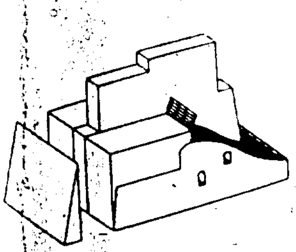
US Army Corps of Engineers



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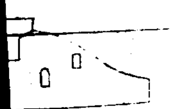

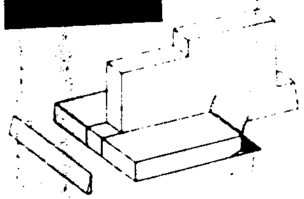

INFORMATION TECHNOLOGY LABORATORY

(2)

COMPUTER-AIDED STRUCTURAL ENGINEERING (CASE) PROJECT

INSTRUCTION REPORT ITL-87-3

USER'S GUIDE: A THREE-DIMENSIONAL STABILITY ANALYSIS/DESIGN PROGRAM (3DSAD)

Report 6

FREE-BODY MODULE

by

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Information Technology Laboratory

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US ARMY ENGINEER WATERWAYS EXPERIMENT STATION

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19 ABSTRACT (Continue on reverse if necessary and identify by block number)

3DSAD performs an overturning and sliding stability analysis for complex three-dimensional structures. Specific structure types and general shapes can be handled. General modules are: geometry--to define, display, and compute mass properties; loads--to define, display, and compute loads; analysis--to perform a base analysis assuming a rigid body on an elastic foundation; and free-body--to use clipping capability for a free-body analysis.

The Free-Body Module is a utility written to provide the user with the ability to perform an analysis of a structure at elevations or cross sections other than its base. It produces a free body containing a new definition of geometry and loads, by allowing the user the ability to "clip" the structure with a single plane or multiple planes. Output consists of a file containing the clipped geometry and loads data for use with the General Geometry or General Loads Module and a base file used with the forces and moments computed from the first data file to perform an analysis with the

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16. SUPPLEMENTARY NOTATION (Continued).

Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. This report was prepared under the Computer-Aided Structural Engineering (CASE) Project. A list of CASE reports is printed on the inside of the back cover.

18. SUBJECT TERMS (Continued).

Clipping capability
Computer-aided design
Free-body computation
Interactive graphics
Kern
Stress analysis
Structural stability
Three-dimensional graphics

19. ABSTRACT (Continued).

General Analysis Module. The General Analysis Module is used to produce a base pressure computation that is an approximation of the internal stresses in the structure at the clipping plane.

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ELECTRONIC COMPUTER PROGRAM ABSTRACT

TITLE OF PROGRAM A Three-Dimensional Stability Analysis/Design (3DSAD) Program: Free-Body Module	**PROGRAM NO.** 713-F3-R008

PREPARING AGENCY US Army Engineer Waterways Experiment Station, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199.

AUTHOR(S)	**DATE PROGRAM COMPLETED**	**STATUS OF PROGRAM**	
		PHASE	**STAGE**
Fred T. Tracy and Mary Ann Leggett	July 1989	OP	

A. PURPOSE OF PROGRAM

3DSAD performs an overturning and sliding stability analysis for complex three-dimensional structures. General shapes and specific structure types can be handled. General modules are geometry, loads, analysis, and free-body. The Free-Body Module provides general clipping capability for performing a free-body analysis of a structure and accompanying loads.

B. PROGRAM SPECIFICATIONS

FORTRAN

C. METHODS

A free-body analysis is made possible by using the clipping capability of the General Geometry and Loads Modules. A plane or groups of planes are used to produce the new geometry and loads data that can then be displayed and forces and moments computed using the General Loads Module. The forces and moments computed from the clipped data in the General Loads Module can be used with the new base file to obtain an approximation of the internal stresses in the structure at the clipping plane using the General Analysis Module.

D. EQUIPMENT DETAILS

A graphics terminal with a time-sharing system, a stand-alone engineering workstation, or personal computer is necessary. Color enhancements such as hidden line and continuous tone shaded plots are available only on the Intergraph Engineering Workstation and the PC, but separate versions are not necessary for the Intergraph Engineering workstations.

E. INPUT-OUTPUT

Input is in the form of an interactive session that can be combined with an input file. Some output is displayed on the terminal or monitor, or sent to a remote plotter or printer, while other output is placed into a file.

F ADDITIONAL REMARKS

This program is available through the CORPS Library for the Honeywell DPS-8, Cybernet CDC, Harris 500, Intergraph Engineering Workstation, or PC.

PREFACE

This report documents the Free-Body Module of the three-dimensional (3-D) stability analysis/design (3DSAD) program. The module was developed and this report was written at the US Army Engineer Waterways Experiment Station (WES), Vicksburg, MS, in the Information Technology Laboratory (ITL) by Mr. Fred T. Tracy, Interdisciplinary Research Group, Computer-Aided Engineering Division (CAED), ITL, and Ms. Mary Ann Leggett, Ph.D, Intergovernmental Personnel Act from Belhaven College, Jackson, MS. The work was sponsored through funds provided WES by the Engineering and Construction Directorate, Headquarters, US Army Corps of Engineers (HQUSACE), under the Computer-Aided Structural Engineering (CASE) Project. Specifications for the program were provided by the members of the CASE Task Group on 3-D Stability. The members of the task group during the initial period of development were as follows:

Mr. Charles Kling, US Army Engineer District, Mobile (Chairman)
Mr. Robert Haavisto, Sacramento District
Mr. John Hoffmeister, Nashville District
Mr. Gerrett Johnson, Seattle District
Mr. Thomas Mudd, St. Louis District
Mr. William Holtham, New England Division

Members of the task group during the latest development were:

Mr. Kling (Chairman)
Mr. Bob Boschert, Sacramento District
Mr. Holtham
Mr. Johnson
Mr. Tom Leicht, St. Louis District
Mr. Lavane Dempsey, St. Paul District

Mr. Donald R. Dressler and Mr. Tony Liu, Structures Branch, Engineering and Construction Directorate, were the HQUSACE points of contact. The work was accomplished at WES under the supervision of Dr. N. Radhakrishnan, Chief, ITL, Mr. Paul Senter, Assistant Chief, ITL, and Dr. Ed Middleton, Chief, CAED. The work was coordinated by Mr. Senter, former CASE Program Manager, and Mr. H. Wayne Jones, CASE Program Manager and Chief, Scientific and Engineering Applications Center, CAED. The report was edited for publication by Ms. Gilda Miller, Information Products Division, ITL, WES.

Wherever references to the following operating systems are made throughout the text of this report, it should be noted that MS-DOS is a registered trademark of Microsoft, Inc., UNIX is a trademark of AT&T, and Intergraph Engineering Workstation is a product of Intergraph Corporation.

Commander and Director of WES during publication of this report was COL Larry B. Fulton, EN. Technical Director was Dr. Robert W. Whalin.

CONTENTS

USER'S GUIDE: A THREE-DIMENTIONAL STABILITY

ANALYSIS/DESIGN PROGRAM (3DSAD)

FREE-BODY MODULE

PART I: OVERVIEW OF THE THREE-DIMENSIONAL STABILITY PROGRAM

Objective

1. The objective of the Computer-Aided Structural Engineering (CASE) Task Group on Three-Dimensional (3-D) Stability Analysis is to develop computer programs to aid design engineers in performing stability computations for general 3-D structures (Tracy 1980; Tracy and Kling 1982; Tracy, Kling, and Holtham 1983; Tracy 1986; Tracy 1987a; Tracy 1987b; and Tracy and Leggett in preparation). To enable this, a computer program called 3DSAD (3-D stability analysis/design) has been developed in a modular fashion. Currently, 3DSAD has four "general" modules:

a. General Geometry Module.

(1) Defines geometry based on two-dimensional (2-D) cross sections extended into the third dimension, eight-node brick elements, or clusters of planar polygons or bicubic patches.

(2) Performs centroid, volume, and weight computations on described geometry.

(3) Employs interactive graphics extensively.

b. General Loads Module.

(1) Computes forces and moments for the defined loads on a general 3-D structure.

(2) Uses all the capabilities of the General Geometry Module to define and display loads as "pressure volumes."

(3) Defines loads as point loads.

(4) Begins with a description of soil and water levels and applies "simplified loads commands" (PC and Intergraph Engineering Workstations only) to define the loads.

(5) Allows the definitions of different load cases.

c. General Analysis Module. This module performs overturning, bearing, and sliding computations for any planar or near planar base.

d. Free-Body Module. This module "clips" the structure and loads by an arbitrary plane to produce a "free body" so that computations can be performed on the new part.

The engineer performing an analysis of any 3-D structure can interact directly with these modules.

2. In addition to the general capabilities that are useful for any 3-D structure, 3DSAD also provides for simplified geometry and load input along with criteria check modules for certain structure types. This latter capability will permit interactive design of these structures. Examples of specific structure types for which modules have been or are being developed are dams, gravity locks, U-frame locks, and intake structure towers.

3. A specific structure input module requires less data than that for a general structure. Modules of this type interact with the General Geometry Module and the General Loads Module to define the geometry and loads internally in the program. After analysis, a specific structure criteria check module verifies pertinent values, changes the dimensions (if necessary), and cycles through the computations. A schematic of this part of the 3DSAD program is shown in Figure 1.

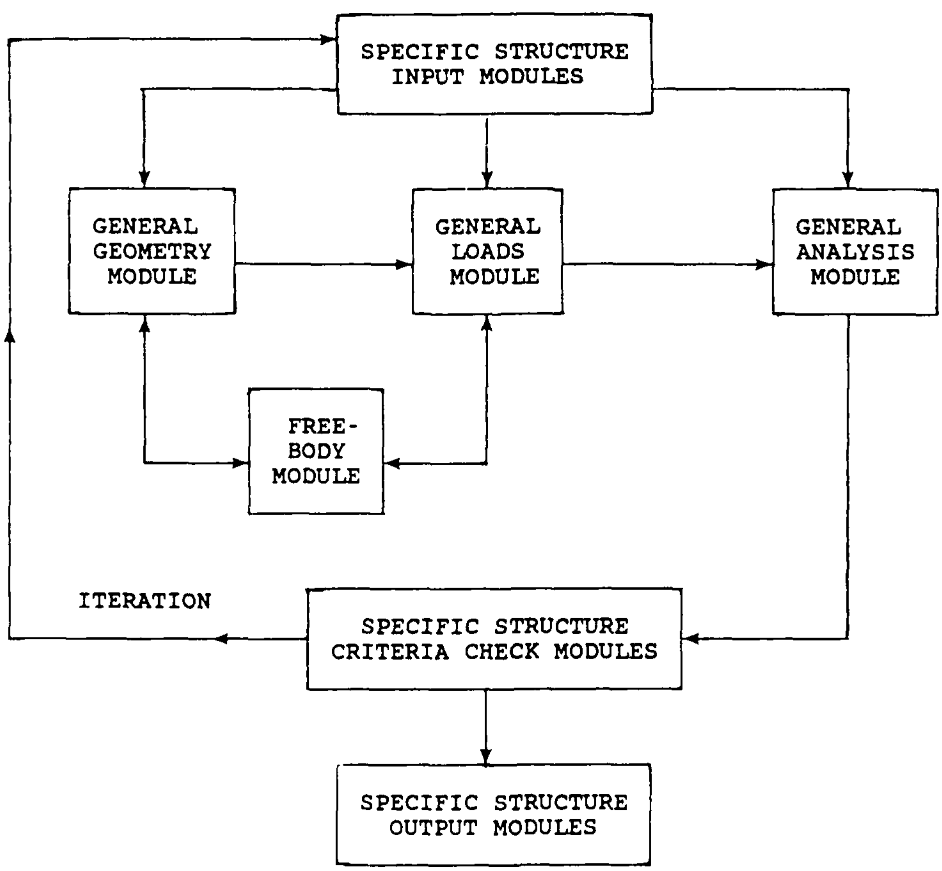

Figure 1. General schematic of 3DSAD

4. The 3DSAD program has been developed in phases. During the first phase, the first three general modules were developed. This approach enabled the stability analysis of any 3-D structure although the input for these general types is more complicated than that for specific structures. In the subsequent phases, the special input and criteria check modules were developed for specific structures. New general modules, such as the Free-Body Module, and enhancements to existing modules have been completed.

The Free-Body Module

5. The practicing engineer not only needs to perform an analysis at the base of the structure but also at other elevations and cross sections. Therefore, the ability to "clip" the structure with a single plane or multiple planes is needed to produce a free body containing a new definition of geometry and loads. The Free-Body Module is a utility written to facilitate this process. Output consists of (a) a file containing the clipped geometry and loads data for use with the General Geometry or General Loads Modules and (b) a base file used with the forces and moments computed from the first data file to perform an analysis with the General Analysis Module. The General Analysis Module is used to produce a base pressure computation which is an approximation of the internal stresses in the structure at the clipping plane. (Note: a more accurate computation of these stresses can be obtained from a finite element method (FEM) solution to the problem.)

PART II: RUNNING THE PROGRAM

Getting Started

6. The user first initiates 3DSAD on his system (details in System Information insert). After initialization, a set of questions are asked and will now be discussed.

STRUCTURE TYPE OR GENERAL MODULE?

7. If the user types a "?", the following message will appear:

```
A THREE-DIM NSIONAL STABILITY ANALYSIS/DESIGN PROGRAM
(3DSAD)

A PRODUCT OF

Computer-Aided Design (CAD) OF STRUCTURAL STABILITY

() () () () () ()

ENTER ?, HELD, OR WHAT TO GET VALID RESPONSES.

ENTER STOP, END, QUIT, OR DONE TO TERMINATE PROGRAM.

STRUCTURE TYPE OR GENERAL MODULE*?
```

The user then issues

FREE

for the Free-Body Module.

Question-and-Answer Sequence

8. Before running the Free-Body Module, the user must save his general geometry and general loads in one or more files. The first question the Free-Body Module asks is

INPUT DATA FILE NAME?

Here the user gives the name of the first of the total number of files to be clipped. The next question is

NUMBER OF CLIPS?

At least one clip must be performed. After this question, any of the same clip commands available in the General Geometry and General Loads Modules are given in response to the question

CLIP COMMAND?

The format of the clip command follows in paragraph 11.

9. So that more than one data file can be clipped, the next question is

NEXT DATA FILE NAME (OR TYPE NONE)?

If the user has no more data files, he should issue NONE at this point. For loads computations, the forces and moments will be computed about a global origin unless another point is specified. The following question allows the user to choose this point.

POINT WHERE FORCES AND MOMENTS ARE TO BE COMPUTED (X, Y, Z)?

The default coordinates are (0, 0, 0).

10. New geometry and loads data resulting from the various clips can be put into a data file for further use. Therefore, the next question to be answered is

FILE NAME FOR CLIPPED GEOMETRY AND LOADS DATA?

If a carraige return or enter is typed, the data file is not saved. With a near horizontal clip, it is also appropriate to save a new base for an analysis using the General Analysis Module. The last question is then

FILE NAME FOR NEW BASE DATA?

As before, if a carriage return or enter is typed, the file is not saved. If file names are assigned, these two files are saved when the Free-Body Module is exited.

"CLIp" Command

11. The "CLIp" command allows the user to cut or clip the geometry and loads by an arbitrary plane to produce a new set of data for performing a free-body analysis. This clipped geometry and loads data are placed into a data file specified by the user. Blocks, bricks, or faces not touched by the clipping plane will be placed untouched in this file. The parts left over from

a clip are converted to faces where the curved parts are modeled by bicubic patches. The possible options of this command are:

```
"CLIp" "X" XVAL NAME
"CLIp" "+X" XVAL NAME
"CLIp" "-X" XVAL NAME
"CLIp" "Y" YVAL NAME
"CLIp" "+Y" YVAL NAME
"CLIp" "-Y" YVAL NAME
"CLIp" "Z" ZVAL NAME
"CLIp" "+Z" ZVAL NAME
"CLIp" "-Z" ZVAL NAME
"CLIp" LAB1 LAB2 LAB3 NAME
```

(Note: Data in quotes are what the user must type, where lower case represents optional characters, and variable names are given in capital letters.)

12. The user can clip parallel to the major axes as shown in the following tabulation.

	Clipping Plane		
Clip command	Direction	Parallel to	Location
"CLIp" "X" XVAL	Vertical	y-z Plane	x = XVAL
"CLIp" "Y" YVAL	Vertical	x-z Plane	y = YVAL
"CLIp" "Z" ZVAL	Horizontal	x-y Plane	z = XVAL

Positive "X", "Y", or "Z" indicates that everything in the positive direction past the specified plane should be kept and the remaining pieces are thrown away; whereas "-X", "-Y", or "-Z" indicates keeping in the negative direction.

13. Clipping can also be accomplished by using three previously defined points in space to define a clipping plane. LAB1, LAB2, and LAB3 are the labels of these three previously defined points in space. If a right-hand screw is advanced in the direction of the specified points, then the screw points in the direction of the data which is retained.

14. NAME results in a specific piece of geometry or loads being clipped, and the unclipped pieces are also placed into the clipped data file. If NAME is not specified, the entire geometry and loads are clipped.

15. The intersection of the clipping plane and geometry data can be saved into a new base data file for use with the General Analysis Module. This file consists of (x, y, z) data points and connectivity data used to define this new base.

Example Problems

16. Two examples illustrating the Free-Body Module are given in the following paragraphs.

Horizontal clip

17. Consider first the simple example of the nonoverflow monolith shown in Figures 2 and 3 and accompanying data files FREEG and FREEL given in Tables 1 and 2, respectively. The problem consists of headwater at 186.5 ft (56.8 m) and tailwater at 122.9 ft (37.46 m). Figure 2 shows a front view of the geometry and pressure volume loads used to model the problem, and Figure 3 shows an isometric view. Table 1 contains the geometric data, and Table 2 the loads data. A clip at z = 150 ft (45.7 m) will be accomplished with forces and moments to be computed at the point (3, 0, 150). The computer run to complete this is as follows:

```
******************************
*  CORPS PROGRAM  #  X8100   *
*        VERSION  # 88/05/16 *
******************************

             3DSAD  -  CASE

STRUCTURE TYPE OR GENERAL MODULE?
FREE

     ENTERING FREE-BODY MODULE.


INPUT DATA FILE NAME?
FREEG

NUMBER OF CLIPS?
1

CLIP COMMAND?
CLIP Z 150

     ENTERING CLIPPING MODULE.

CLIPPING NON1

     EXITING CLIPPING MODULE.

NEXT DATA FILE NAME (OR TYPE NONE)?
FREEL

NUMBER OF CLIPS?
2

CLIP COMMAND?
CLIP Z 150

     ENTERING CLIPPING MODULE.
```

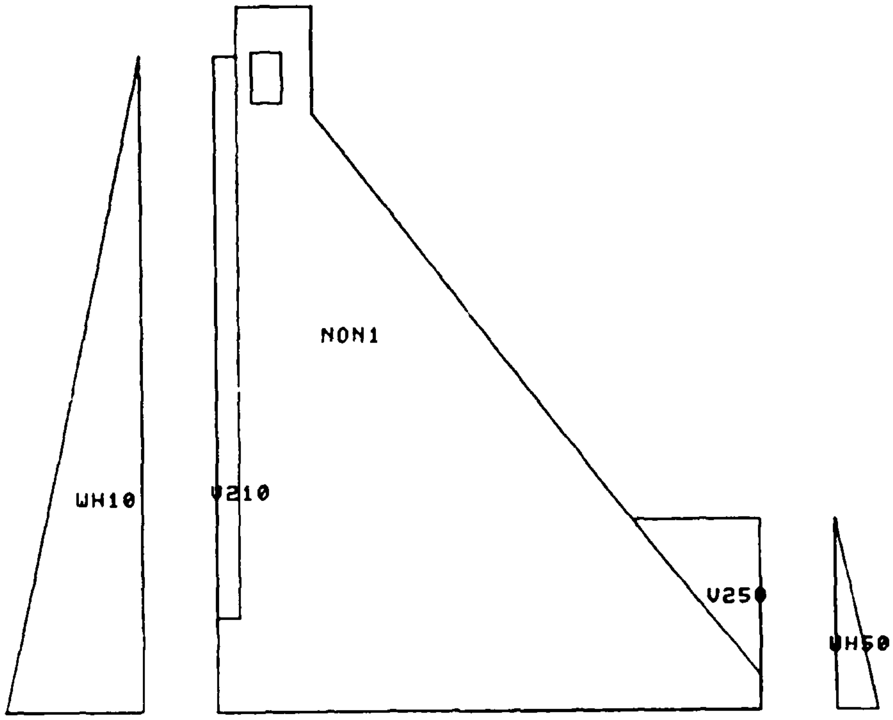

Figure 2. Front view

Table 1

Nonoverflow Monolith Geometry

Data File FREEG

```
20000 POINTS   12
20010      1      0.           0.          95.500
20020      2      0.           0.         109.000
20030      3       3.000       0.         109.000
20070      4       3.000       0.         193.500
20080      5      13.000       0.         193.500
20110      6      13.000       0.         178.500
20120      7      72.280       0.         100.500
20140      8      72.280       0.          95.500
20150      9       5.000       0.         180.000
20160     10       5.000       0.         187.000
20170     11       9.000       0.         187.000
20180     12       9.000       0.         180.000
20190 BLOCK NON1     0.15000      10.000     1
20200        1.000        1.000
20210  8  1  2  3  4  5  6  7  8
20220        1.000        1.000
20230   4 12 11 10  9
```

Table 2

Nonoverflow Monolith Loads

Data File FREEL

```
20000 POINTS    4
20020     1       0.          0.        109.000
20030     2       3.000       0.        109.000
20070     3       3.000       0.        186.500
20080     4       0.          0.        186.500
20090 BLOCK  -Z  V210     0.06250      10.000
20100        1.000        1.000
20110     4    4    3    2    1
20120 POINTS    3
20130     9      72.280       0.        122.900
20140    10      55.256       0.        122.900
20150    11      72.280       0.        100.500
20170 BLOCK  -Z  V250     0.06250      10.000
20180        1.000        1.000
20190     3   11   10    9
20200 POINTS    3
20210    13     -10.000       0.        186.500
20220    14     -10.000       0.         95.500
20230    15     -28.200       0.         95.500
20240 BLOCK  +X  WH10     0.31250      10.000
20250        1.000        1.000
20260     3   13   14   15
20270 POINTS    3
20280    16      10.000       0.        122.900
20290    17      10.000       0.         95.500
20300    18      15.480       0.         95.500
20310 BLOCK  -X  WH50     0.31250      10.000
20320        1.000        1.000
20330     3   18   17   16
20360 TRAN WH50
20370           72.280 0. 0.
20380 COLOR       RED      V210
20390 COLOR       RED      V250
20400 COLOR      CYAN      WH10
20410 COLOR      CYAN      WH50
```

(COLOR commands appearing in example data files are valid for PC and Intergraph engineering workstation only.)

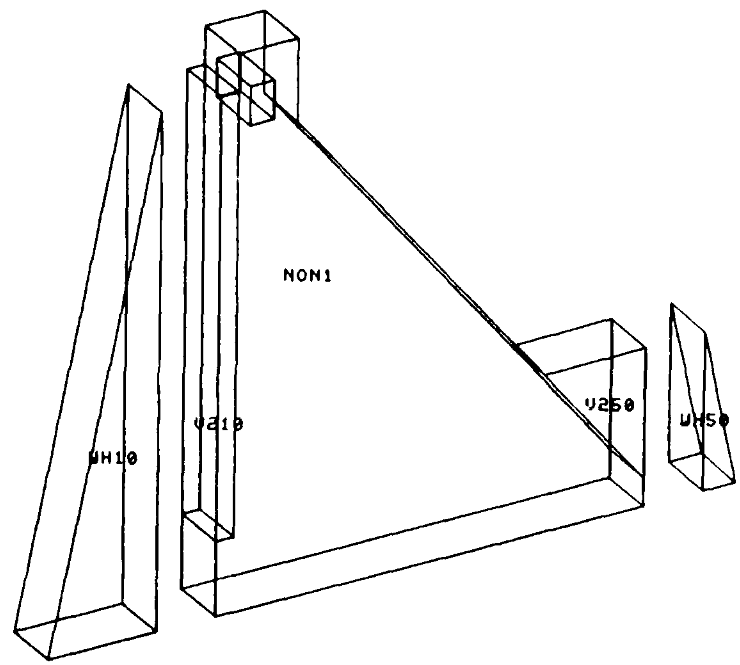

Figure 3. Isometric view

```
CLIPPING V210

CLIPPING V250

CLIPPING WH10

CLIPPING WH50

     EXITING CLIPPING MODULE.

CLIP COMMAND?
CLIP X 3 V210

     ENTERING CLIPPING MODULE.

CLIPPING V210
CLIPPING WH10

     EXITING CLIPPING MODULE.

NEXT DATA FILE NAME (OR TYPE NONE)?
NONE

POINT WHERE FORCES AND MOMENTS ARE TO BE COMPUTED (X, Y, Z)?
3 0 150

FILE NAME FOR CLIPPED GEOMETRY AND LOADS DATA?
FREEC

FILE NAME FOR NEW BASE DATA?
FREEB

     EXITING FREE-BODY MODULE.
```

18. Two clips are needed on the loads file, FREEL, because the heel supporting the vertical load on the upstream side was removed by the first clip, leaving a piece of vertical water load that was discarded by the second clip. The clipped data file FREEC is given in Table 3. FREEC can be read into the General Loads Module, plotted, and the forces and moments computed. The plots given in Figures 4 and 5 and the forces and moments given in Table 4 are generated by the following command sequence:

```
STRUCTURE TYPE OR GENERAL MODULE?
LOADS

      ENTERING GENERAL LOADS MODULE.

RESTART FILE NAME OR CARRIAGE RETURN?
<CR>

OUTPUT FILE NAME OR CARRIAGE RETURN?
<CR>
```

Table 3

Output Data File FREEC

```
20000 POINTS    18
20000    1          3.00           .00        150.00
20000    2          3.00           .00        193.50
20000    3          3.00         10.00        193.50
20000    4          3.00         10.00        150.00
20000    5         13.00           .00        193.50
20000    6         13.00         10.00        193.50
20000    7         13.00           .00        178.50
20000    8         13.00         10.00        178.50
20000    9         34.66           .00        150.00
20000   10         34.66         10.00        150.00
20000   11          5.00           .00        180.00
20000   12          9.00           .00        180.00
20000   13          9.00         10.00        180.00
20000   14          5.00         10.00        180.00
20000   15          9.00           .00        187.00
20000   16          9.00         10.00        187.00
20000   17          5.00           .00        187.00
20000   18          5.00         10.00        187.00
20000 FACE       NON1         .1500    13
20000    4    1    2    3    4
20000    4    2    5    6    3
20000    4    5    7    8    6
20000    4    7    9   10    8
20000    5    9    7    5    2    1
20000    5    4    3    6    8   10
20000    4   11   12   13   14
20000    4   12   15   16   13
20000    4   15   17   18   16
20000    4   17   11   14   18
20000    4   17   15   12   11
20000    4   13   16   18   14
20000    4    4   10    9    1
20000 POINTS     6
20000   19        -10.00           .00        186.50
20000   20        -10.00         10.00        186.50
20000   21        -17.30         10.00        150.00
20000   22        -17.30           .00        150.00
20000   23        -10.00           .00        150.00
20000   24        -10.00         10.00        150.00
20000 COLOR CYAN WH10
20000 FACE    +X WH10         .3125     5
20000    4   19   20   21   22
20000    4   23   24   20   19
20000    3   19   22   23
20000    3   20   24   21
20000    4   24   23   22   21
20000 TRAN
20000    -3.000000    0.000000E+00    -150.000000
```

```
COMMAND?
INPUT FREEC
COMMAND?
LABEL LOADS
COMMAND?
PLOT
COMMAND?
ISOMETRIC
COMMAND?
PLOT
COMMAND?
FORCE ALL
```

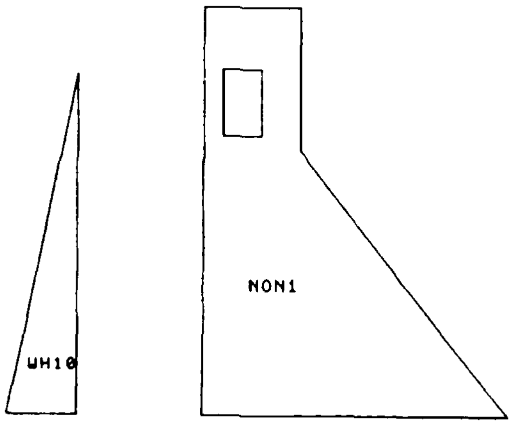

Figure 4. Front view

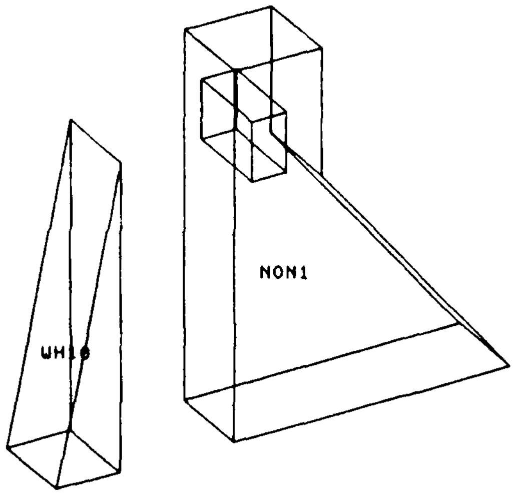

Figure 5. Isometric view

Table 4

Force and Moment Results

NAME	FX MX	FY MY	FZ MZ
NON1	.00	.00	-1073.48
	-5367.41	11067.06	.00
WH10	416.33	.00	.00
	.00	5065.35	-2081.64
TOTAL	416.33	.00	-1073.48
	-5367.41	16132.41	-2081.64

Table 5

Modified Base File FREEB

```
20000 POINTS     4
20000     1        3.00          .00       150.00
20000     9       34.66          .00       150.00
20000    10       34.66        10.00       150.00
20000     4        3.00        10.00       150.00
20000 BASE
20000     4    1    9    10     4
20000 UPLIFT     4
20000     1    2.28
20000     9    0
20000    10    0
20000     4    2.28
20000 PHI     38
20000 SHRSTR     72
20000 CASE    FREE     2
20000    416.33    .00    -1073.48    -5367.41    81802.03    -2081.64
```

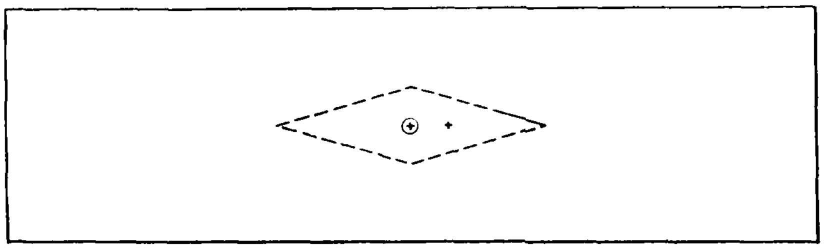

Figure 6. Kern plot

Table 6

Summary of Input Data

LOAD CASE FREE CATEGORY = 2

INPUT FORCES AND MOMENTS EXCLUDING UPLIFT

FX =	416.330	FY =	.000	FZ =	-1073.480
MX =	-5367.4	MY =	81802.0	MZ =	-2081.6

INPUT COORDINATES AND UPLIFT VALUES

NAME	X	Y	Z	UPLIFT
1	3.000	.000	150.000	2.280
2	34.660	.000	150.000	.000
3	34.660	10.000	150.000	.000
4	3.000	10.000	150.000	2.280

PHI =	38.00	SHRSTR =	72.00	SANGLE =	DEFAULT
		DENSITY =	.0625		

Table 7

General Analysis Module Output

LOAD CASE FREE CATEGORY = 2

FINAL BASE AREA PROPERTIES

AREA =	316.600	IXP =	2638.3	IYP =	26445.5
XBAR =	18.830	YBAR =	5.000	ZBAR =	150.000
XYANG =	.000	ZNANG =	.000	PXANG =	.000

SUMMARY OF FINAL FORCES AND MOMENTS

--INPUT--

FX =	416.330	FY =	.000	FZ =	-1073.480
MX =	-5367.4	MY =	81802.0	MZ =	-2081.6

--COMPUTED UPLIFT--

FX =	.000	FY =	.000	FZ =	360.924
MX =	1804.6	MY =	-4891.7	MZ =	.0

--TOTAL--

FX =	416.330	FY =	.000	FZ =	-712.556
MX =	-3562.8	MY =	76910.3	MZ =	-2081.6

FINAL IN PLANE COORDINATES AND BASE PRESSURES

NAME	X	Y	Z	PRESSURE
1	3.000	.000	150.000	1.626
2	34.660	.000	150.000	2.875
3	34.660	10.000	150.000	2.875
4	3.000	10.000	150.000	1.626

FINAL SHEAR FRICTION FACTOR OF SAFETY

PHI =	38.00	SHRSTR =	72.00	SANGLE =	.00

FACTOR OF SAFETY = 56.09

EFFECTIVE BASE = 100.0%

Table 8

Geometry and Loads Data File FREEGL

```
20000 POINTS    16
20010      1      0.           0.         268.000
20020      2      1.500        0.         283.000
20030      3     20.700        0.         283.000
20050      4     20.700        0.         288.940
20060      5     24.230        0.         291.000
20070      6     40.020        0.         282.560
20080      7     54.230        0.         275.000
20890      8     54.230        0.         268.000
20100      9     26.000        0.         275.000
20110     10     26.000        0.         279.000
20120     11     28.000        0.         279.000
20130     12     28.000        0.         275.000
20140     13     34.000        0.         280.000
20150     14     34.000        0.         284.000
20160     15     36.000        0.         284.000
20170     16     36.000        0.         280.000
20180 QUAD     4     5      22.465       0.          290.485
20190 QUAD     5     6      32.125       0.          288.658
20200 CIRC     7     6      28.000 LEFT
20210 CIRC    11    10       1.000 RIGH
20220 BLOCK OVE1     0.15000      32.000     2
20230          1.000        1.000
20240  8   1   2   3   4   5   6   7   8
20250          1.000        1.000
20260   4  12  11  10   9
20270          1.000        1.000
20280   4  16  15  14  13
20290 POINTS    14
20300     17     20.700       13.000     288.940
20310     18     24.230       13.000     291.000
20320     19     40.020       13.000     282.560
20330     20     47.025       13.000     277.500
20340     21     45.010       13.000     297.500
20350     22     40.590       13.000     297.500
20360     23     40.590       13.000     315.670
20370     24     19.920       13.000     315.670
20380     25     19.920       13.000     311.220
20390     26      4.500       13.000     311.220
20400     27      4.500       13.000     291.000
20410     28      1.500       13.000     291.000
20420     29      1.500       13.000     283.000
20430     30     20.700       13.000     283.000
20440 CIRC    20    19      28.000
20450 QUAD    18    19      32.125      13.000     288.658
20460 QUAD    18    17      22.465      13.000     290.485
20470 BLOCK        PIE1     0.15000       6.000
20480          1.000        1.000
20490     14    30    29    28    27    26    25    24    23    22    21    20
20500     19    18    17
20510 POINTS     3
20520     31     24.230        0.         291.000
20540     32     26.369        0.         300.000
20550     33     24.230        0.         291.000
20560 CIRC    32    31      20.000 RIGH
20570 CIRC    32    33      20.000 RIGH
20580 BLOCK   GAT1     0.06250      13.000
```

(Continued)

Table 8 (Concluded)

```
20590        1.000      1.000
20600      3    33   32   31
20610 POINTS     3
20620     34      24.230     19.         291.000
20630     35      26.369     19.         300.000
20640     36      24.230     19.         291.000
20650 CIRC   35   34     20.000 RIGH
20660 CIRC   35   36     20.000 RIGH
20670 BLOCK  GAT2    0.06250     13.000
20680        1.000      1.000
20690      3    34   35   36
20700 color red gat1
20710 color red gat2
20720 color green piel
20730 POINTS     7
20740     37        .000        .000     268.000
20750     38       1.500        .000     283.000
20760     39      20.700        .000     283.000
20770     40      20.700        .000     288.940
20780     41      24.230        .000     291.000
20790     42      24.634        .000     295.000
20800     43        .000        .000     295.000
20810 QUAD   40   41     22.465        .000      290.485
20820 CIRC   42   41     20.000 RIGH
20830 BLOCK  -Z  V210     .06250      13.000
20840        1.000      1.000
20850      7    43   42   41   40   39   38   37
20860 POINTS     7
20870     44        .000      19.000     268.000
20880     45       1.500      19.000     283.000
20890     46      20.700      19.000     283.000
20900     47      20.700      19.000     288.940
20910     48      24.230      19.000     291.000
20920     49      24.634      19.000     295.000
20930     50        .000      19.000     295.000
20940 QUAD   47   48     22.465      19.000      290.485
20950 CIRC   49   48     20.000 RIGH
20960 BLOCK  -Z  V212     .06250      13.000
20970        1.000      1.000
20980      7    50   49   48   47   46   45   44
20990 POINTS     6
21000     51        .000      13.000     268.000
21010     52       1.500      13.000     283.000
21020     53       1.500      13.000     291.000
21030     54       4.500      13.000     291.000
21040     55       4.500      13.000     295.000
21050     56        .000      13.000     295.000
21060 BLOCK  -Z  V211     .06250       6.000
21070        1.000      1.000
21080      6    56   55   54   53   52   51
21090 POINTS     3
21100     57     -10.000        .000     295.000
21110     58     -10.000        .000     268.000
21120     59     -15.400        .000     268.000
21130 BLOCK  +X  WH10     .31250      32.000
21140        1.000      1.000
21150      3    57   58   59
21160 color cyan v210
21170 color cyan v211
21180 color cyan v212
21190 color mage wh10
```

19. If forces and moments are computed about the global origin (0, 0, 0), the results are as in the following tabulation.

NAME	FX MX	FY MY	FZ MZ
TOTAL	416.33 -5367.41	.00 81802.03	-1073.48 -2081.64

These forces and moments can be used along with base data from file FREEB, uplift data, shear strength, and friction angle to perform a General Analysis Module computation. Table 5 shows the modified base file FREEB containing the necessary data. The computer run to produce the output is as follows:

```
*********************************
*  CORPS PROGRAM  #  X8100      *
*        VERSION  # 89/03/01    *
*********************************

STRUCTURE TYPE OR GENERAL MODULE?
ANAL

     ENTERING GENERAL ANALYSIS MODULE.

RESTART FILE NAME OR CR?
<CR>

COMMAND?
INPUT FREEB

DO YOU WISH TO SEE A SUMMARY OF THE ANALYSIS INPUT DATA?
Y

DO YOU WISH TO SEE THE FINAL KERN PLOT?
Y
```

Figure 6 shows the kern plot, Table 6 contains the summary of input data, and Table 7 shows the resulting computations. Since the resultant is inside the kern, the computed pressures are all positive.

Vertical clip

20. The user may desire to perform an analysis on a 1-ft (0.3048 m) cross section of his geometry and loads. Data used to accomplish this task can be generated by using the vertical clip option of the Free-Body Module. To illustrate, consider the data file (called FREEGL) in Table 8 containing a nonoverflow cross section, two gates, a pier, a horizontal water pressure volume, and a vertical water pressure volume. A front and isometric view of this data are shown in Figures 7 and 8. Suppose we wish to compute the forces and moments on a 1-ft (0.3048 m) strip in the very center of the structure (y = 16 ft (4.9 m)). The following execution of the Free-Body Module consisting

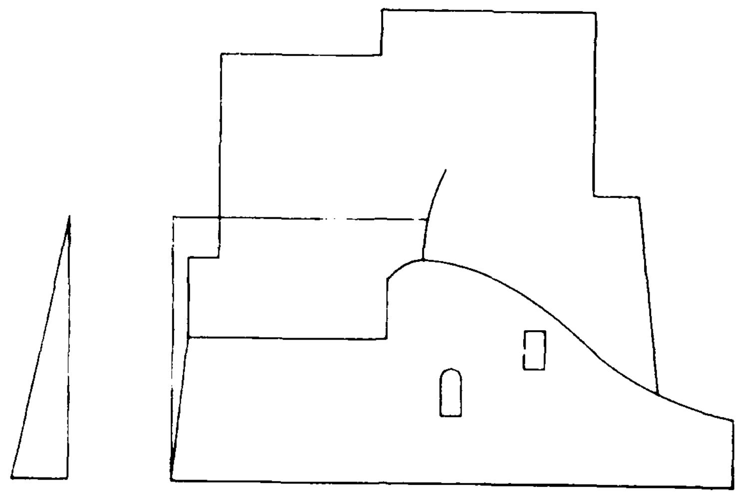

Figure 7. Front view

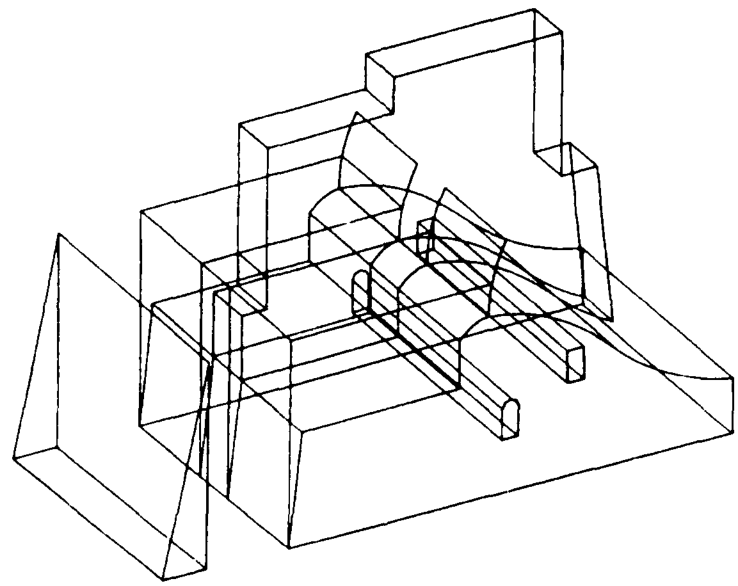

Figure 8. Isometric view

of clips at 15.5 ft (4.7 m) and 16.5 ft (5.0 m) will accomplish this task:

```
**********************************
*  CORPS PROGRAM  #  X8100       *
*        VERSION  # 88/05/16     *
**********************************

STRUCTURE TYPE OR GENERAL MODULE ?
FREE

      ENTERING FREE-BODY MODULE.

INPUT DATA FILE NAME?
FREEGL

NUMBER OF CLIPS?
2
```

```
CLIP COMMAND?
CLIP Y 15.5

     ENTERING CLIPPING MODULE.

CLIPPING OVE1

CLIPPING PIE1

CLIPPING GAT1

CLIPPING GAT2

CLIPPING V210

CLIPPING V212

CLIPPING V211

CLIPPING WH10

     EXITING CLIPPING MODULE.

CLIP COMMAND?
CLIP -Y 16.5

     ENTERING CLIPPING MODULE.

CLIPPING OVE1

CLIPPING PIE1

CLIPPING GAT2

CLIPPING V212

CLIPPING V211

CLIPPING WH10

     EXITING CLIPPING MODULE.

NEXT DATA FILE NAME (OR TYPE NONE) ?
NONE

POINT WHERE FORCES AND MOMENTS ARE TO BE COMPUTED (X, Y, Z)?
0 16 0

FILE NAME FOR CLIPPED GEOMETRY AND LOADS DATA?
FREEC

FILE NAME FOR NEW BASE DATA?
<CR>

     EXITING FREE-BODY MODULE.
```

21. The output file from this run is given in Table 9. As shown in the horizontal clip example, this file can be read into the General Loads Module, plotted, and forces and moments computed. Front and isometric views are given in Figures 9 and 10, and the forces and moments about the point (0, 16, 0) are given in Table 10.

Table 9

Clip Data File FREEC

20000	POINTS	76		
20000	1	24.23	16.50	291.00
20000	2	23.05	16.50	290.77
20000	3	21.88	16.50	290.08
20000	4	20.70	16.50	288.94
20000	5	24.23	16.17	291.00
20000	6	23.05	16.17	290.77
20000	7	21.88	16.17	290.08
20000	8	20.70	16.17	288.94
20000	9	24.23	15.83	291.00
20000	10	23.05	15.83	290.77
20000	11	21.88	15.83	290.08
20000	12	20.70	15.83	288.94
20000	13	24.23	15.50	291.00
20000	14	23.05	15.50	290.77
20000	15	21.88	15.50	290.08
20000	16	20.70	15.50	288.94
20000	17	40.02	16.50	282.56
20000	18	34.76	16.50	287.04
20000	19	29.49	16.50	289.86
20000	20	40.02	16.17	282.56
20000	21	34.76	16.17	287.04
20000	22	29.49	16.17	289.86
20000	23	40.02	15.83	282.56
20000	24	34.76	15.83	287.04
20000	25	29.49	15.83	289.86
20000	26	40.02	15.50	282.56
20000	27	34.76	15.50	287.04
20000	28	29.49	15.50	289.86
20000	29	54.23	16.50	275.00
20000	30	49.03	16.50	276.58
20000	31	44.23	16.50	279.13
20000	32	54.23	16.17	275.00
20000	33	49.03	16.17	276.58
20000	34	44.23	16.17	279.13
20000	35	54.23	15.83	275.00
20000	36	49.03	15.83	276.58
20000	37	44.23	15.83	279.13
20000	38	54.23	15.50	275.00
20000	39	49.03	15.50	276.58
20000	40	44.23	15.50	279.13
20000	41	26.00	16.50	279.00
20000	42	26.50	16.50	279.87
20000	43	27.50	16.50	279.87
20000	44	28.00	16.50	279.00
20000	45	26.00	16.17	279.00
20000	46	26.50	16.17	279.87

(Continued)

(Sheet 1 of 4)

Table 9 (Continued)

20000	47	27.50	16.17	279.87							
20000	48	28.00	16.17	279.00							
20000	49	26.00	15.83	279.00							
20000	50	26.50	15.83	279.87							
20000	51	27.50	15.83	279.87							
20000	52	28.00	15.83	279.00							
20000	53	26.00	15.50	279.00							
20000	54	26.50	15.50	279.87							
20000	55	27.50	15.50	279.87							
20000	56	28.00	15.50	279.00							
20000	57	.00	15.50	268.00							
20000	58	.00	16.50	268.00							
20000	59	54.23	16.50	268.00							
20000	60	54.23	15.50	268.00							
20000	61	1.50	15.50	283.00							
20000	62	1.50	16.50	283.00							
20000	63	20.70	15.50	283.00							
20000	64	20.70	16.50	283.00							
20000	65	28.00	15.50	275.00							
20000	66	28.00	16.50	275.00							
20000	67	26.00	16.50	275.00							
20000	68	26.00	15.50	275.00							
20000	69	36.00	15.50	280.00							
20000	70	36.00	16.50	280.00							
20000	71	34.00	16.50	280.00							
20000	72	34.00	15.50	280.00							
20000	73	36.00	15.50	284.00							
20000	74	36.00	16.50	284.00							
20000	75	34.00	15.50	284.00							
20000	76	34.00	16.50	284.00							
20000	FACE	OVE1	.1500	22							
20000	C	1	2	3	4	5	6	7	8	9	10
20000	11	12	13	14	15	16					
20000	C	17	18	19	1	20	21	22	5	23	24
20000	25	9	26	27	28	13					
20000	C	29	30	31	17	32	33	34	20	35	36
20000	37	23	38	39	40	26					
20000	C	41	42	43	44	45	46	47	48	49	50
20000	51	52	53	54	55	56					
20000	4	57	58	59	60						
20000	4	61	62	58	57						
20000	4	63	64	62	61						
20000	4	16	4	64	63						
20000	4	60	59	29	38						
20000	4	65	66	67	68						
20000	4	56	44	66	65						
20000	4	68	67	41	53						
20000	4	69	70	71	72						
20000	4	73	74	70	69						
20000	4	75	76	74	73						
20000	4	72	71	76	75						
20000	8	38	26	13	16	63	61	57			
20000	60										
20000	4	53	56	65	68						
20000	4	75	73	69	72						
20000	8	1	17	29	59	58	62	64			
20000	4										
20000	4	41	67	66	44						
20000	4	70	74	76	71						
20000	POINTS	60									

(Continued)

(Sheet 2 of 4)

Table 9 (Continued)

20000	77	40.02	16.50	282.56
20000	78	42.18	16.50	280.63
20000	79	44.52	16.50	278.94
20000	80	47.03	16.50	277.50
20000	81	40.02	16.17	282.56
20000	82	42.18	16.17	280.63
20000	83	44.52	16.17	278.94
20000	84	47.03	16.17	277.50
20000	85	40.02	15.84	282.56
20000	86	42.18	15.84	280.63
20000	87	44.52	15.84	278.94
20000	88	47.03	15.84	277.50
20000	89	40.02	15.50	282.56
20000	90	42.18	15.50	280.63
20000	91	44.52	15.50	278.94
20000	92	47.03	15.50	277.50
20000	93	24.23	16.50	291.00
20000	94	29.49	16.50	289.86
20000	95	34.76	16.50	287.04
20000	96	24.23	16.17	291.00
20000	97	29.49	16.17	289.86
20000	98	34.76	16.17	287.04
20000	99	24.23	15.84	291.00
20000	100	29.49	15.84	289.86
20000	101	34.76	15.84	287.04
20000	102	24.23	15.50	291.00
20000	103	29.49	15.50	289.86
20000	104	34.76	15.50	287.04
20000	105	20.70	16.50	288.94
20000	106	21.88	16.50	290.08
20000	107	23.05	16.50	290.77
20000	108	20.70	16.17	288.94
20000	109	21.88	16.17	290.08
20000	110	23.05	16.17	290.77
20000	111	20.70	15.84	288.94
20000	112	21.88	15.84	290.08
20000	113	23.05	15.84	290.77
20000	114	20.70	15.50	288.94
20000	115	21.88	15.50	290.08
20000	116	23.05	15.50	290.77
20000	117	20.70	15.50	283.00
20000	118	20.70	16.50	283.00
20000	119	1.50	15.50	283.00
20000	120	1.50	16.50	283.00
20000	121	1.50	15.50	291.00
20000	122	1.50	16.50	291.00
20000	123	4.50	15.50	291.00
20000	124	4.50	16.50	291.00
20000	125	4.50	15.50	311.22
20000	126	4.50	16.50	311.22
20000	127	19.92	15.50	311.22
20000	128	19.92	16.50	311.22
20000	129	19.92	15.50	315.67
20000	130	19.92	16.50	315.67
20000	131	40.59	15.50	315.67
20000	132	40.59	16.50	315.67
20000	133	40.59	15.50	297.50
20000	134	40.59	16.50	297.50
20000	135	45.01	15.50	297.50
20000	136	45.01	16.50	297.50
20000	COLOR GREE	PIE1		

(Continued)

(Sheet 3 of 4)

Table 9 (Concluded)

```
20000 FACE        PIE1        .1500    16
20000 C     77    78    79    80    81    82    83    84    85    86
20000   87    88    89    90    91    92
20000 C     93    94    95    77    96    97    98    81    99   100
20000   101   85   102   103   104    89
20000 C   105   106   107    93   108   109   110    96   111   112
20000   113    99   114   115   116   102
20000     4   117   118   105   114
20000     4   119   120   118   117
20000     4   121   122   120   119
20000     4   123   124   122   121
20000     4   125   126   124   123
20000     4   127   128   126   125
20000     4   129   130   128   127
20000     4   131   132   130   129
20000     4   133   134   132   131
20000     4   135   136   134   133
20000     4    92    80   136   135
20000    14   102    89    92   135   133   131   129
20000   127   125   123   121   119   117   114
20000    14    77    93   105   118   120   122   124
20000   126   128   130   132   134   136    80
20000 POINTS   12
20000  257          .00        15.50       295.00
20000  258          .00        16.50       295.00
20000  259          .00        16.50       268.00
20000  260          .00        15.50       268.00
20000  261         4.50        15.50       295.00
20000  262         4.50        16.50       295.00
20000  263         4.50        15.50       291.00
20000  264         4.50        16.50       291.00
20000  265         1.50        15.50       291.00
20000  266         1.50        16.50       291.00
20000  267         1.50        15.50       283.00
20000  268         1.50        16.50       283.00
20000 COLOR CYAN V211
20000 FACE    -Z V211        .0625     8
20000     4   257   258   259   260
20000     4   261   262   258   257
20000     4   263   264   262   261
20000     4   265   266   264   263
20000     4   267   268   266   265
20000     4   260   259   268   267
20000     6   267   265   263   261   257   260
20000     6   258   262   264   266   268   259
20000 POINTS    6
20000  269       -10.00        15.50       295.00
20000  270       -10.00        16.50       295.00
20000  271       -15.40        16.50       268.00
20000  272       -15.40        15.50       268.00
20000  273       -10.00        15.50       268.00
20000  274       -10.00        16.50       268.00
20000 COLOR MAGE WH10
20000 FACE    +X WH10        .3125     5
20000     4   269   270   271   272
20000     4   273   274   270   269
20000     4   272   271   274   273
20000     3   273   269   272
20000     3   270   274   271
20000 TRAN
20000       .000   -16.000      .000
```

(Sheet 4 of 4)

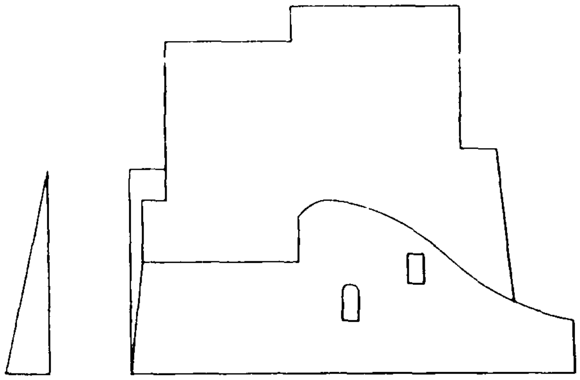

Figure 9. Front view

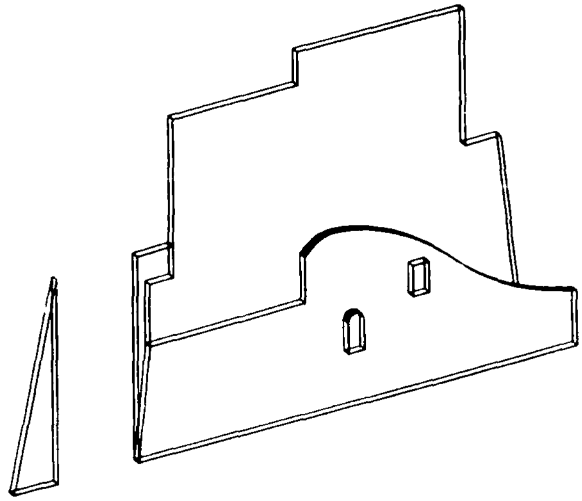

Figure 10. Isometric view

Table 10

Force and Moment Results

NAME	FX MX	FY MY	FZ MZ
OVE1	.00	.00	-122.58
	.00	3138.20	.00
PIE1	.00	.00	-168.77
	.00	4053.59	.00
V211	.00	.00	-2.58
	.00	3.45	.00
WH10	22.78	.00	.00
	.00	6310.41	.00
TOTAL	22.78	.00	-293.93
	.00	13505.64	.00

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	Title	Date
Technical Report K-78-1	List of Computer Programs for Computer-Aided Structural Engineering	Feb 1978
Instruction Report O-79-2	User's Guide: Computer Program with Interactive Graphics for Analysis of Plane Frame Structures (CFRAME)	Mar 1979
Technical Report K-80-1	Survey of Bridge-Oriented Design Software	Jan 1980
Technical Report K-80-2	Evaluation of Computer Programs for the Design/Analysis of Highway and Railway Bridges	Jan 1980
Instruction Report K-80-1	User's Guide: Computer Program for Design/Review of Curvilinear Conduits/Culverts (CURCON)	Feb 1980
Instruction Report K-80-3	A Three-Dimensional Finite Element Data Edit Program	Mar 1980
Instruction Report K-80-4	A Three-Dimensional Stability Analysis/Design Program (3DSAD)	
	Report 1: General Geometry Module	Jun 1980
	Report 3: General Analysis Module (CGAM)	Jun 1982
	Report 4: Special-Purpose Modules for Dams (CDAMS)	Aug 1983
Instruction Report K-80-6	Basic User's Guide: Computer Program for Design and Analysis of Inverted-T Retaining Walls and Floodwalls (TWDA)	Dec 1980
Instruction Report K-80-7	User's Reference Manual: Computer Program for Design and Analysis of Inverted-T Retaining Walls and Floodwalls (TWDA)	Dec 1980
Technical Report K-80-4	Documentation of Finite Element Analyses	
	Report 1: Longview Outlet Works Conduit	Dec 1980
	Report 2: Anchored Wall Monolith, Bay Springs Lock	Dec 1980
Technical Report K-80-5	Basic Pile Group Behavior	Dec 1980
Instruction Report K-81-2	User's Guide: Computer Program for Design and Analysis of Sheet Pile Walls by Classical Methods (CSHTWAL)	
	Report 1: Computational Processes	Feb 1981
	Report 2: Interactive Graphics Options	Mar 1981
Instruction Report K-81-3	Validation Report: Computer Program for Design and Analysis of Inverted-T Retaining Walls and Floodwalls (TWDA)	Feb 1981
Instruction Report K-81-4	User's Guide: Computer Program for Design and Analysis of Cast-in-Place Tunnel Linings (NEWTUN)	Mar 1981
Instruction Report K-81-6	User's Guide: Computer Program for Optimum Nonlinear Dynamic Design of Reinforced Concrete Slabs Under Blast Loading (CBARCS)	Mar 1981
Instruction Report K-81-7	User's Guide: Computer Program for Design or Investigation of Orthogonal Culverts (CORTCUL)	Mar 1981
Instruction Report K-81-9	User's Guide: Computer Program for Three-Dimensional Analysis of Building Systems (CTABS80)	Aug 1981
Technical Report K-81-2	Theoretical Basis for CTABS80: A Computer Program for Three-Dimensional Analysis of Building Systems	Sep 1981
Instruction Report K-82-6	User's Guide: Computor Program for Analysis of Beam-Column Structures with Nonlinear Supports (CBEAMC)	Jun 1982
Instruction Report K-82-7	User's Guide: Computer Program for Bearing Capacity Analysis of Shallow Foundations (CBEAR)	Jun 1982

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WATERWAYS EXPERIMENT STATION REPORTS PUBLISHED UNDER THE COMPUTER-AIDED STRUCTURAL ENGINEERING (CASE) PROJECT

(Continued)

	Title	Date
Instruction Report K-83-1	User's Guide: Computer Program With Interactive Graphics for Analysis of Plane Frame Structures (CFRAME)	Jan 1983
Instruction Report K-83-2	User's Guide: Computer Program for Generation of Engineering Geometry (SKETCH)	Jun 1983
Instruction Report K-83-5	User's Guide: Computer Program to Calculate Shear, Moment, and Thrust (CSMT) from Stress Results of a Two-Dimensional Finite Element Analysis	Jul 1983
Technical Report K-83-1	Basic Pile Group Behavior	Sep 1983
Technical Report K-83-3	Reference Manual: Computer Graphics Program for Generation of Engineering Geometry (SKETCH)	Sep 1983
Technical Report K-83-4	Case Study of Six Major General-Purpose Finite Element Programs	Oct 1983
Instruction Report K-84-2	User's Guide: Computer Program for Optimum Dynamic Design of Nonlinear Metal Plates Under Blast Loading (CSDOOR)	Jan 1984
Instruction Report K-84-7	User's Guide: Computer Program for Determining Induced Stresses and Consolidation Settlements (CSETT)	Aug 1984
Instruction Report K-84-8	Seepage Analysis of Confined Flow Problems by the Method of Fragments (CFRAG)	Sep 1984
Instruction Report K-84-11	User's Guide for Computer Program CGFAG, Concrete General Flexure Analysis with Graphics	Sep 1984
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Instruction Report ITL-87-1	User's Guide: Computer Program for Two-Dimensional Analysis of U-Frame Structures (CUFRAM)	Apr 1987
Instruction Report ITL-87-2	User's Guide: For Concrete Strength Investigation and Design (CASTR) in Accordance with ACI 318-83	May 1987
Technical Report ITL-87-6	Finite-Element Method Package for Solving Steady-State Seepage Problems	May 1987
Instruction Report ITL-87-3	User's Guide: A Three Dimensional Stability Analysis/Design Program (3DSAD) Module	Jun 1987
	Report 1: Revision 1: General Geometry	Jun 1987
	Report 6: Free-Body Module	Sep 1989
Instruction Report ITL-87-4	User's Guide: 2-D Frame Analysis Link Program (LINK2D)	Jun 1987
Technical Report ITL-87-4	Finite Element Studies of a Horizontally Framed Miter Gate	Aug 1987
	Report 1: Initial and Refined Finite Element Models (Phases A, B, and C), Volumes I and II	

(Continued)

SPECIFIC SYSTEM INFORMATION

Introduction

This insert gives specific information for running the Three-Dimensional Stability Analysis/Design (3DSAD) Program on different computer systems.

Description of Program

3DSAD, called X8100 in the Conversationally Oriented Real-Time Program-Generating System (CORPS) Library, is a program for a three-dimensional stability analysis/design of hydraulic structures. The Free-Body Module documented in the enclosed report provides general clipping capability for performing a free-body analysis of a structure and accompanying loads.

Coding and Data Format

3DSAD is written in FORTRAN and is operational on the following systems:

a. US Army Engineer Waterways Experiment Station (WES), Vicksburg, MS, and Division office Honeywell DPS/8.

b. Cybernet Computer Service's CDC Cyber 175.

c. District office Harris 500.

d. DEC VAX systems.

e. Apollo engineering workstation.

f. Intergraph engineering workstation.

g. PC.

Data must be prepared in a data file with line numbers or given interactively without line numbers. Interactive output comes directly back to the terminal or computer monitor, and auxiliary plots are available on a drum plotter or printer, depending on the system. The graphics terminal used with Honeywell, CDC, Harris, and VAX must be a Tektronix 4014 or equivalent.

How to Use 3DSAD

Directions for accessing the program for each of the seven computers is given. It is assumed that the user can sign on or initialize the appropriate system before executing 3DSAD. In the instructions, information given by the computer is in all capitals, and user responses are in boldface type. When actually running the program, each user response is also followed by pressing the "Carriage Return" or "Enter" key.

Honeywell System

After signing on to the system, the user issues the command

FORT

to bring the user to the proper level to execute the program. Next, the user issues the run command

RUN WESLIB/CORPS/X8100,R

to initiate execution of the program. The program is then run as indicated in this user's guide. A data file is typically prepared prior to issuing the run command. An example initiation of execution is as follows:

```
USER ID -- ROMONEY
PASSWORD - SECRET
*FORT
*RUN WESLIB/CORPS/X8100,R
```

Cybernet System

The log-on procedure is followed by a call to the CORPS procedure file to access the CORPS Library as follows:

OLD,CORPS/UN=CECELB

The command

BEGIN,,CORPS,X8100

is then given to initiate execution of 3DSAD. An example is:

```
FAMILY:  KOE
USER NAME:  CEMONEY
PASSWORD -
SECRET
RECOVER/CHARGE:  CHARGE,CER0EGC,CEMONEY
/OLD,CORPS/UN=CECELB
/BEGIN,,CORPS,X8100
```

Harris 500 System

The log-on is followed by a call to the program executable file with the user typing the asterick and file description as follows:

***CORPS,X8100**

to initiate execution of the program. An example is:

ENTER SIGN-ON
1234ABC,STRUCT
***CORPS,X8100**

DEC VAX System

The log-on procedure is followed by executing the program. If 3DSAD is installed under the subdirectory CORPS with the executable file name X8100, type

RUN [CORPS]X8100

to initiate execution of the program. For example,

USERNAME:VOMONEY
PASSWORD:SECRET
$ RUN [CORPS]X8100

Apollo and Intergraph Engineering Workstation

Assuming that 3DSAD is installed under the subdirectory CORPS with the executable file name X8100, then type

/CORPS/X8100

to initiate the program.

PC

3DSAD runs on a PC with the following characteristics:

a. DOS operating system (required).

b. 640K of memory (required).

c. CGA, EGA, or VGA graphics card and monitor (required).

d. Hard disk (required).

e. Math coprocessor (recommended).

Because of its size, 3DSAD is broken into separate versions that are installed as separate executable files. They are:

a. X8100 - Contains CDAMS, basic General Geometry Module, basic General Loads Module, and General Analysis Module.

b. X8100E - Contains enhanced General Geometry and Loads Modules, including full hidden line and continuous tone shaded plot capability and simplified loads commands.

c. X8100F - Contains Free-Body Module and basic General Geometry and Loads Modules with increased dimensions.

d. X8100L - Contains CLOCKS, basic General Geometry Module, basic General Loads Module, and General Analysis Module.

To initiate execution of 3DSAD, go to the subdirectory where the desired executable is stored and type the executable name. For example, to run the Free-Body Module, type

X8100F

How to Use CORPS

The CORPS system contains many other useful programs that may be catalogued from CORPS by use of the LIST command. The command sequence for this on the Honeywell is:

```
RUN WESLIB/CORPS/X8100,R
ENTER COMMAND (HELP, LIST, BRIEF, MESSAGE, EXECUTE, OR STOP)
*?LIST
```

On the Cybernet system the commands are:

```
OLD,CORPS/UN=CECELB
BEGIN,,CORPS
ENTER COMMAND (HELP, LIST, BRIEF, MESSAGE, EXECUTE, OR STOP)
*?LIST
```

On the Harris system the commands are:

```
*CORPS
ARE YOU USING A PRINTER TERMINAL OR CRT?
ENTER P OR C
P
CORPS SYSTEM COMMANDS:
BRIEF - LIST EXPLANATION OF A PROGRAM.
EXECUTE - RUN A CORPS PROGRAM.
LIST - LIST THE AVAILABLE CORPS PROGRAMS.
STOP - EXIT FROM CORPS SYSTEM MACRO.
HELP - HELP AND EXPLANATION OF CORPS SYSTEM
AND THE RUNNING OF THE MACRO.

NOTE:  COMMANDS MAY BE ABBREVIATED TO THE FIRST
       LETTER OF THE COMMAND.

ENTER COMMAND (BRIEF, EXECUTE, LIST, HELP, STOP):
LIST
```

This capability is not yet implemented on the VAX, Apollo, Intergraph, or PC.

WATERWAYS EXPERIMENT STATION REPORTS PUBLISHED UNDER THE COMPUTER-AIDED STRUCTURAL ENGINEERING (CASE) PROJECT

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	Title	Date
Technical Report ITL-87-4	Finite Element Studies of a Horizontally Framed Miter Gate Report 2: Simplified Frame Model (Phase D) Report 3: Alternate Configuration Miter Gate Finite Element Studies—Open Section Report 4: Alternate Configuration Miter Gate Finite Element Studies—Closed Sections Report 5: Alternate Configuration Miter Gate Finite Element Studies—Additional Closed Sections Report 6: Elastic Buckling of Girders in Horizontally Framed Miter Gates Report 7: Application and Summary	Aug 1987
Instruction Report GL-87-1	User's Guide: UTEXAS2 Slope-Stability Package; Volume I, User's Manual	Aug 1987
Instruction Report ITL-87-5	Sliding Stability of Concrete Structures (CSLIDE)	Oct 1987
Instruction Report ITL-87-6	Criteria Specifications for and Validation of a Computer Program for the Design or Investigation of Horizontally Framed Miter Gates (CMITER)	Dec 1987
Technical Report ITL-87-8	Procedure for Static Analysis of Gravity Dams Using the Finite Element Method — Phase Ia	Jan 1988
Instruction Report ITL-88-1	User's Guide: Computer Program for Analysis of Planar Grid Structures (CGRID)	Feb 1988
Technical Report ITL-88-1	Development of Design Formulas for Ribbed Mat Foundations on Expansive Soils	Apr 1988
Technical Report ITL-88-2	User's Guide: Pile Group Graphics Display (CPGG) Post-processor to CPGA Program	Apr 1988
Instruction Report ITL-88-2	User's Guide for Design and Investigation of Horizontally Framed Miter Gates (CMITER)	Jun 1988
Instruction Report ITL-88-4	User's Guide for Revised Computer Program to Calculate Shear, Moment, and Thrust (CSMT)	Sep 1988
Instruction Report GL-87-1	User's Guide: UTEXAS2 Slope-Stability Package; Volume II, Theory	Feb 1989
Technical Report ITL-89-3	User's Guide: Pile Group Analysis (CPGA) Computer Group	Jul 1989
Technical Report ITL-89-4	CBASIN--Structural Design of Saint Anthony Falls Stilling Basins According to Corps of Engineers Criteria for Hydraulic Structures; Computer Program X0098	Aug 1989
Technical Report ITL-89-5	CCHAN--Structural Design of Rectangular Channels According to Corps of Engineers Criteria for Hydraulic Structures; Computer Program X0097	Aug 1989
Technical Report ITL-89-6	The Response-Spectrum Dynamic Analysis of Gravity Dams Using the Finite Element Method; Phase II	Aug 1989