Discussion

By M. H. Cutler*

As Dr. Terzaghi spoke of his experiences at the "Annual Student's Night", the good fortune of the members of the audience, both younger and older, in being able to listen to the voice of international experience came to mind. Now that others will be able to benefit by publication of this talk, there are comments on certain phases which occur to me, based on my past 35 years of experience with a fully integrated engineering and construction organization which has been in existence more than twice this period.

This paper contains sound advice for the Engineer in any status, for the Client and for the Contractor. His recommendations are in line with organization procedures within a properly organized and integrated engineering and construction firm. Experiences similar to some of those described are the reason our organization by long established policy declines to function simply as design engineers without supervision of the construction.

The responsibility of an engineer to see that his design is executed within the framework of his assumptions and in accordance with his intents can not be avoided. Yet all too often inspection is cursory or regarded as something which can be left in the hands of a boy just out of school as a kind of "on the job training". The deficiencies in school and other construction revealed by earthquake disasters have led to the widespread revision in inspection of public construction in those areas and the development of a corps of capable inspectors with wide construction experience and sound judgment. And yet there are all too many other areas where this inspection is considered only as a political plum.

The comments regarding design assumptions and field conditions are particularly pertinent. Certainly complete cooperation among the departments involved in the design and execution of a project is essential. We have found it particularly advantageous to include one or more of the supervisory construction personnel in the early exploration and planning of a project in the office, during the time the basic design is initiated. In any case, continuous contact is maintained between the engineer and the field work by personal visits, telephone and teletype. There is, of course, no substitute for qualified and experi-

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enced personnel in all phases of the work. Earthworks and foundations particularly demand special care and cooperation between field and office, since compatibility between assumptions and actual conditions must be continuously checked with full appreciation that the earth's crust is not a uniform and quality controlled product, such as most of the elements making up a building superstructure. There is more than a germ of truth in the generality that the greatest consistency in foundation conditions lies in the variability.

The remarks on work carried out on a contract basis struck a responsive note. If the interest of the Owner, the Engineer and the Contractor are opposed, "the Contractor can not be expected to be interested or even aware of the reasoning behind the design." It is our philosophy that the best solution to this dilemma lies in a contract under which the interests of these parties are common.

There was a circumstance where we were constructing a plant from designs by others. Our superintendent's experience yardstick told him there was a discrepancy between the size of footings at the allowable soil bearing and the load to be carried. His comment to this effect was brushed off by the Engineer rather peremptorily but, being a persistent individual, the superintendent referred the matter to our engineering department which quickly verified that an arithmetic error had resulted in footings ¼ the proper size.

In another instance, a manufacturer had placed the responsibility for a project design of his process engineer, who, with the assistance of a contractor, had selected a site, cut and driven more than 3,000 spruce piles 50 ft long and poured some of the foundations, without benefit of suitable subsoil investigation. Some of the piles did not "fetch up" and another 50 ft length of pile was spliced weakly on the lower section. When three 50 ft lengths of piles, one on the other, still did not "fetch up", it was decided to obtain consulting advice, and we were called in. Subsoil investigations developed information that a surface stratum of sand was underlain by a substantial and variable depth of very soft plastic clay. Below the clay and above bedrock was another sand layer containing appreciable artesian pressure. Further investigation indicated that most of the piles as driven had their tips in the soft clay and that prohibitive differential settlements must be expected. During the investigation, evidence of suspected bank instability was proved and it appeared prudent to move the entire plant construction to another portion of the site where rock founda-

tions were readily accessible. This procedure, of course, involved the abandonment of a substantial sum already spent on the plant construction and required prolonged and detailed discussions of the reasons for abandonment, particularly since "a similar plant had been built on another site in another section of the country on 50 ft wooden piles and had proved to be satisfactory." We are indebted to Dr. Terzaghi for his assistance as our consultant in this case and the added weight of his experience and confirming testimony which resulted in the mill being moved to a safe location.

In closing this discussion, it is a pleasure to pay tribute to Dr. Karl Terzaghi for his invaluable assistance as consultant to our organization on many complex foundation problems over the past 30 years.

Discussion

By D. J. Bleifuss*

I have read Mr. Terzaghi's paper with considerable interest; the subject is one which should be given a good deal of attention. I must start my discussion by disagreeing with him when he says his personal experiences and observations are limited; the scope of his experience is about as unlimited as it is possible for any one man's to be. There are few consultants as well qualified to discuss this subject.

He is quite right in saying that consultants are often not used to the best advantage. A client may not employ a consultant at all, when he really needs one badly. A client may select the wrong consultant. A client may make the wrong arrangement with the right consultant.

It is a curious fact that many laymen consider themselves qualified to criticise an engineer, or to do their own engineering. Time and education will take care of this, as the public comes more and more to realize that this civilization of ours is based on the work of the engineer. The roads we travel on; the cars we ride in; the machinery we use; the energy to drive our machinery; our communication systems; our water systems; they are all based on the work of the engineer.

A client may select the wrong consultant. To many people, an engineer is an engineer; they make no distinction between bridge,

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