Discussion of "Compaction Grouting Test Program for Liquefaction Control" by Eugene A. Miller and Glen A. Roycroft

April 2004, Vol. 130, No. 4, pp. 355–361.
DOI: 10.1061/(ASCE)1090-0241(2004)130:4(355)

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The discusser thanks the authors for their presentation of a practical application of compaction grouting. Their minimum acceptable factor of safety of 1.2 appears to be based on their engineering judgment. Judgment comes from our experiences. To develop our judgment to determine how safe our design really is requires that we experience failures. Fortunately, we have only few of these experiences.

We can quantify risk through probability analysis. Traditionally, these analyses have been so overly complicated that practicing engineers have not used them. Duncan (2000) greatly simplified the analysis so that engineers could quantify risk. Failmezger et al. (2004) provided further simplification and found that risk is linearly related to the average factor of safety and its standard deviation. Christian (1997) showed that a site with less variability or uncertainty could have a lower average factor of safety and still be safer than a site with more variability and a higher average factor of safety.

The only value of factor of safety that has meaning is 1.00; either the site is safe or it is unsafe. As engineers, we need to evaluate the risk that a factor of safety will be less than 1.00. The results should be discussed with the owner, and the owner should be involved with risk decisions. After all, it is the owner's money and soil.

The authors have presented a substantial amount of data for risk assessment. Presented in Fig. 1 is a design chart showing the relationship for probabilities of success of 90, 95, 99, and 99.9%. From the data presented in Fig. 10 of the paper (1.5 m spacing), the discusser found that the average factor of safety was 1.51 and that its standard deviation was 0.47. From the data presented in Fig. 11 (1.2 m spacing), the reviewer found that the average factor of safety was 1.65 and that its standard deviation was 0.41. On the basis of the presented design chart, the analysis for 1.5 m spacing yields a probability of success less than 90% (85% numerically computed) and the analysis for 1.2 m spacing yields a probability of success equal to 95%.

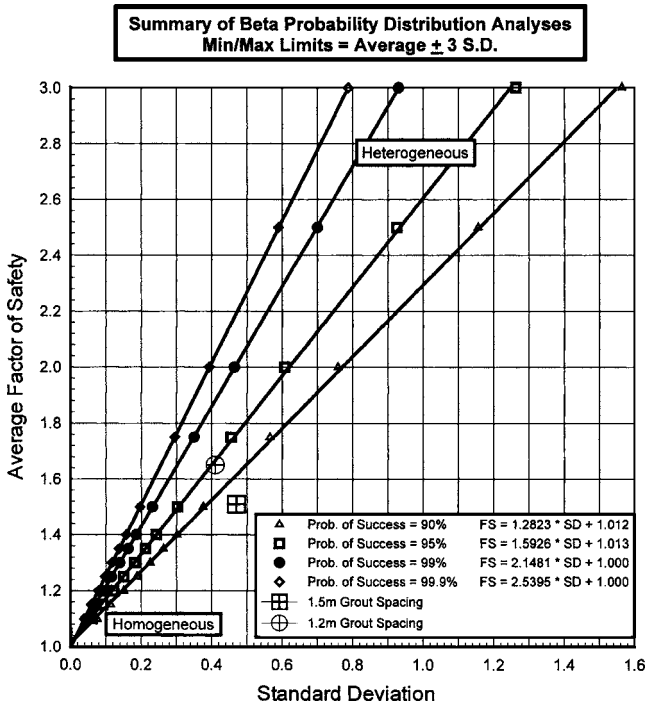

Fig. 1. Design chart showing probabilities of success of 90, 95, 99, and 99.9%

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