Fundamentals of Soil Mechanics

for Sedimentary and Residual Soils

Laurence D. Wesley

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PREFACE

This book was originally planned with the title *Soil Mechanics for Geotechnical Engineers*. I mention this because its target readership is indeed geotechnical engineers, including those who teach and train geotechnical engineers, and students aiming to become geotechnical engineers. Its name was changed to the present title following discussions with my publisher; together we agreed that the current title is preferable as it conveys more clearly the distinctive content of the book.

My first aim in writing this book has been to give equal coverage to residual soils and sedimentary soils. I have believed for a long time that there is a need for such a book, because many graduates are leaving universities throughout the world without even hearing of residual soils, let alone having any understanding of their properties. This is despite the fact that in not a few cases, the universities from which they graduate are surrounded by residual soils on every side, as far as the eye can see.

All graduates should have a basic knowledge of residual soils, first, because they are likely to encounter residual soils from time to time during their working life and, second, because there are important characteristics of residual soils that do not fit into the conventional concepts or the "theoretical framework" of classical soil mechanics. The application of these concepts to residual soils can produce quite misleading conclusions. A prime example is the use of stress history, and the e-log p graph associated with it, as an explanation of soil behavior. Stress history and the concepts of normal consolidation and overconsolidation have little or no relevance to residual soils.

Having said the above, I do not think that the differences between residual soils and sedimentary soils are such that residual soils should be covered as an alternative to or an extension of conventional soil mechanics. The

most basic fundamentals of soil mechanics, such as the principle of effective stress and the Mohr-Coulomb failure criterion, are equally applicable to both groups. The important characteristics of residual soil behavior can easily be incorporated into conventional soil mechanics teaching. I have tried to do that in this book. There are no chapters dedicated specifically to residual soils. Material has simply been included on residual soils throughout the book, wherever their properties deviate significantly from those of sedimentary soils. I guess I am hoping that this book will give a push (or at least a gentle nudge) for the inclusion in "mainstream" soil mechanics of those aspects of residual soil behavior that ought to be there.

I would add also that the supposed differences between residual and sedimentary soils are perhaps not as wide as is often imagined. The e-log p graph for soil compressibility is a case in point. Because of my experience with residual soils, I have been pushing for many years for the use of a linear pressure scale (rather than a log one) for interpreting the one-dimensional compression behavior of soils only to discover in recent years that Professor Janbu of the Norwegian University of Science and Technology has been urging this over a much longer period of time on the basis of his experience with sedimentary soils. The reasons for using a linear pressure scale are almost as compelling for sedimentary soils as for residual soils.

My second aim with this book is to emphasize concepts and principles rather than methods. My experience in mentoring and training graduate engineers has been that they have a strong command of methods but a rather weak grasp of concepts and principles. This is not surprising; engineers want to get on with designing and building things and have a "mental predisposition" toward methods rather than concepts. This can easily lead to a "handbook" or "recipe" approach to design. This might be acceptable in some branches of civil engineering but is decidedly unsatisfactory in geotechnical engineering. Nature rarely produces the tidy situations that are amenable to such an approach. Unfortunately, the advent of the computer has added to this emphasis on methods rather than concepts and principles.

In keeping with the above aims I have concentrated on the properties of undisturbed soils.

As far as possible, I have avoided presenting conceptualized or idealized versions of soil behavior, especially those derived from the study of remolded soils, and presented only the results of actual tests on undisturbed soils. Idealizations certainly have their place and are inevitable in design situations. However, idealizations are only appropriate when the limitations or approximations associated with them are clearly understood and taken account of.

If I was to dedicate this book to anyone, I think it would have to be Professor Nilmar Janbu, mentioned above. The following quotations (Janbu, 1998) highlight what he has been saying for many years:

> It is very surprising, to say the least, to observe all the efforts still made internationally in studying remoulded clays. If the aim of such research is practical application, it is obviously a total waste of money.
>
> . . . it remains a mystery why the international profession still uses the awkward *e*-log *p* plots, and the incomplete and useless coefficient Cc which is not even determined from the measured data, but from a constructed line outside the measurements. . .

Both statements are highly relevant to sedimentary soils. They are even more relevant to residual soils, and I hope in writing this book I have been adequately mindful of them.

REFERENCE

Janbu, N. *Sediment deformation*. Bulleting 35, Norwegian University of Science and Technology, Trondheim, Norway, 1998.

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