Basics of Design of Piled Foundations

One-day Course and Seminar by Bengt H. Fellenius, Dr.Tech., P.Eng
This one-day event addresses the practice of piled foundation design. What data one must pull together and what processes of analysis and calculations necessary for a design of a specific project are presented. Negative skin friction and associated drag force and downdrag are emphasized along with settlement analysis. Although detailing the various methods and aspects of determining pile capacity, the seminar also shows that deep foundation design is a good deal more than finding some value of capacity and emphasizes how to determine and base a design on the expected settlement.

The presentation includes both broad generalities and in-depth details. Specifics of where to install instrumentation, perform a test, and analyze the test data are addressed. Settlement analysis is of vital importance to the design of piled foundations, and the course addresses principles and mechanics of settlement analysis. How to consider and compare straight-shaft piles to piles with changing cross section, e.g., expanded base piles, open- vs. closed-toe pipe piles, is also addressed. Brief comments are given on some Code and Standards requirements for Limit States Design, LSD, (Ultimate Limit States, ULS, and Serviceability Limit States, SLS, by Canadian terminology and Load and Resistance Factor Design, LRFD, by US terminology). The lectures are illustrated with case history examples throughout. Much emphasis is placed on the design and performance of pile groups and piled raft foundations.

To simplify following along the flow of the presentation and taking notes, printed hand-out course notes are provided, consisting of all Power Points slides, six to a page. Full-size color copies are available online: www.Fellenius.net.

The slides contain only a minimum of text. For a background and explanation to much of the presentations, refer to the text book "Basics of Foundation Design" (recently updated) also available for downloading from the web site (the file is called “3xx The Red Book_Basics of Foundation Design.pdf”. After downloading, the book can be viewed and read on-screen or be printed (color or black & white) without any restriction. The book contains a list of references pertinent to the material presented in the course. Copies of the referenced papers where I am the author or co-author are available for downloading at the web site (click on the link "Download Papers").

Website: www.Fellenius.net
08:00h Registration

08:30h Analysis of Load Transfer, Capacity, and Response to Load

Load-movement response of foundations; Bearing capacity and load-transfer; Set-up and relaxation; Residual force; Results of prediction events.

10:00h Break

10:15h Continuing Analysis of ...

11:30h The Static Loading Test: Performance, Analysis, and Instrumentation

Methods of testing and basic interpretation of the results. How to analyze results from strain-gage instrumented piles to arrive at resistance distribution along the pile shaft and the pile toe response. Determining pile elastic modulus. The importance of residual force and how to include its effect in the analysis. Principles and evaluation of the bidirectional test and case examples. Case histories of analyses on results of static loading tests on driven and bored piles.

12:30h LUNCH

13:30h Continuing The Static Loading Test ...

14:30h Piles and Pile Groups — Long-Term Behavior and how we know what we know

Important case histories presenting studies that demonstrated the actual long-term response of piles to load and observed settlement of single piles, pile groups, and piled rafts. The lessons learnt will be referenced to aspects of design applying the Unified Method for Design of Piled Foundations considering Capacity, Drag Force, Settlement, and Downdrag, including influence from adjacent structures, fills, and excavations, specifically regarding response to load for, piled rafts, pile enhanced foundations, and piled pad foundations (inclusion design).

15:30h Break

15:45 The Unified Design Method

1. Capacity (choice of factor of safety, and rules of LRFD and Limit States Design) and design for structural strength (including drag force)
2. Settlement of single piles and pile groups due to load directly on the piles and due to influence from adjacent activity (downdrag)
3. How to combine the various aspects for the design of an actual case with emphasis on foundation settlement illustrated with examples.

17:00h Questions and Discussions
Dr. Bengt H. Fellenius is a professional engineer specializing in foundation design and studies by participation in project teams, special investigations, instrumented field tests, etc. Services are also provided in regard to construction problems, claims, and litigation in collaboration with Consultants and Contractors, as well as Owners.

Dr. Fellenius, Professor of Civil Engineering at the University of Ottawa from 1979 through 1998, is an internationally recognized authority in the field of soil mechanics and foundation engineering, and, in particular, in deep foundations. He has gained a wealth of practical experience during more than 50 years of work at home and overseas through a variety of assignments that encompass foundation, embankment, and soil improvement design for water and sewage treatment plants, industrial plants, as well as bridges, highway, and airport projects, and marine structures and urban area development projects; some of which he has written up in 300+ technical journal and conference papers, articles, books, and book chapters. Copies of many of the papers are available for downloading from Dr. Fellenius' web site: [www.Fellenius.net]

Dr. Fellenius moved from his native Sweden to Canada in 1972 where he worked on foundation investigations and design and construction projects in North America and overseas. In 1973, he was one of the first to apply geotextile soil separation sheets to stabilize roadbeds and construction surfaces, investigating conventional carpet underlay (Celanese) for this purpose. He was active in promoting to the US market the splicing of prestressed concrete piles by means of mechanical full-strength splices, and he introduced to Canada and the USA ground improvement applications of lime column method for reducing soil compressibility and wick drains (the Geodrain and Alidrain) for accelerating consolidation and stabilizing landslides. He was one of the earliest (1977) to research and use dynamic testing and the Pile Driving Analyzer in actual project design and construction.
In 1984 he introduced the Jambu method of determining soil compressibility and analysis of settlement. He has also had a fundamental part of the development of commercial software for analysis of settlement from loads on natural soils and soils subjected to soil improvement methods, design of piled foundations, and other software. In 1984, he published the design and analysis method for foundation design known as the “Unified Method of Design for Capacity, Drag Load, Settlement, and Downdrag”.

Dr. Fellenius is and has been an active participant in many national and international professional societies and research associations and in Canadian and US Codes and Standards Development. For example, Member of the subcommittee for the American Society for Testing and Materials D-4945 Standard for High-Strain Dynamic Testing of Piles; Chairman of the Canadian Geotechnical Society, CGS, Technical Committee on Foundations writing the 1985 Canadian Foundation Engineering Manual; Member of the Ministry of Transportation Committee for Development of the 1983 and 1992 Ontario Bridge Design Code; Author of three Publics Works Canada publications: Marine Division Master Specifications for Piling, Pile Design Guidelines, and Hammer Selection Guide; Past Overseas Correspondent Member to the Geotechnical Engineering Advisory Panel of the Institution of Civil Engineers, ICE (London); and Past Members of Editorial Board for the ASCE Geotechnical Engineering Journal.

Dr. Fellenius has given lectures and courses to several universities and been invited lecturer at international conferences throughout Europe, the Americas, and South-east Asia.
REGISTRATION Form

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