International Workshop on Uncertainties in Nonlinear Soil Properties and their Impact on Modeling Dynamic Soil Response

Sponsored by the National Science Foundation and PEER-Lifelines Program

PEER Headquarters, UC Berkeley, March 18-19, 2004

Opinion paper on

Development of data base for merging and sharing of worldwide data sets

by

Mladen Vucetic, Professor
Civil and Environmental Engineering Department
University of California, Los Angeles

During cyclic soil testing investigations, in particular the small-strain nondestructive cyclic testing, vast amounts of data can be collected. This necessitates the development of new procedures for data processing, analysis and sharing that take advantage of today's fast computers and sophisticated software. One such new procedure has been developed and preliminary used at the UCLA Soil Dynamics Laboratory. The procedure is summarized in a UCLA report by Hsu and Vucetic (2002). It includes the reading, checking, organizing, combining, comparing, and analyzing vast arrays of cyclic simple shear test data. The main component of this procedure is a conveniently structured database with a cyclic loop as the elementary unit. In the database, each cyclic loop is characterized by a series of parameters such as Plasticity Index, PI, void ratio, e, degree of saturation, S, vertical stress, σ_v, overconsolidation ratio, OCR, cyclic shear strain amplitude, γ_c, frequency, f, secant shear modulus, G_s, equivalent viscous damping ratio, λ, parameter describing the shape of cyclic straining, etc.

The main premise of the database is that cyclic loops obtained following different cyclic loading paths look basically the same as long as they pertain to the same PI, e, S, σ_v, OCR, γ_c, f, and the shape of cyclic straining. It is thus presumed that cyclic behavior parameters of these loops such G_s and λ are almost identical. The power of such database is that very large number of cyclic loops and their characteristics can be compared and manipulated between different tests in various ways, thus enabling the creation and instant graphical presentation of various useful behavioral trends and comparisons.

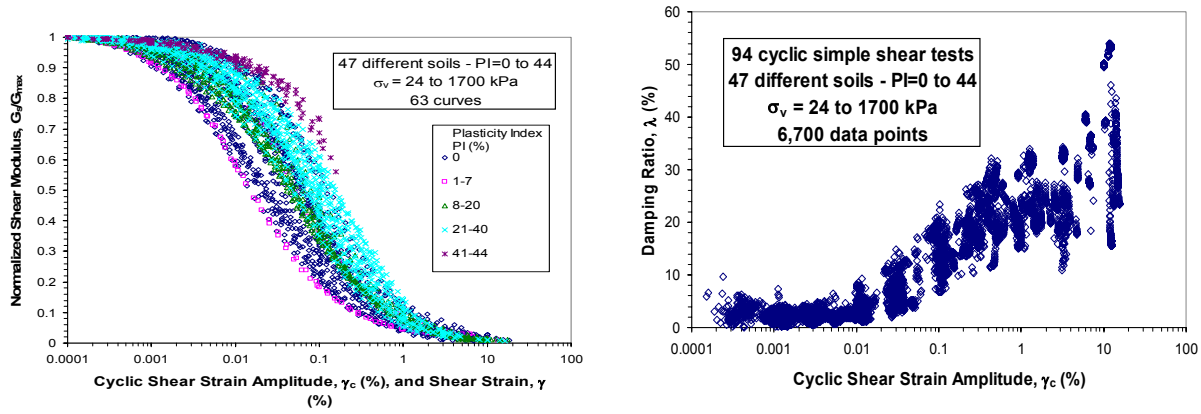
The "Microsoft Access" database software was employed to develop the database the structure of which is rather complex. It includes 10 separate tables and over hundred fields with the characteristics of cyclic loops that are linked and can be related to each other. In spite of its complexity, the database is rather flexible and relatively easy to use. Using the customized "Microsoft Excel" worksheets the database is also easily maintainable and updateable with the data from new tests.

The database was designed not just for handling the simple shear test results generated at UCLA, but also to accommodate the results of other types of tests that can be gathered from the literature.

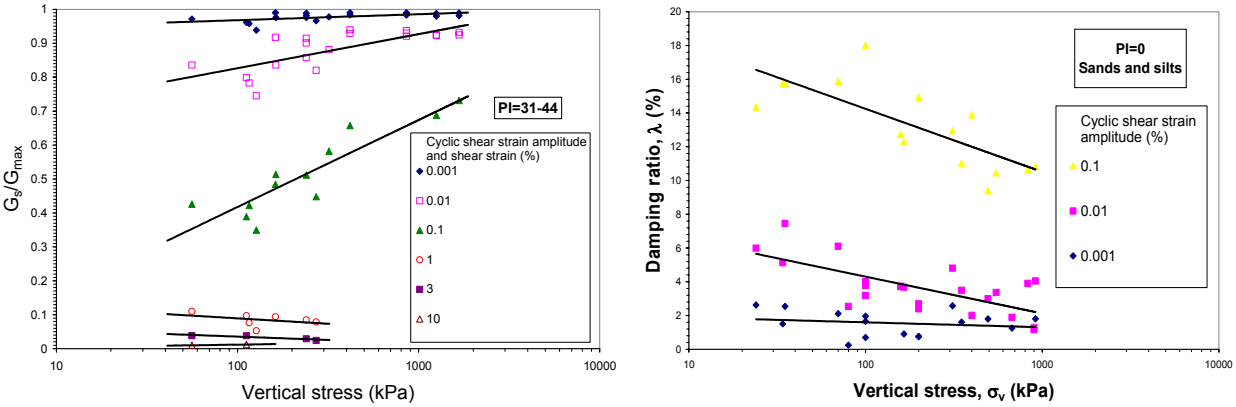
Currently, only the UCLA simple shear test results have been included into the database. They are obtained from 94 tests on 47 different soils, amounting to 12,500 cyclic loops. Below are some examples of plots and charts generated automatically from the database.

Reference:

Hsu, C-C., and Vucetic, M. (2002): "Dynamic and cyclic behavior of soils over the wide range of shear strains in NGI-type simple shear testing devices", *UCLA Research Report* No. ENG-02-228, Civil and Environmental Engineering Department, University of California, Los Angeles, January, 267 p



Reduction of normalized secant shear modulus, G_s/G_{max}, and variation of damping ratio, λ, with amplitude γ_c from UCLA database – each point represents a cyclic loop (Hsu and Vucetic, 2002)



Variation of normalized secant shear modulus, G_s/G_{max}, and damping ratio, λ, with vertical stress, σ_{vc} , for selected groups of soils from UCLA database – each point represents a cyclic loop (Hsu and Vucetic, 2002)