REVIEW OF PROCEDURES FOR DEVELOPING SEISMIC DESIGN PARAMETERS

by N.C. Donovan* and J.E. Valera*

SYNOPSIS

Following a brief review of the development of seismic design parameters in the United States some problems in present design techniques are outlined. Complex computational techniques are often used without adequate concern for either their veracity or the empirical observations upon which earthquake design procedures are based. The need for an evaluation of the sensitivity of parameters for design is discussed.

GENERAL OUTLINE

The first approaches to seismic design procedures were based on the simple suggestion that some arbitrary additional wind load be applied to the structure. Following the 1933 Long Beach earthquake the passage of the Riley Act in California resulted in the enactment of legislation by which some percentage of gravity was to be used to obtain the lateral design force. Sano had formulated similar seismic design principles for use in Japan some twenty years previously.

Structural flexibility which can change the distribution of lateral forces was first introduced in the 1939 Los Angeles City Building Code. The continued efforts of California Structural Engineers led in 1959 to the first edition of "Recommended Lateral Force Requirements" published by the Structural Engineers Association of California. This code and its subsequent revisions have served as the basis for the Uniform Building Code which is widely used in the United States.

Following recent advances in computational techniques it appears that many engineers have forgotton that codes were originally developed on the basis of empirical observations. While Dr. R.W. Clough showed that for simple structures code requirements and dynamic procedures could be approximately correlated he did not advocate the abandonment of direct and straightforward design methods. There is a strong tendency at the present time by many to rely very heavily on the results of complex analyses, often greatly extrapolating from known information and observation. Input motions for design are often required to satisfy very precise spectral limits without consideration or understanding of the effects of these limits. In many cases the uncertainty inherent in real ground motions is as large as the effect being analyzed.

Complex design procedures can give a false sense of achievement. More valuable information can be obtained by simple procedures which are able to examine the sensitivity of specific parameters and study their effects in detail. With complex procedures the sensitivity of the input parameters may neither be investigated nor understood.

CONCLUSION

The engineering profession must not lose sight of the empirical observations upon which design procedures are based.

---

*Partner, Dames & Moore San Francisco, California, U.S.A.