Correlations Between Grain Size Distribution and Proctor Density

Using statistical methods, correlations between parameters of the grain size distribution and Proctor density of coarse grain soils collected in an existing data base were evaluated. Based on these results, an attempt was made to develop relations which enable the assessment of the Proctor density from the grain size distribution. The aim of this project was to develop a simple method to test the plausibility of Proctor test results in order to improve quality control of compaction works.

The results of about 5000 tests on samples of natural sand and gravel as well as mixed soils (recycling material) taken in the Berlin area were evaluated. For the Proctor density ρ_{Pr} of these soils the dependence on the uniformity coefficient $U = d_{60}/d_{10}$ and the relation $U_{90} = d_{90}/d_{10}$ yield the best continuity as well as the least scattering. Additionally, the dependence of Proctor density on optimal moisture content w_{Pr} and other parameters related to the grain size distribution was evaluated.

Based on the correlations established a simple model for the assessment of Proctor density, depending on the parameters of the grain size distribution $U = d_{60}/d_{10}$ and $U_{90} = d_{90}/d_{10}$ was developped. Compared to published data the relations established from the present data base yield slightly smaller values for the Proctor density. This difference is probably due to the large proportion of tested samples of recycling material contained in the data base.