FFDM Software Development Series 2

Functions of SLOPE-DISP 3.0

Ching-Chuan Huang

Professor Emeritus
Department of Civil Engineering,
National Cheng Kung University, Tainan, Taiwan
Email: samhcc@mail.ncku.edu.tw
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2.1 CONTENTS OF SLOPE-DISP 3.0

Computer program SLOPE-DISP 3.0 consists of five major routines:

1. Main analytical routines (Section 2.2)
2. Text file output routines (Section 2.3)
3. User-friendly guided input routines (Section 2.4)
4. Real-time analytical result output window (Section 2.5)
5. Critical-surface-related output text file and inspection window (Section 2.6)

2.2 MAIN ANALYTICAL ROUTINE

A total of 9 types of analyses incorporated with various failure surface geometries, searching algorithms, and analytical methods can be use:

Type-1 analysis: This is a trial-and-error circular failure analysis. Three slice methods, namely, the Fellenius (or Swedish) method, the simplified Bishop method, and the Spencer method, are simultaneously applied for all trial-and-error surfaces to provide a generic analytical result of slopes in terms of safety status and displacements of the slope. In addition to the regular Spencer's method, a Spencer's method with a modified solution approach (Spencer-1 method) is also incorporated.

Type-2 analysis: This type of analysis is identical to the Type-1 analysis, except that all failure surfaces passing through a designated point. This type of analysis can be used in stability analyses for a slope with a known point of failure, such as a tension crack, a large shear displacement in an inclinometer, a large settlement of an isolated footing situated on a slope, etc.

Type-3 analysis: This type of analysis performs stability and/or displacement analyses for a specific circular failure surface using the four methods as used in Type-1 analysis. This type of analysis can be used in a detailed inspection for a known circular surface obtained in previous analyses or in a post-failure site reconnaissance. This type of analysis can also be used as a tool of stress-based and/or displacement-based back-analyses.

Type-4 analysis: This is a trial-and-error-based multi-wedge failure analysis. This type of analysis is effective in the case of steep slopes with a facing and reinforcement. Two analytical methods, namely, the multi-wedge and simplified Janbu methods are applied in this type of analysis. It is suggested that this type of analysis is exclusively used in the case of reinforced steep slopes because the multi-wedge failure mechanism is prevailing in such slopes. This type of analysis is featured in its capabilities of examining the

interactions between facing and reinforcement. By using this analysis, failures of facing-reinforcement connections can be examined.

Type-5 analysis: This is a trial-and-error-based noncircular failure analyses using simplified Janbu, rigorous Janbu, Spencer and Spencer-1 methods for safety factors and slope displacements computations. Automatic generations of logarithmic spirals according to the designated upper and lower limits of failure zone is incorporated.

Type-6A analysis: This is a one-failure-surface analysis for a slope with a failure surface comprising a logarithmic spiral. The simplified Janbu, the rigorous Janbu's, the Spencer and the Spencer-1 methods are used to calculate safety factors and displacements of the slope.

Type-6B analysis: This is a one-failure-surface analysis for a specific surface comprising a polyline. The simplified Janbu, the rigorous Janbu's, the Spencer and the Spencer-1 methods are used to calculate safety factors and displacements of the slope.

Type-7 analysis: This is a trial-and-error-based compound failure surface analysis. The compound failure surface consists of a linear segment (or a polyline segment) and an arc. In this analysis, circular and compound failure surfaces co-exists because not all automatically generated arcs are cut by the linear (or polyline) segment. All trial-and-error surfaces (circular and compound) are analyzed using the simplified Janbu, the rigorous Janbu, the Spencer and the Spencer-1 methods to give critical values of safety factors and slope displacements.

Type-8 analysis: This type of analysis is identical to the Type-7 analysis, except that this is for a designated compound failure surface. This type of analysis can be used in a detailed inspection for a known compound surface. This type of analysis can also be used as a tool of stress-based and/or displacement-based back-analyses.

2.3 TEXT FILE OUTPUT ROUTINE

The output text file contains the following analytical results:

(a) Minimum values of safety factor among all trial-and-error surfaces.

(b) Maximum values of vertical displacement at the crest of slopes (d_0) among all trial-and-error surfaces (based on requests).

(c) Coordinates of critical failure surface geometry.

(d) Effective normal stresses at the base of the critical slip surface.

(e) Porewater pressures at the base of the critical slip surface.

(f) Mobilized forces and failure modes of reinforcement.

(g) Mobilized forces and failure modes of reinforcement at facing-backfill interface. (only in Type-4 analysis)

2.4 USER-FRIENDLY GUIDED INPUT ROUTINE

The user-friendly guided input program provides two input modes:

Mode 1: Creating a new input data file.

Mode 2: Appending data to an existing input data file.

2.4.1 MODE 1: MAKING A NEW INPUT DATA FILE

(a) Real-time graphics of input slope conditions

(b) Graphics for slope profiles, water table, reinforcement, and facing.

(c) Comparison between input M-C envelope and imported experimental data.

(d) Comparison between input soil model and imported experimental data.

(e) Comparison between input reinforcement pullout curve and imported experimental data.

2.4.2 MODE 2: EDITING AN EXISTING INPUT DATA FILE

(a) Event-by-event graphical presentations of slope conditions.

(b) Real-time presentations and editing of input data files

2.5 OUTPUT TEXT FILE INSPECTION ROUTINE

A ‘Read-only’ mode is provided for the inspection of output text file at the end of the analysis for a project.