

FREQUENCY SPECTRA OF SOME SELECTED
QUARRY BLAST SEISMOGRAMS

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A Digest Presented to the Faculty of the Graduate
School of Saint Louis University in Partial
Fulfillment of the Requirements for the
Degree of Master of Science (Research)

1963

DIGEST OF THESIS

A general knowledge of the frequencies of seismic vibrations is essential not only to the study of the earth but also to many engineering and military problems. An important role of frequency is demonstrated by the fact that it is a factor influencing the force applied to, and the response of, structural systems during motion of their foundations.

This study is confined to the determination of the vibrational frequency associated with certain seismic waves recorded from blasts generated in a limestone quarry in St. Louis County.

Two different methods were applied to determine the frequency of the seismic waves recorded at one site (2,200 feet from the quarry). The first method consisted of measurement by eye when a millimeter scale was applied to the first one-half cycle of one prominent pulse of each component. Fifty-six seismograms were analyzed by this method. The second method involved measurement of the same prominent phases with a microscope and the analysis of eighteen seismograms by the Fourier transform technique.

From the data of the conventional visual readings, the number of occurrences of various predominant frequencies associated with each

pulse was plotted versus the number of shot holes in the blast. The data from the Fourier analysis were plotted as the predominant frequencies of the peak Fourier amplitude versus the number of shot holes.

On the basis of these data the results of this study can be summarized in the following:

- 1 - The lowest preferred frequency band of about 5-8 cycles per second was associated with the Rayleigh (R) phases (recorded on the vertical components).

- 2 - In the P phases the preferred frequency band (from about 11-14 cycles per second) was higher than that in the Rayleigh phases.

- 3 - It is surprising to note that the predominant frequencies associated with the SH phases were grouped in a limited frequency range rather than scattered as might be expected from the nature of such phases. The frequency band of these events exhibited a range from 12 to 17 cycles per second.

- 4 - Background vibrations of a higher frequency (near 50 cycles per second), which were recorded mostly on the vertical and the transverse components, were not studied.

- 5 - Both methods of frequency investigations employed in this study exhibited consistency in the

results. This was especially apparent in the cases of the longitudinal and the transverse components, for which the preferred frequencies were:

	(Conventional)	(Fourier)
R:	9-12, 75% of total cases	5-8 , 77% of total cases
P:	12-14, 80% of total cases	11-14, 65% of total cases
SH:	12-16, 80% of total cases	14-17, 59% of total cases

6 - The most significant conclusion of this study seems to be the demonstration of preferred vibrational frequency bands in selected seismic waves propagated from the Alpha Quarry and recorded at one site.