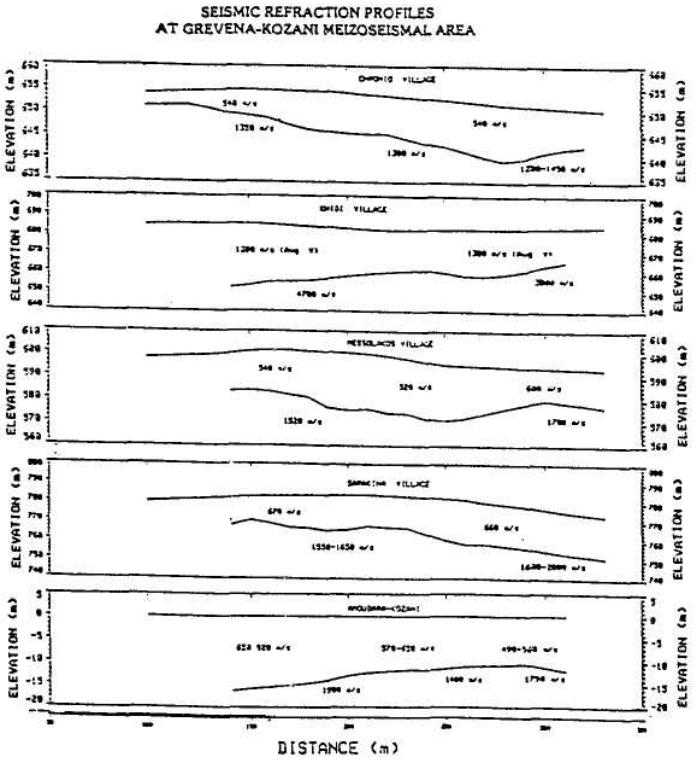

Figure 2

For the deeper layer the seismic velocities are clearly higher than the surface layers but in some cases (at Chromio and Messolakos villages) still remain low to be characterized as bedrock. The range of the seismic velocities of the deeper layer is among 1250 and 4500 m/s and the corresponding elastic modulus Ed 2.0-39.3 Nt/m^2. In some areas the hard bedrock is deep seated exceeding the 25 meters (Messolakos village).

The geoelectrical soundings were conducted to investigate deeper structures and to control seismic refraction results. It was detected a low resistivity layer (up to 30 Ohm.m) in all cases except that of Exarchos village where high resistivities were obtained (see figure 3). The low resistivity values are due to the presence of clayey material in the loose alluvial formations.

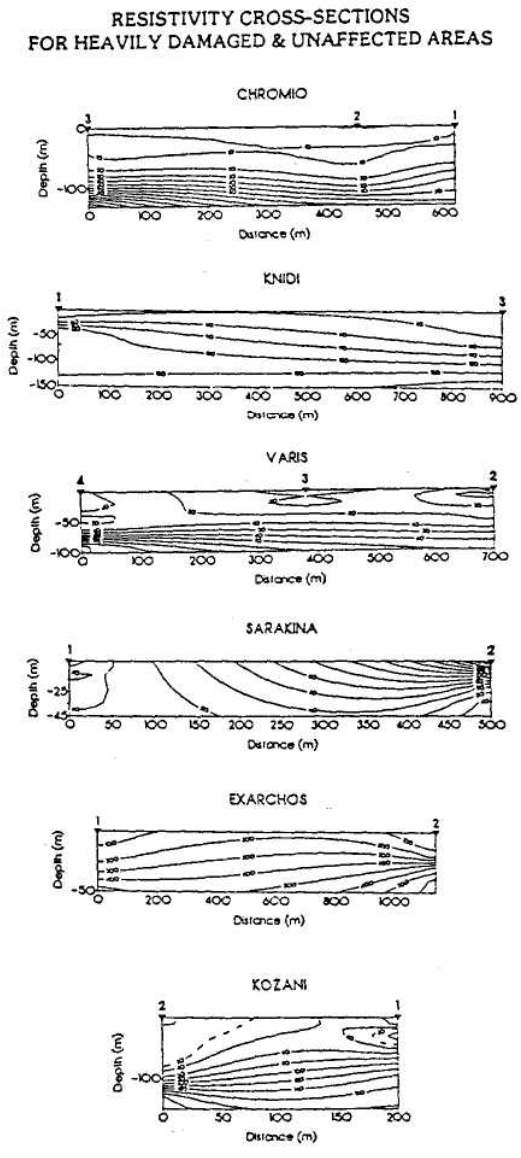

Figure 3

In conclusion, soil conditions are not favorable for further building reconstruction in areas where thick surface layers of low seismic velocity and low resistivity values are present. The geophysical results pointed also out that some populated areas of the meizoseismal region have to be abandoned (Chromio and Messolakos villages) or to move into more stable parts or undamaged sections of the struck villages (e.g. a westward extension of the knidi village and a northward reconstruction of Sarakina village will Ensure a safe reconstruction concerning the local soil conditions). For these areas a detailed knowledge of the subsurface structure will be of vital importance for seismic hazard assessment.

References

Palmer D. (1986). Refraction Seismics. The lateral resolution of structure and seismic velocity. Geophysical Press, London-Amsterdam, Vol. 13, pp. 269.

Papadopoulos T.D. (1995). Report on geophysical investigations at the Grevena-Kozani meizoseismal area. Min. of Phys. Plann.-Envir.-Public Works, June 1995.