

SECTION 1 - INTRODUCTION

This manual serves two purposes. First, it forms part of the documentation of the finite element computer program SAGE. Second, the data and correlations it contains can also be used for estimating shear strengths and stress-strain properties for other purposes. The stress-strain models available in SAGE are described together with information that can be used to estimate values of the parameters involved in these models.

SAGE has ten options for modeling the stress-strain behavior of soils, rocks, concrete and steel. These are:

- **Linear elastic stress-strain behavior.** See **Section 2** for data and correlations that can be used to estimate values of Young's modulus (E) and Poisson's ratio (ν) for steel, concrete, soils and rock masses.
- **Hyperbolic stress-strain behavior with Stress-Dependent Poisson's Ratio.** See **Section 3** for values of the hyperbolic stress-strain parameters c , ϕ , K , K_{UR} , n , and R_f . See **Section 4** for values of the Poisson's ratio parameters G , F , and d .
- **Hyperbolic stress-strain behavior with Bulk Modulus Related to σ_3 .** See **Section 3** for values of the hyperbolic stress-strain parameters c , ϕ , K , K_{UR} , n , and R_f . See **Section 5** for values of the bulk modulus parameters K_b and m .
- **Hyperbolic stress-strain behavior with Bulk Modulus Related to σ_m .** See **Section 3** for values of the hyperbolic stress-strain parameters c , ϕ , K , K_{UR} , n , and R_f . See **Section 6** for values of the bulk modulus parameters B_i and ϵ_u .
- **Hyperbolic stress-strain behavior with Stress-Dependent Poisson's Ratio, with Mohr-Coulomb Plasticity after Failure.** See **Section 3** for values of the hyperbolic stress-strain parameters c , ϕ , K , K_{UR} , n , and R_f . See **Section 3** for values of the Poisson's ratio parameters G , F , and d . See **Section 7** for values of the dilatancy angle, ψ .
- **Hyperbolic stress-strain behavior with Bulk Modulus Related to σ_3 , with Mohr-Coulomb Plasticity after Failure.** See **Section 3** for values of the hyperbolic stress-strain parameters c , ϕ , K , K_{UR} , n , and R_f . See **Section 5** for values of the bulk modulus parameters K_b and m . See **Section 7** for values of the dilatancy angle, ψ .

- **Hyperbolic stress-strain behavior with Bulk Modulus Related to σ_m , with Mohr-Coulomb Plasticity after Failure.** See **Section 3** for values of the hyperbolic stress-strain parameters c , ϕ , K , K_{UR} , n , and R_f . See **Section 6** for values of the bulk modulus parameters B_i and ϵ_u . See **Section 7** for values of the dilatancy angle, ψ .
- **Mohr-Coulomb Plasticity, with Constant Young's Modulus and Poisson's Ratio before Failure.** See **Section 2** for data and correlations that can be used to estimate values of Young's modulus (E) and Poisson's ratio (ν). See **Section 7** for values of the dilatancy angle, ψ .
- **Modified Cam Clay.** See **Section 8** for data and correlations that can be used to estimate values of e_1 , p'_c , M , λ , κ , ν , k_v , k_h , and k_o .
- **Permeability of Soils.** See **Section 9**.