

ANOMALOUS ENERGY DISTRIBUTION  
FROM ALPHA QUARRY BLASTS

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## DIGEST

Blast vibration records and verbal complaints obtained from persons living within a one and one-half mile radius of the Alpha Portland Cement Company's quarry in Lemay, Missouri have indicated an anomalous distribution of seismic energy from blasting. This report was prepared for the purpose of determining from the available data the distribution and extent of the anomalous vibrations, and the possible cause or causes of the existing phenomena.

A crew of seismologists from the Institute of Technology of Saint Louis University has been recording the vibrations due to blasting at the Alpha quarry in order that more can be learned concerning the amount of ground vibrations caused by blasting, and to warn the quarry managers when the vibrations from blasting were becoming strong enough to cause damage to structures.

With the data that had been obtained when the present research was initiated, the author attempted to show the existing distribution of blast vibrations near the quarry. Various methods were

employed such as plotting on a map of the area the accelerations of gravity and predominant frequencies derived from blast records that were obtained at various locations near the quarry. These attempts yielded sporadic results that were difficult, if not impossible, to interpret.

A later attempt to isolate the regions in question was based on the work of F. J. Crandell who set forth, in 1949, a relatively new method for evaluating the effects of blasting vibrations. By computing what Crandell terms the "Energy Ratio" of a blast, both the acceleration and frequency derived from the blast could be taken into account.

The values of Energy Ratio were computed from the available data and numbers proportional to these values were plotted on a map of the quarry area. Subsequently drawn lines of equal Energy Ratio clearly indicated two areas of relatively high Energy Ratio; one to the south, and the other to the south-east of the quarry. These two areas were found to be separated by a smaller area of relatively low Energy Ratio. Although sparse data was available for the region north of the quarry,

thereby rendering conclusive interpretation impossible, the computed values of Energy Ratio for this area were found to be relatively small.

Upon correlation of the areas of anomalous Energy Ratio with the geology and topography of the area, it was found that the areas of relatively high Energy Ratio were situated on the crests of topographic highs where existing overburden has been estimated to be 30 to 50 feet in thickness, while the area of relatively low Energy Ratio was located in a region where a small tributary stream had eroded the overburden. Furthermore, the area to the north of the quarry was found to be separated from the rest of the region by a broad alluvium filled creek valley.

With the evidence that has been accumulated, it was found that the study of anomalous energy distribution from Alpha Quarry blasts in Lemay, Missouri has yielded the following new or confirmatory knowledge to that already had regarding the effects of quarry blasting:

1. The anomalous distribution of relative Energy Ratio found to the south and south-east of the Alpha Quarry in Lemay, Missouri may be caused by the relative

thickness of overburden found at the locations described.

2. Relatively thick overburden will yield values of Energy Ratio which are comparatively high in relation to regions having relatively thin or no overburden for the same distance, quantity of dynamite, and type of shot.

3. For the purposes of this investigation, the criterion of Energy Ratio for determining the damaging force that may be imposed upon structures due to ground vibrations is superior to the criterion of acceleration of gravity.

4. Deep and unconsolidated sediments such as those found in the Gravois Creek valley, lying between the blast and seismometer station, have the ability to appreciably damp the earth waves that must travel through them.