BOOK REVIEW

REUBEN H. KAROL: *Chemical Grouting*. Second Edition, Revised and Expanded. Marcel Dekker, Inc. New York and Basel 1990.

This book is recommended for civil engineers, architects and chemical engineers having to do with grouting, soil solidification.

This book of 465 pages, 14 chapters offers the latest knowledge matter in grouting in theory and practice. There are several case histories, and even new information compared to the first edition of 1980, concerning sodium silicate, acrylamide based, and other grouting modes. It offers useful instruction to researchers, lecturers, designers and implementers of chemical soil consolidation, grouting, to professionals of civil engineering.

The *introductory chapter* describes soil drainage methods related to grain size and coefficient of permeability — involving also grouting. Although actually there is ample literature on grouting, statements in some publications are antagonistic, outdated. Cement mortar grouting has been used by Brunel in 1838 on the first Thames tunnel in England. The first chemical grout is credited to a European, Jeziorsky, who was granted a patent in 1886 based on injecting concentrated sodium silicate into one hole and a coagulant into another (nearby) hole. In 1925 Joosten a Dutch engineer, developed a so-called double liquid (sodium silicate and calcium chloride solution) procedure. In the 1950s, a new period of chemical grouting started with the advent of polymer chemistry in the United States.

Chapter 2 has been concerned with properties and parameters of the soil medium to be grouted, and *Chapter 3* with the theory of grouting.

Chapter 4 spends about 100 pages on knowledge concerning chemical grouting, such as grout properties, expected strength of the grouted soil. Most current grouting materials belong to six groups:

1. Sodium silicate formulations.
2. Acrylics.
3. Lignosulfites-lignosulfonates.
4. Phenoplasts.
5. Aminoplasts.
6. Other materials.

Among sodium silicate based grouting methods, a detailed analysis is devoted to the double liquid (Joosten) procedure and to the SIROK method. Among organic monomer mixes, acrylamide grouts were the first to be used, from 1940 to 1950. Many illustrative figures help to present essential factors affecting properties of lignosulfonate, phenoplast and aminoplast grouts (viscosity, strength, gel time etc.).

Chapter 5 describes grouting technologies — in particular, grouting pipe, factors affecting grout diffusion, the case of stratified soils.

Chapter 6 gives a deepgoing survey of grouting equipments, pumps, pipes, systems.

Chapter 7 has been concerned with field tests, investigations, such as testing the suitability for grouting, determination of permeability by field test pumping.

Chapter 8 describes grouting to shut off seepage, enumerates types of seepage problems, outlines laboratory and field tests, as well as grouting procedures. Several interesting cases of application are reported (e.g. grouting from the inside of a tunnel).

In *Chapter 9* about 30 pages are spent on grouted curtains, are barriers of groundwater flow. Typical applications are curtains inside or below dams to prevent water seepage. Grout curtain design is illustrated by examples; also a computer program is given for designing optimum distribution of grouting holes.

Chapter 10 is on grouting for strength analysis of grouted soil strength. Stability increase of structures by grouting is illustrated on hand of practical examples realized in different countries.

Chapter 11 discusses grouting in tunnels and shafts, involving shallow tunnels, chemical grouting practice in Europe, recent developments in tunnel grouting practice, reduction of surface subsidence by grouting.

Chapter 12 has been concerned with special applications of chemical grouts such as sewerline rehabilitation, sampling of sand in situ density, "sealing piezometers", etc.

Chapter 13 has been concerned with some detail problems of chemical grouting, supervision and inspection.

The last *Chapter 14* discusses problems of chemical grouting materials research. Research work generally aims at finding new grouting materials, more effective than the existing ones. Important chemical companies (e.g. Cynamid, Diamond Alkali, Du Pont, Rhone-Poulenc, Solétanche) profusely fund research works. As examples, some experimental programs and results are autlined.

Appendices to this book rather valuable for specialists include, among others, glossary of selected terms, interpretation of terms, computer program for grouting.

József FARKAS
Department of Geotechnique, TUB