SOIL DINAMICS
DYNAMIQUE DES SOLS

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The objectives of these Sessions were to promote discussion of the current state of the art and to facilitate interchange and results from recent research. Meetings were held on Tuesday and Wednesday afternoon of the Conference.

Toward acnieving these objectives, the Organizer and his Advisory Committee made the following arrangements:

1.- Outstanding engineers from the United States, Sweden and Japan were invited to prepare four state-of-the-art papers. The papers were preprinted and distributed to all attendees at the opening of the first meeting, and the authors presented resumees of their papers at the meetings.

2.- Research briefs, short descriptions of recent or current research, were solicited. Sixty-five briefs were contributed by engineers throughout the world; these briefs were preprinted and distributed to all attendees.

3.- Approximately one and one-half hours was alloted for free discussion during each meeting, and attendees were invited to offer comments or contributions of up to five minutes in duration.

4.- A proceedings containing the state-of-the-art papers and written discussions will be published.

The keynote in organizing these Sessions was simplicity. To avoid handling of money, donations were sought to cover the costs of the preprints. No provision was made for translation and the meetings were conducted in English.

The peak attendance was 125 at the first meeting, and about 100 at the second meeting. The number of delegates attending some portion of the sessions was estimated to exceed 300. There were numerous spontaneous questions and discussions contributed by delegates, especially during the second session when the chairman was firm in enforcing the five- minutes limitation.

TECHNICAL CONTRIBUTIONS

Effect of Local Soil Conditions Upon Earthquake Damage

Two papers were prepared on this subject, one by Dr. Yorihiko Ohsaki of the Building Research Institute in Tokyo, and the second by Professor H. Bolton Seed of the University of California in Berkeley, California.

All of Dr. Ohsaki's paper, and the major portion of Dr. Seed's paper, was devoted to the relstionship among building damage by shaking, the strength and frequency content of ground motions, and local soil conditions. Dr. Ohsaki assembled the first comprehensive account of Japanese experiences concerning this relationship, and presented response spectra from earthquake records made in buildings upon rock, upon soil, upon piles and upon piers. Dr. Seed showed that predictions based upon linear ground response theory, using soil properties adjusted for the level of strain, are consistent with the few available measured ground motions and damage patterns. Several delegates offered contributions describing methods for evaluating the soil properties required by this theory. While there are shortcomings to this theory, the theory has been very useful in interpreting actual earthquake damage and may be used to guide the formulation of new building code provisions. Such provisions should recognize that both the depth of the soil and the nature of the soil must be considered in relation to the natural period of a structure. Dr. Ohsaki suggested several possible ways for incorporating these factors into building codes.

A portion of Dr. Seed's paper, and numerous contributions by delegates, discussed settlements, bearing capacity failures and slope failures caused by earthquakes, and the role of liquefaction in causing such failures. All failures which have been studied in detail involved uniform fine sands with a standard penetration resistance less than 25 blows/ft. However, the case records are too few to permit useful generalizations. Laboratory tests involving cyclic loadings have clarified the nature of the mechanism of liquefaction, and have provided one

method for estimating the danger that a sand deposit might liquefy during and earthquake of given intensity. Since, however, there still are may uncertainties regarding the accuracy and applicability of such laboratory test, more research will be necessary before such predictions can be made with great confidence.

MACHINE FOUNDATIONS

The state-of-the-art paper was prepared by Dr. Robert McNeill of Woodward-Clyde and Associates in Los Angeles, California. This paper, which was based upon up-to-date research but which was written from a practical viewpoint, covered the evaluation of dynamic loads, determination of soil properties, response design, isolation design and corrective measures. Several case studies were presented. Dr. McNeill concluded that the state-of-the-art today provides rational and practical methods by which the engineer can make reliable and economical designs and deplored the fact that these methods are ignored in the design of many foundations, often with desasteroud consequences. Finally, Dr. McNeill listed seven topics requiring further research.

There were numerous contributions by delegates, dealing with methods for evaluation soil properties, additional field and model test, theoretical studies of the effect of embedment, and several additional case studies. When published in the proceedings, these contributions will be valuable additions to current knowledge. It was pointed out that North American engineers and researcher apparently are unware of recent developments in Eastern Europe, and several new references were mentioned.

VIBRATORY COMPACTION

Dr. Bengt Broms of the Swedish Geotechnical Institute and Dr. Lars Forssblad of AB Vibro-Verken, both in Stockholm, prepared the state-of-the-art paper, which was delivered by Dr. Forssblad. The paper surveyed the influence of various factors upon compaction: water content, resonance, shear strength and dynamic stresses. The paper then summarized results from numerous field tests and actual applications of vibratory rollers, vibrating plates, vibroflotation and laboratory compaction tests. When writing specifications governing vibratory compactors, it is essential to specify the weight of the compactor, the frequency at which it is to operate, and other details as well. Some data and guidelines were given regarding damage caused by viorations. The main conclusion was that the usefulness of vibratory compaction has been amply demostrated and that a major start has been made toward understanding the fundamentals of vibratory compaction. It appears that different theories of compaction apply at different depths beneath a compactor. While there is some evidence to indicate that vibratory compaction is effective to considerable depth (perhaps 10 feet or more), this evidence is not conclusive and it is essentialthat further field studies be conducted. Such studies must use direct methods of density and compressibility measurement, and must not rely upon measurement of penetration resistance.

GENERAL COMMENTS

Many favorable comments were received upon the conduct of the sessions, and hence the format of the sessions apparently was successful.

It appeared that the majority of the delegates attending the sessions, already had considerable experience in soil dynamics. Since the state-of-the-art papers, all of which presented very practical conclusions, would have been of great interest to all soil engineers, it is unfortunate that the multiplicity of specialty sessions and technical visits discouraged more delegates from hearing these papers.

Most of the contributions during the discussions were by North American engineers. This too was unfortunate, since it meant that there was little interchange of information from deverse parts of the world. In future especialty sessions, the Organizer would more actively solicit contributions from a wide spectrum of delegates.

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