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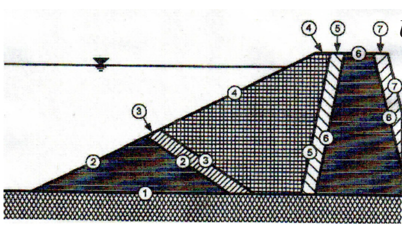
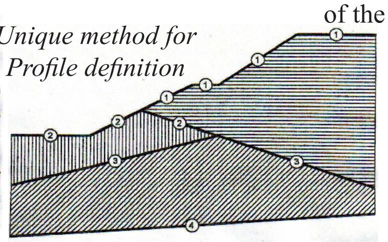
UTEXAS4
Stability Analysis of Complex Slopes

GENERAL DESCRIPTION

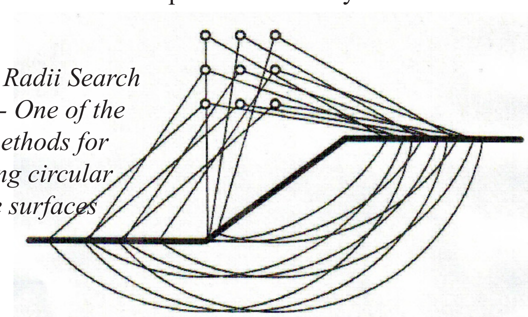
UTEXAS4 is a computer software application for computing the stability of earth and earth-rock slopes and embankments. UTEXAS4 is written and maintained by Dr. Stephen G. Wright of *Shinoak Software*, who is well-recognized as one of the leading experts in solving problems in soil strength and slope stability (Duncan and Wright, 2005).

UTEXAS4 has been considered one of the most sophisticated commercial software available to study the stability of slopes using a two-dimensional, limit-equilibrium method. The program has been widely used by the US Army Corps of Engineers and US Federal Highway Administration.

UTEXAS4 features unique random techniques for generation of potential failure surfaces for subsequent determination of the most critical surfaces and their corresponding factors of safety. The factor of safety is defined with respect to shear strength, i.e. the factor of safety is the ratio of the soil shear strength to the equilibrium shear stress. Values of the factor of safety at or less than unity are considered to represent instability and failure of the slope.

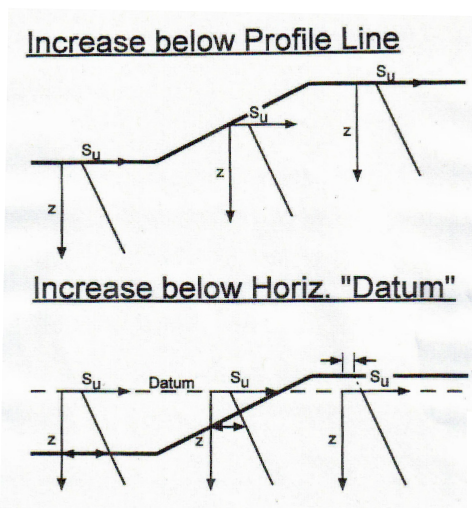
Unique method for Profile definition



"Constant Radii Search Circles" - One of the three methods for searching circular failure surfaces

PROGRAM FEATURES

- The user has unique options to define irregular slope profiles encountered in the analysis.
- The program can be used to the stability (factor of safety) for inhomogeneous slopes and embankments using both circular and noncircular slip surfaces.
- Spencer's procedure of slices is used to compute the factor of safety. Automatic searches can be performed to locate the critical circular or noncircular slip surface with the lowest factor of safety.



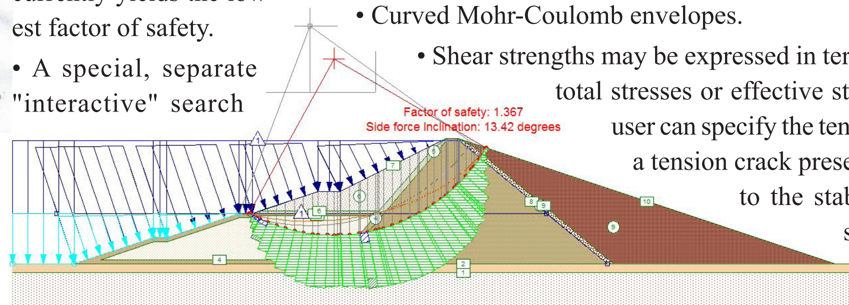
Use of linear-increase of shear strength for soil properties

- Searches with both circular and noncircular slip surfaces are fully animated to show each trial slip surface as they are tried along with the location of the slip surface which currently yields the lowest factor of safety.
- A special, separate "interactive" search scheme allows the user to select trial slip surfaces, one by one, and compute the factor of safety for each surface. As the factor of safety is computed for each slip surface, contours of factor of safety are drawn and updated to help locating the most critical slip surface with the lowest factor of safety. In this method engineers can see how the factor of safety changes with the location of the critical circle and eventually locate the most critical circle on their own and using their own judgment.

Shear Strengths

UTEXAS4 allows several representations for the soil shear strength, including:

- Conventional linear Mohr-Coulomb envelopes described by a cohesion intercept (c or c') and friction angle (ϕ or ϕ').
- Linear increase in undrained shear strength (Su = c) below a horizontal reference datum.
- Curved Mohr-Coulomb envelopes.
- Shear strengths may be expressed in terms of either total stresses or effective stresses. The user can specify the tension crack if a tension crack presents a thread to the stability of the slope.



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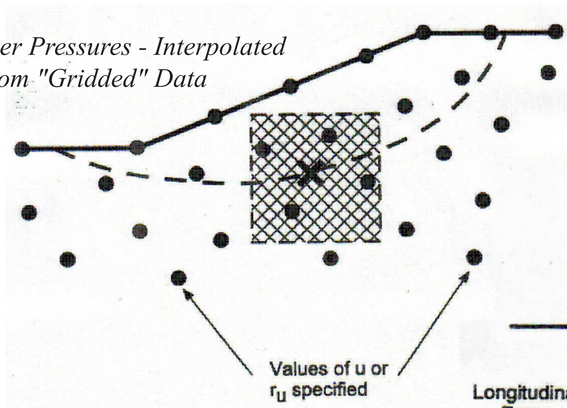
PROGRAM FEATURES

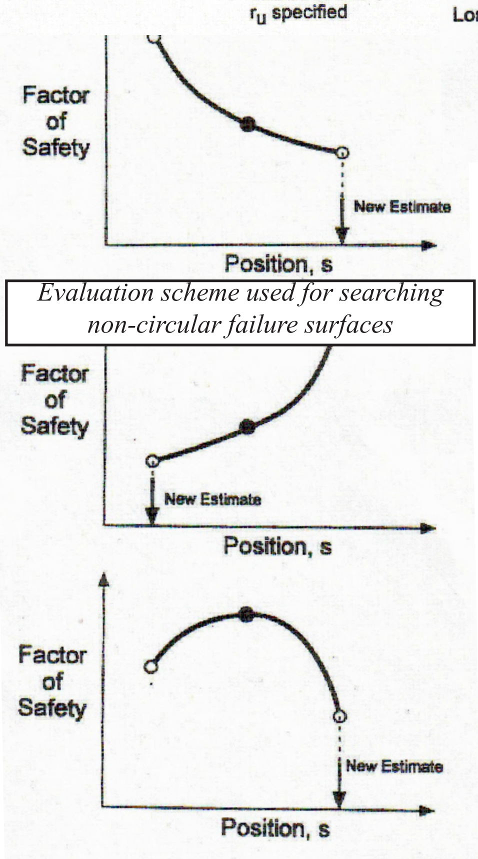
Pore Water Pressures

The program provides a convenient feature so that pore water pressure at any location inside the slope can be interpreted from the grid data. For effective stress analyses pore water pressures may be specified in two ways as described below:

- A constant value of Bishop's pore water pressure coefficient, r_u, may be specified. Pore water pressures are then calculated by multiplying the total vertical stress (γz) by the pore water pressure coefficient.
- A piezometric line may be specified where the pore water pressures are computed as the vertical distance between the piezometric line and point of interest times the unit weight of water. Pore water pressures are assumed to be zero above the piezometric line.

Pore Water Pressures - Interpolated from "Gridded" Data





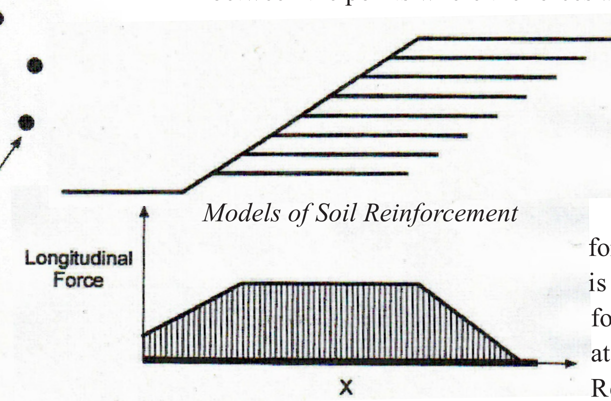
Evaluation scheme used for searching non-circular failure surfaces

Distributed Surface Loads

Distributed surface loads can be used to model external water loads as well as loads imposed by footings, material stockpiles, etc. Distributed loads are specified in the input data by specifying the coordinates of points on the surface of the slope and the corresponding value of stress (pressure). The distributed loads are assumed to act normal (perpendicular) to the surface of the slope and to vary linearly between points where the loads are specified.

Internal Soil Reinforcement

Internal soil reinforcement representing geosynthetic geogrids and geotextiles, piles, soil nails, tie-back anchors and other forms of slope strengthening can be included in an analysis. Each reinforcing element is specified as input data by a series of points along the reinforcing element and the value of the longitudinal (axial) and transverse (shear) force at each point. The forces in the reinforcement are assumed to vary linearly between the points where the forces are specified.



Models of Soil Reinforcement

In the slope stability computations forces are assigned to individual slices at the points where the reinforcement intersects the slice. The force applied to each slice is equal to the specified force in the reinforcement at the point of intersection. Reinforcement elements may be horizontal, vertical or inclined. Also, as noted above both longitudinal (axial) and transverse (shear) forces can be entered. If the slide-suppressor wall or drilled-shaft wall are used for increasing the stability of the slope, the program allows the user to take into account the resistance provided by the wall onto the slope profile for the stability analysis.

Slide Suppressor Wall