STATISTICAL SEISMICITY OF TAIWAN

Y.S. Lou[I] and Bruce P.H. Chu[II]

SYNOPSIS

Statistical analyses are performed upon the earthquakes in existing catalogues (1720-1974) of earthquakes in Taiwan. A method of evaluating seismicity of sites in Taiwan is presented. The method uses an attenuation law based on the spatial distribution of iso-acceleration areas in conjunction with the past record of seismic events. The probability and the number of occurrences and the return period of various levels of ground acceleration (velocity and displacement) at a given site are presented. The method is then applied at a number of sites in Taiwan and the results are examined and compared with other statistical methods. The parameters affecting the results are also discussed.

The Chinese people began recording earthquakes over 3000 years ago, and their seismic records in the past 2700 years have been generally regarded as reliable. Being located on the Pacific Earthquake Belt, Taiwan is subject to frequent tremors, including devastating ones. An average of 1200 earthquakes are recorded on the Island each year. Among those earthquakes, about 25 percent are felt earthquakes.

Since there are substantial amounts of earthquake data available, attempts are made to utilize those data in engineering application. The method developed by Converse Davis Dixon Associates(1) was used in evaluating the seismicity of Taiwan. This method uses attenuation law based on the special distribution of iso-acceleration area in conjunction with the past record of seismic events. A nuclear power plant site was selected to demonstrate the application of this method.

Figure 1 is the earthquake epicenter map for proposed nuclear power plant site; Figure 2 is the seismicity of this site; Figures 3 and 4 are the occurrence and reoccurrence of firm ground acceleration. Table 1 indicates the selection of maximum ground accelerations based on the probability of occurrence and average return period.

It is concluded that, from the statistical viewpoint, the selection of Operating Basic Earthquake (OBE) for this example site would be in the range of 0.2g to 0.25g and for the reason of conservation, an OBE of 0.25g (for the free field) is recommended for this site.

The result has demonstrated the applicability of the analytical procedures presented in this paper in determining the seismicity and its selection of design earthquakes ground acceleration.

[I]Senior Engineer, Converse Davis Dixon Associates, P.O. Box 2268D, Pasadena, California 91105, USA.

[II]Director, Atomic Power Department, Taiwan Power Company, Taipei, Taiwan, Republic of China.

(1)N. Dean Marachi and S.J. Dixon, "A Method for Evaluation of Seismicity, Proceedings of the International Conference on Microzonation Vol. I, Seattle, Washington, 1972.

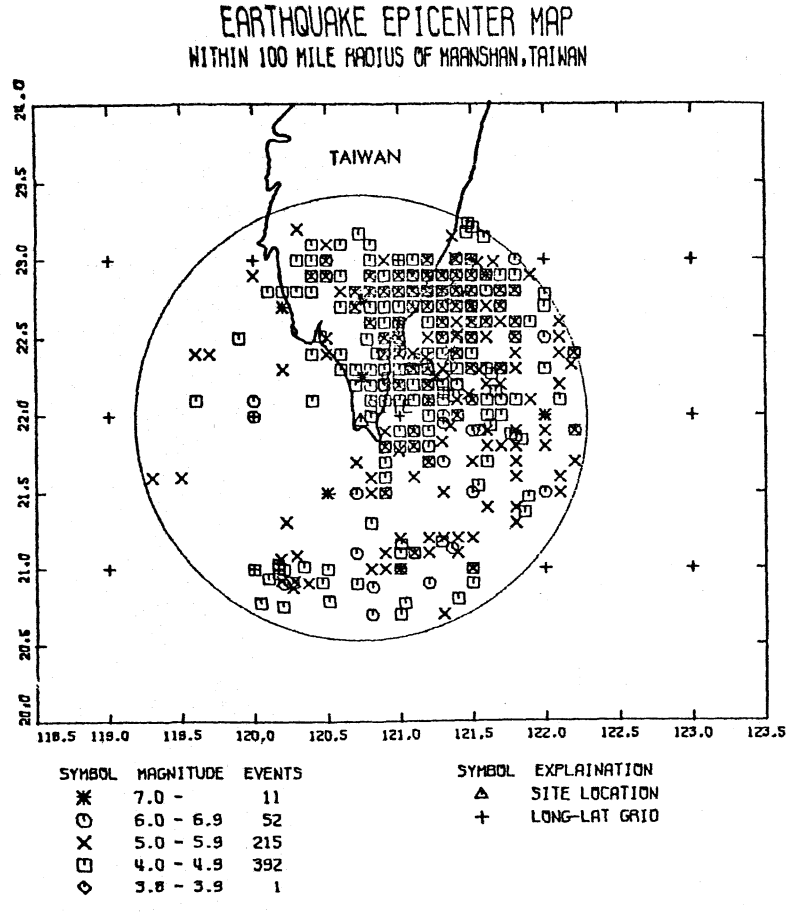

FIGURE 1 EARTHQUAKES WITHIN 100 MILES OF MAANSHAN SITE, TAIWAN, ROC

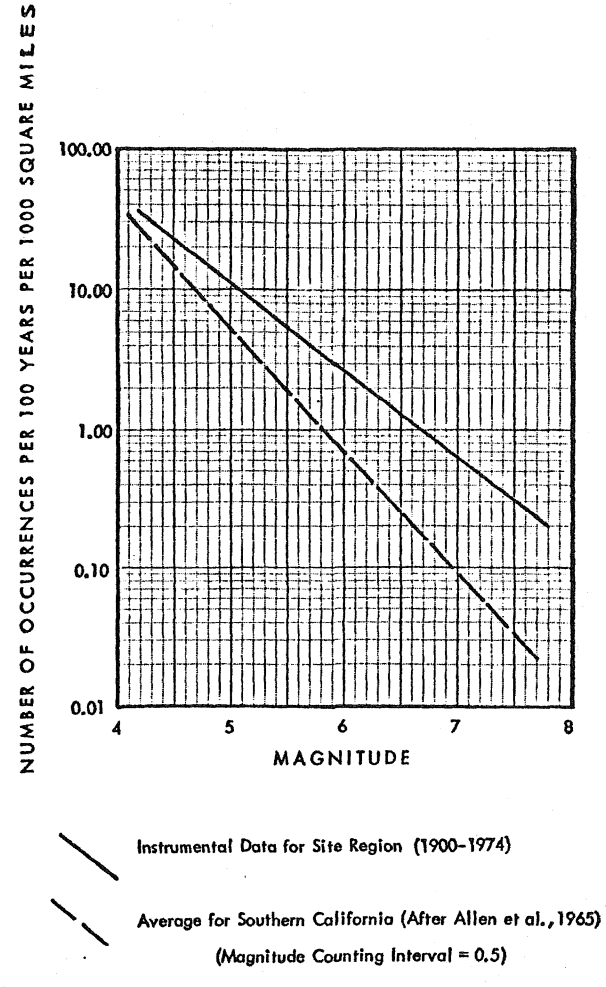

FIGURE 2 SEISMICITY OF MAANSHAN SITE

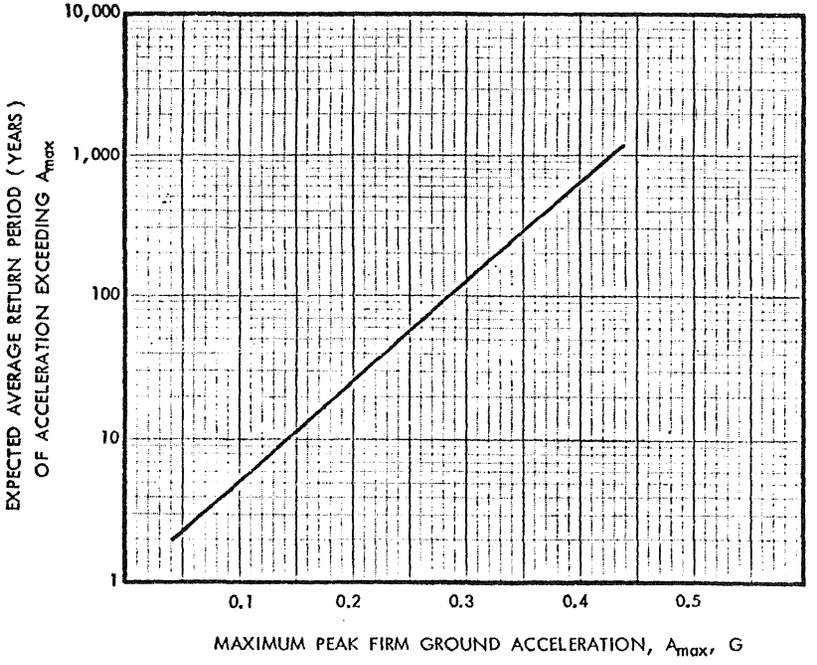

FIGURE 4 RECURRENCE OF FIRM GROUND ACCELERATION

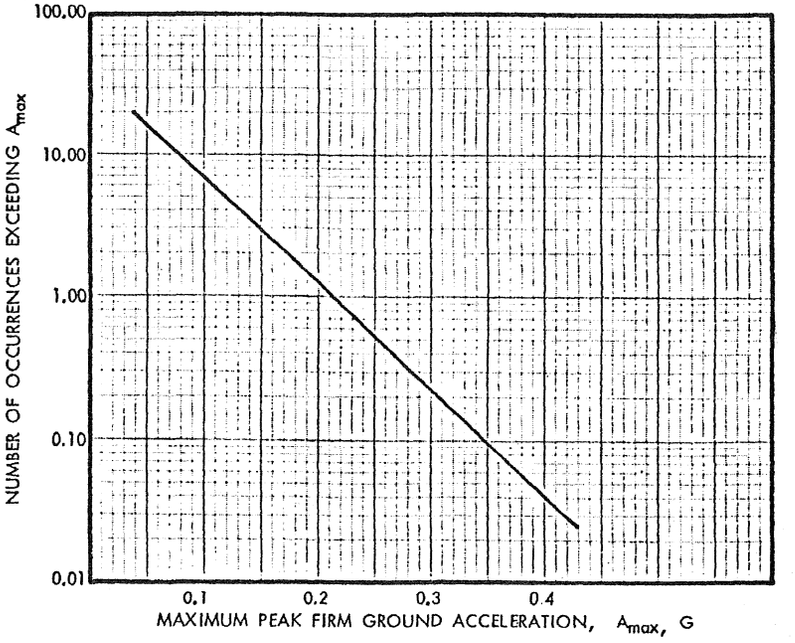

FIGURE 3 OCCURRENCES OF FIRM GROUND ACCELERATION - 40 YEAR PERIOD

TABLE 1

Number of Occurrence Exceeding Various g-level
(Radius of Study = 72 km)

Acceleration (g)	Number of Occurrence per 40 Years	Probability of Occurrence (%)	Estimate Number of Occurrence for next 40 Years
0.15	3.51	97	3.40
0.20	1.71	81	1.38
0.25	0.73	51	0.37

TABLE 2

Average Return Period for Firm Ground Acceleration

Acceleration (g)	Average Return Period (Years)	Estimate Number of Occurrence for next 40 Years
0.15	12	3.34
0.20	27	1.48
0.25	60	0.67

DISCUSSION

Tiedemann, Harbert (West Germany)

For large earthquakes which occured near Taiwan a few years ago rather different magnitudes were given by different seismographic stations. How do you allow in the studies for the error margin in the records ?

Author's Closure

Not received.