# APPENDIX A - TABLES

## TABLE OF CONTENTS

# APPENDIX A - TABLES

Table A-1

$K_D$ Values for Use in Determining Armor Unit Weight (Source: EM 1110-2-2904)

| Armor Units | n[2] | Placement | Structure Trunk[7] Breaking Wave | Structure Trunk[7] Nonbreaking Wave | Structure Head Breaking Wave | Structure Head Nonbreaking Wave | Slope cot θ |
|---|---|---|---|---|---|---|---|
| Quarrystone | | | | | | | |
| Smooth rounded | 2 | Random | 1.2[1] | 2.4 | 1.1[1] | 1.9 | 1.5-3.0[8] |
| Smooth rounded | >3 | Random | 1.6[1] | 3.2[1] | 1.4[1] | 2.3[1] | 1.5-3.0[8] |
| Rough angular | 1 | Random[3] | ---[3] | 2.9[1] | ---[3] | 2.3[1] | 1.5-3.0[8] |
| Rough angular | 2 | Random | 2.0 | 4.0 | 1.9[1]<br>1.6[1]<br>1.3 | 3.2<br>2.8<br>2.3 | 1.5<br>2.0<br>3.0 |
| Rough angular | >3 | Random | 2.2[1] | 4.5[1] | 2.1[1] | 4.2[1] | 1.5-3.0[8] |
| Rough angular | 2 | Special[4] | 5.8 | 7.0 | 5.3[1] | 6.4 | 1.5-3.0[8] |
| Parallelepiped[9] | 2 | Special | 7.0 - 20.0 | 8.5 - 24.0[1] | --- | --- | 1.0-3.0 |
| Tetrapod and Quadripod | 2 | Random | 7.0 | 8.0 | 5.0[1]<br>4.5[1]<br>3.5[1] | 6.0<br>5.5<br>4.0 | 1.5<br>2.0<br>3.0 |
| Tribar | 2 | Random | 9.0[1] | 10.0 | 8.3[1]<br>7.8[1]<br>6.0 | 9.0<br>8.5<br>6.5 | 1.5<br>2.0<br>3.0 |
| Dolos | 2 | Random | 15.0[6] | 31.0[6] | 8.0[1]<br>7.0 | 16.0[1]<br>14.0[1] | 2.0[5]<br>3.0 |
| Modified cube | 2 | Random | 6.5[1] | 7.5 | --- | 5.0[1] | 1.5-3.0[8] |
| Hexapod | 2 | Random | 8.0[1] | 9.5 | 5.0[1] | 7.0[1] | 1.5-3.0[8] |
| Toskane | 2 | Random | 11.0[1] | 22.0 | --- | --- | 1.5-3.0[8] |
| Tribar | 1 | Uniform | 12.0 | 15.0 | 7.5[1] | 9.5[1] | 1.5-3.0[8] |
| Quarrystone - graded angular riprap | - | Random | 2.2 | 2.5 | --- | --- | --- |

(1) CAUTION: These $K_D$ values are unsupported and are provided only for preliminary design.

(2) n is the number of units comprising the thickness of the armor layer.

(3) The use of single layer of quarrystone armor units is not recommended for structures subject to breaking waves, and only under special conditions for structures subject to nonbreaking waves. When it is used, the stone should be carefully placed.

(4) Special placement with long axis of stone placed perpendicular to structure face.

(5) Stability of dolosse on slopes steeper than 1 on 2 should be substantiated by site-specific tests.

(6) Refers to no-damage criteria (<5 percent displacement, rocking, etc.); if no rocking (<2 percent) is desired, reduce $K_D$ 50 percent (Zwamborn and Van Niekerk, 1982).

(7) Applicable to slopes ranging from 1 on 1.5 to 1 on 5.

(8) Until more information is available, the use of $K_D$ should be limited to slopes ranging from 1 on 1.5 to 1 on 3. Some armor units tested on a structure head indicate a $K_D$-slope dependence.

(9) Parallelepiped-shaped stone: long slab-like stone with long dimension approximately three times the shortest dimension (Markle and Davidson, 1979).

## Table A-2

| Layer Coefficient and Porosity for Various Armor Units (Source: SPM) | | | | |
|---|---|---|---|---|
| Armor Unit | n | Placement | Layer Coefficient | Porosity % |
| Quarrystone (smooth) | 2 | Random | 1.02 | 38 |
| Quarrystone (rough) | 2 | Random | 1.00 | 37 |
| Quarrystone (rough) | >3 | Random | 1.00 | 40 |
| Quarrystone (parallelepiped) | 2 | Special | - | 27 |
| Cube (modified) | 2 | Random | 1.10 | 47 |
| Tetrapod | 2 | Random | 1.04 | 50 |
| Quadripod | 2 | Random | 0.95 | 49 |
| Hexipod | 2 | Random | 1.15 | 47 |
| Tribar | 2 | Random | 1.02 | 54 |
| Dolos | 2 | Random | 0.94 | 56 |
| Toskane | 2 | Random | 1.03 | 52 |
| Tribar | 1 | Uniform | 1.13 | 47 |
| Quarrystone | Graded | Random | - | 37 |

## Table A-3

| Rough Slope Run-Up Coefficients (Source: Smith, 1986) | | |
|---|---|---|
| Armor Material | a | b |
| Riprap | 0.956 | 0.398 |
| Rubble (Permeable - No Core) | 0.692 | 0.504 |
| Rubble (2 Layers - Impermeable Core) | 0.775 | 0.361 |
| Modified Cubes | 0.950 | 0.690 |
| Tetrapods | 1.010 | 0.910 |
| Quadripods | 0.590 | 0.350 |
| Hexapods | 0.820 | 0.630 |
| Tribars | 1.810 | 1.570 |
| Dolosse | 0.988 | 0.703 |

## Table A-4

### Grain-Size Scales (Soil Classification)

| Unified Soils Classification | ASTM Mesh | PHI | MM | Wentworth Classification | |
|---|---|---|---|---|---|
| Cobble | | -8.00 | 256.00 | Cobble | |
| | | -7.00 | 128.00 | | |
| | | -6.75 | 107.60 | | |
| | | -6.50 | 90.51 | | |
| | | -6.25 | 76.11 | | |
| | | -6.00 | 64.00 | | |
| | | -5.75 | 53.82 | | |
| Coarse Gravel | | -5.50 | 45.26 | | G |
| | | -5.25 | 38.06 | | R |
| | | -5.00 | 32.00 | | A |
| | | -4.75 | 26.91 | | |
| | | -4.50 | 22.63 | | V |
| | | -4.25 | 19.00 | | |
| | | -4.00 | 16.00 | Pebble | E |
| | | -3.75 | 13.45 | | |
| Fine Gravel | | -3.50 | 11.31 | | L |
| | | -3.25 | 9.51 | | |
| | 2.5 | -3.00 | 8.00 | | |
| | 3 | -2.75 | 6.73 | | |
| | 3.5 | -2.50 | 5.66 | | |
| | 4 | -2.25 | 4.76 | | |
| | 5 | -2.00 | 4.00 | | |
| Coarse | 6 | -1.75 | 3.36 | | |
| | 7 | -1.50 | 2.83 | Granule | |
| | 8 | -1.25 | 2.38 | | |
| | 10 | -1.00 | 2.00 | | |
| | 12 | -0.75 | 1.68 | | |
| | 14 | -0.50 | 1.41 | Very Course | |
| | 16 | -0.25 | 1.19 | | |
| S Medium | 18 | 0.00 | 1.00 | | |
| A | 20 | 0.25 | 0.84 | | |
| | 25 | 0.50 | 0.71 | Coarse | |
| N | 30 | 0.75 | 0.59 | | S |
| | 35 | 1.00 | 0.50 | | |
| D | 40 | 1.25 | 0.42 | | A |
| | 45 | 1.50 | 0.35 | Medium | |
| | 50 | 1.75 | 0.30 | | N |
| | 60 | 2.00 | 0.25 | | |
| | 70 | 2.25 | 0.21 | | D |
| Fine | 80 | 2.50 | 0.177 | Fine | |
| | 100 | 2.75 | 0.149 | | |
| | 120 | 3.00 | 0.125 | | |
| | 140 | 3.25 | 0.105 | | |
| | 170 | 3.50 | 0.088 | Very Fine | |
| | 200 | 3.75 | 0.074 | | |
| | 230 | 4.00 | 0.0625 | | |
| | 270 | 4.25 | 0.0526 | | |
| | 325 | 4.50 | 0.0442 | | |
| Silt | 400 | 4.75 | 0.0372 | Silt | M |
| | | 5.00 | 0.0313 | | |
| | | 6.00 | 0.0156 | | U |
| | | 7.00 | 0.0078 | | |
| | | 8.00 | 0.0039 | | D |
| | | 9.00 | 0.0020 | | |
| Clay | | 10.00 | 0.0009 | Clay | |
| | | 12.00 | 0.0002 | | |

## Table A-5

| Major Tidal Constituents | | |
|---|---|---|
| Symbol | Constituent Name | Frequency (degrees/hour) |
| $M_2$ | Lunar semidiurnal | 28.984 |
| $S_2$ | Principal solar semidiurnal | 30.000 |
| $N_2$ | Larger lunar elliptic semidiurnal | 28.439 |
| $K_1$ | Lunisolar diurnal | 15.041 |
| $M_4$ | Shallow-water overtide of principal lunar | 57.968 |
| $O_1$ | Principal lunar diurnal | 13.943 |
| $M_6$ | Shallow-water overtide of principal lunar | 86.952 |
| $MK_3$ | Shallow-water compound | 44.025 |
| $S_4$ | Shallow-water overtide of principal solar | 60.000 |
| $MN_4$ | Shallow-water compound | 57.423 |
| $\nu 2$ | Larger lunar evectional | 28.512 |
| $S_6$ | Shallow-water overtide of principal solar | 90.000 |
| $\mu 2$ | Variational | 27.968 |
| $2N_2$ | Lunar elliptic semidiurnal (second order) | 27.895 |
| $OO_1$ | Lunar diurnal (second order) | 16.139 |
| $\lambda 2$ | Smaller lunar evectional | 29.455 |
| $S_1$ | Solar diurnal | 15.000 |
| $M_1$ | Smaller lunar elliptic diurnal | 14.496 |
| $J_1$ | Smaller lunar elliptic diurnal | 15.585 |
| $M_m$ | Lunar monthly | 0.544 |
| $S_{sa}$ | Solar semidiurnal | 0.082 |
| $S_a$ | Solar annual | 0.041 |
| $M_{sf}$ | Lunisolar synodic fortnightly | 1.015 |
| $M_f$ | Lunar fortnightly | 1.098 |
| $\rho 1$ | Larger lunar evectional diurnal | 13.471 |
| $Q_1$ | Larger lunar elliptic diurnal | 13.398 |
| $T_2$ | Larger solar elliptic | 29.958 |
| $R_2$ | Smaller solar elliptic | 30.041 |
| $2Q_1$ | Lunar elliptic diurnal (second order) | 12.854 |
| $P_1$ | Solar diurnal | 14.958 |
| $2SM_2$ | Shallow-water compound | 31.015 |
| $M_3$ | Lunar terdiurnal | 43.476 |
| $L_2$ | Smaller lunar elliptic semidiurnal | 29.528 |
| $2MK_3$ | Shallow-water compound | 42.927 |
| $K_2$ | Lunisolar semidiurnal | 30.082 |
| $M_8$ | Shallow-water overtide of principal lunar | 115.936 |
| $MS_4$ | Shallow-water compound | 58.984 |

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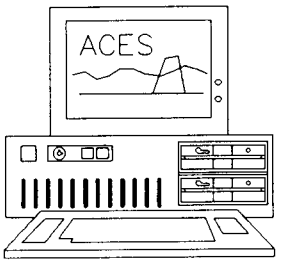
# APPENDIX B - HARDWARE AND INSTALLATION

## TABLE OF CONTENTS

# APPENDIX B - HARDWARE AND INSTALLATION

## HARDWARE




The Automated Coastal Engineering System (ACES) is designed to run on IBM PC-AT (or compatible) machines having the following configuration:

640 Kb memory
80287 math co-processor

The screen displays in ACES are designed in color. A color adaptor and monitor (VGA, EGA, PGA, or CGA) are preferable. Some monochrome display adaptors and monitors will also work. A printer is preferable, but not required.

Tables B-1 through B-3 list the hardware devices (graphics adaptors, printers, and plotters) that are supported by the graphics software.

| Table B-1. Supported Graphics Adaptors (Resolution and Colors) |
|---|
| Color Graphics Adaptor (CGA) |
| Enhanced Graphics Adaptor (EGA) |
| Monochrome Display (640 x 350; 4 colors) |
| Color Display (640 x 200; 16 colors) |
| Enhanced Color Display (640 x 200; 16 colors) |
| NEC GB-1 with Multi-Frequency Monitor (640 x 480; 16/64 colors) |
| EVEREX EVGA with Multi-Frequency Monitor (800 x 600; 16/64 colors) |
| Video Graphics Adaptor (VGA) |
| Analog Monitor (640 x 480; 16/256 colors) |
| Video 7 with Multi-Frequency Analog Monitor (720 x 640; 16/256 colors) |
| Video 7 with Multi-Frequency Analog Monitor (800 x 600; 16/256 colors) |
| ORCHID/GENOA with Multi-Frequency Analog Monitor (800 x 600; 16/256 colors) |
| AST/PARADISE with Multi-Frequency Analog Monitor (800 x 600; 16/256 colors) |
| Other Graphics Adaptors |
| Hercules (720 x 348; 2 colors) |
| COMPAQ Portable III with Gas Plasma Display (640 x 400; 2 colors) |

| Table B-2. Supported Printers |
|---|
| IBM Graphics |
| Epson FX/RX Series |
| HP LaserJet |
| HP PaintJet |

| Table B-3. Supported Plotters |
|---|
| HP-Compatible 2-Pen Plotter |
| HP-Compatible 6-Pen Plotter |
| HP-Compatible 8-Pen Plotter |

## INSTALLATION

Installation of this version of ACES requires installing ACES in a specified directory and customizing the graphics setup. The next two sections describe these installation procedures.

### ACES Software Installation

The ACES software is distributed on one high-density (1.2-Mb) diskette. To install ACES on a hard disk requires creating a directory where ACES will reside, and de-archiving the files on the ACES diskette to that directory. These steps are detailed below.

1. Use the DOS **MD** or **MKDIR** command to create a subdirectory in which the ACES files will reside. The example below assumes that the subdirectory will be called **ACES107** and will be a subdirectory of the *root* directory on the **C:** drive.

   **CD C:** (go to the root directory)

   **MD C:\ACES107** [ENTER] (create a new directory called ACES107)

   **CD \ACES107** [ENTER] (move into the new directory)

2. Insert the ACES disk in Drive A and type:

   **A:PKXARC A:*.ARC** ENTER

   ACES will now be installed in subdirectory ACES107. Refer to the section of Appendix B titled **Graphics Software Installation** for instructions for installing the ACES graphics capability.

3. Any last-minute changes or additions to the ACES Program are documented in a file called **README**. Review this file and make note of any changes. To display the **README** file, type:

   **TYPE README | MORE** ENTER

4. For ACES to run properly, the configuration file **CONFIG.SYS** must contain the following two statements:

   FILES=n
   BUFFERS=n

   where n is greater than or equal to 20. If n is less than 20, edit the **CONFIG.SYS** file and reboot DOS.

5. To run the ACES program, type:

   **ACES** ENTER

---

### Graphics Software Installation

The graphics capabilities of this version of ACES must be installed with a special program called **INSTALL.COM**. The following section provides an example installation using the program **INSTALL.COM**.

### Example of Graphics Software Installation

A typical interactive session for **INSTALL.COM** is described below. Please note that all user responses are highlighted in **boldface type**. Standard default options (inside brackets [ ]) can be selected by pressing [ENTER] from the keyboard. This example installation assumes the following configuration to be installed:

- Enhanced Graphics Adaptor (EGA)
- Resolution (640 x 350)
- Supporting 16 colors
- Plotter Type - HP compatible 8-pen plotter (COM1:)
- Printer Type - Hewlett Packard (HP) Laserjet (LPT1:)

The graphics software may be installed by following these steps (user responses are highlighted in **boldface type**):

1. C:\ACES107> **INSTALL** [ENTER]

2. Enter the code for the display adaptor that matches your system:

   0) Monochrome Display Adaptor (No graphics)

   1) Color Graphics Adaptor (CGA)

   2) Enhanced Graphics Adaptor (EGA)

   3) Video Graphics Adaptor (VGA)

   4) Other

   Enter selection [1] .... **2** [ENTER]

3. Enter the code for the EGA and display monitor that matches your system:

| | Resolution and Colors |
|---|---|
| 0) Return to previous menu | |
| 1) Enhanced Graphics Adaptor w/ Monochrome Display | 640 x 350 x 4 |
| 2) Enhanced Graphics Adaptor w/ Color Display | 640 x 200 x 16 |
| 3) Enhanced Graphics Adaptor w/ Enhanced Color Display, 64K | 640 x 200 x 16 |
| 4) Enhanced Graphics Adaptor w/ Enhanced Color Display, >64K | 640 x 350 x 16/64 |
| 5) NEC GB-1 EGA w/ multi-frequency monitor | 640 x 480 x 16/64 |
| 6) Everex EVGA w/ multi-frequency monitor | 800 x 600 x 16/64 |

Enter selection [0] .... **4** ENTER

4. Select a pen plotter:
   0) No Plotter
   1) HP-compatible 2-pen plotter
   2) HP-compatible 6-pen plotter
   3) HP-compatible 8-pen plotter

   Enter selection [0] .... **3** ENTER

5. Select a graphics printer:
   0) No Printer
   1) IBM Graphics
   2) Epson FX/RX Series
   3) HP LaserJet
   4) HP PaintJet

   Enter selection [1] .... **3** ENTER

6. Select plotter port:

   1) COM1: 2) COM2: 3) LPT1: 4) LPT2: 5) LPT3:

   Enter selection [1] .... **1** ENTER

7. Select printer port:

   1) LPT1: 2) LPT2: 3) LPT3:

   Enter selection [1] .... **1** ENTER

   Please wait ...

   Finished installing ACES.EXE & INSTALL 4.5...21 Nov 1989

   NOTE: Before sending graphics to a plotter, be sure to type

   MODE COM1:(rate),n,8,1,p

   where (rate) is the baud rate to which the plotter is set with the switches on the rear panel.

# APPENDIX C - GRAPHICS OPTIONS

## TABLE OF CONTENTS

# APPENDIX C - GRAPHICS OPTIONS

## INTRODUCTION

A simple graph often can reveal information that is not immediately apparent in a table. The Automated Coastal Engineering System (ACES) has the capability to instantly create and modify graphs for certain applications. This appendix of the *User's Guide* describes how to create, customize, and print graphs. For installation of the graphics capability, see Appendix B.

## MAIN GRAPHICS OPTIONS MENU

For ACES applications providing graphics capabilities, the Main Graphics Options Menu appears at the bottom of the screen below each plot. The current option is highlighted for identification. Options may be accessed by using the ⟨- and -⟩ keys from the keyboard. Options may also be accessed by typing the first letter of the option name. The graphics software also supports a mouse (Microsoft Mouse compatible), which can be used as an input device. The main graphics options available are shown in Table C-1. A description of each option (and suboptions) is given in the sections that follow.

Table C-1. Graphics Options

| Option | Description | Default |
|---|---|---|
| Scal | AUTOMATIC or USER-DEFINED SCALING | Automatic |
| Grid | GRIDAXIS Toggle Switch | tic axis |
| Colr | Change COLOR of Each Curve | |
| Dump | SCREEN DUMP to Installed Printer | |
| Styl | Change LINE & MARKER STYLES of Each Curve | Solid Line |
| Legn | Relocate the LEGEND | |
| Axis | AXIS TYPE - Linear/Log | Linear |
| Read | READ POINTS from the Selected Curve | |
| Devi | Select OUTPUT DEVICE - Screen, Plotter, HPGL file | Screen |
| Wind | WINDOW the Current Plot | All |
| Zero | ZERO LINE DISPLAY Toggle Switch | |
| Next | NEXT Plot | |
| Quit | Return to Current ACES Application | |

### Scal

Automatic (computer-generated) or user-defined scaling may be selected for the current display. Suboptions available under **Scal** are:

**(a) Automatic** - This is the default case. Minimums and maximums are computed for both X and Y from the data selected for plotting. These values (xmin, xmax, ymin, ymax) become the window for the current display.

**(b) User-Defined** - A user-defined scale may be selected. The current minimum and maximum values for both X and Y are displayed (inside parentheses) at the bottom of the screen. These may be changed to new values or selected with a carriage return to accept the current value shown. The revised plot is then displayed.

**(c) Ret** - Program control is returned to the Main Graphics Options Menu.

---

### Grid

This option allows switching (toggling) between *tic* axes (the default) and *grid* generated axes for the plot. Since the default plot uses *tic* axes, the first time this option is selected, *grid* axes will be generated for both the X- and Y-axes. Again selecting this option returns the axis to the default or *tic* axes display.

**NOTE:** The selected axis type remains in effect for all subsequent plots for a particular application unless changed with this option.

---

### Colr

The color of each curve on the display can be changed. **Colr** options are displayed across the bottom of the screen. Suboptions available under **Colr** are:

**(a) - 0,1,2,...,15** - These numbers represent colors supported by this graphics software. The color name for each number is displayed in the lower left corner of the screen just above the numbers.

> **NOTE:** If a color is not supported by the graphics adapter (see Table B-1 in Appendix B), the curve will retain its original color. The color **black** can be used to *blackout* or temporarily delete a particular curve.

**(b) - Plt** - Replot the graph after changes have been made.

**(c) - Ret** - Control is returned to the Main Graphics Options Menu.

The ⟵ and ⟶ keys are used to move the highlighted box to the number representing the desired color. Press ENTER to select the highlighted color for the curve. This process can be repeated for the remaining curves on the graph. The suboption **Plt** will replot the graph with the new color selections.

> **NOTE:** The curve that is to be changed is identified in the upper left corner of the screen, and its current color number is highlighted at the bottom of the screen. Press ENTER if no change in the curve color is desired.

---

### Dump

A screen image of the current display (without the Main Graphics Options Menu) is sent to the installed printer. Program control is temporarily suspended until printing is completed.

> **NOTE:** If no printer has been installed, a message will be displayed at the bottom of the screen. Press ENTER to return to the Main Graphics Options Menu.

---

### Styl

The *Line Styles* and/or *Marker Types* of each curve on the current display can be changed. The suboptions available under **Styl** are displayed across the bottom of the screen. Suboptions are:

**(a) Line Styles - 0,1,2,...,6** - These numbers represent the *Line Styles* supported by this graphics software. A *Line Styles* description for each number is displayed in the lower left corner of the screen just above the numbers. The *Line Styles* supported are:

0 - No Line (Points Only)
1 - Solid Line (Default)
2 - Long Dashed Line
3 - Dotted Line
4 - Dashed Dotted Line
5 - Medium Dashed Line
6 - Dash Dot Dot Line
Ret - Program control is returned to the **Styl** Options Menu.

The ⟨-⟩ and ⟨->⟩ keys are used to move the highlighted box to the desired *Line Styles* number. Press [ENTER] to select the highlighted *Line Style*. This process can be repeated for the remaining curves on the graph. The suboption **Plt** will replot the graph with the new *Line Styles*. The suboption **Ret** will return to the **Styl** Options Menu.

**NOTE:** The curve that is to be affected by the *Line Styles* change is identified in the upper-left corner of the screen, and its current *Line Style* number is highlighted at the bottom of the screen. Press [ENTER] if no change in the curve *Style* is desired.

**(b) Marker Types - 0,1,2,...,6** - These numbers represent the *Marker Types* supported by this graphics software. A *Marker Types* description for each number is displayed in the lower-left corner of the screen just above the numbers. The *Marker Types* supported are:

0 - No Marker (Default)
1 - Dot

2 - Cross
3 - Star
4 - Square
5 - X
6 - Diamond
Ret - Program control is returned to the **Styl** Options Menu.

The ⟨-⟩ and ⟨->⟩ keys are used to move the highlighted box to the desired *Marker Types* number. Pressing [ENTER] will select the highlighted *Marker Types*. This process can be repeated for the remaining curves on the graph. The suboption **Plt** will replot the graph with the new *Marker Types*. The suboption **Ret** will return to the **Styl** Options Menu.

> **NOTE:** The curve that is to be affected by the *Marker Types* change is identified in the upper-left corner of the screen and its current *Marker Type* number is highlighted at the bottom of the screen. Press [ENTER] if no change in the curve *Marker* is desired.

**(c) Plt** - Replot the graph after changes have been made.

**(d) Ret** - Program control is returned to the Main Graphics Options Menu.

---

**Legn**

The legend may be moved to any position on the current display. When this option is selected, cross hairs appear on the screen at the upper-left corner of the legend. The arrow keys may be used to position the cross hairs at a new location. Press [ENTER] to display the revised plot.

> **NOTE:** The new legend position remains in effect for all remaining plots of the current application unless changed with this option.

---

### Axis

This option allows the flexibility of switching to logarithmic or linear coordinate systems for the selected data.

> **NOTE:** If the data contain negative values which cannot be scaled into logarithmic coordinates, a message will appear on the screen stating that no logarithmic axis can be drawn. The resulting plot is then displayed with a linear coordinate system (default).

Suboptions available under **Axis** are:

**(a) Lin X-Lin Y** - This is the default case. The coordinate system is linear for both the X- and Y-axes.

**(b) Lin X-Log Y** - The coordinate system is linear for the X-axis and logarithmic (base 10) for the Y-axis.

**(c) Log X-Lin Y** - The coordinate system is logarithmic (base 10) for the X-axis and linear for the Y-axis.

**(d) Log X-Log Y** - The coordinate system is logarithmic (base 10) for both the X- and Y-axes.

**(e) Ret** - Program Control is returned to the Main Graphics Options Menu.

---

### Read

This option displays the estimated $y$ value for a corresponding $x$ value for each curve. At the prompt, an $x$ value is entered that is bounded by the window of the current display (xmin < $x$ < xmax). The estimated $y$ value is displayed at the bottom of the screen. Each selected $(x,y)$ pair is marked on its corresponding curve by an $x$. Press [ENTER] to return program control to the Main Graphics Option Menu.

> **NOTE:** If an $x$ value that is not inside the window of the current display is selected, a message is displayed at the bottom of the screen stating that the entered $x$ value is out of range. Press [ENTER] to re-display the plot and return to the Main Graphics Options Menu.

---

**Devi**

This option selects a specific output device to which the current display will be sent. Suboptions available under **Devi** are:

**(a) Screen** - This is the default case. The selected plot will be displayed on the installed graphics display.

**(b) Plotter** - The plot will be sent to the installed plotter.

> **NOTE:** Program control is suspended until the plotter has stopped. If no plotter has been installed, a message will be displayed requesting that the **INSTALL** program be run to configure the proper hardware setup. The ACES program will be terminated, and control will be returned to the DOS prompt.

**(c) Plot File** - The plot will be sent to a plot file for processing at a later time. The plot file is named xxxx.PLT, where xxxx is a 4-digit number beginning with 0000. Any subsequent plots sent to this device are named 0001.PLT, 0002.PLT, etc. These plot files are HP compatible *only* and can be postprocessed upon completion of the ACES interactive session. These files can be copied to the appropriate communication port where the plotter is connected to generate the plots. For example, to copy plot file 0001.PLT to the plotter that is connected to communication port 2 (COM2:), the following is entered at the DOS prompt:

C:\ACES105> **COPY 0001.PLT COM2:** ENTER

> **NOTE:** The communication port must be set to coincide with the plotter's baud rate, parity, and stop bit settings for correct use. (Third party software is available that will translate these plot files to an HP-compatible LaserJet Series printer.)

**(d) Ret** - Program Control is returned to the Main Graphics Options Menu.

---

### Wind

This option specifies the boundaries and size of the current display. Suboptions available under **Wind** are:

**(a) All** - This is the default case. The original plot will be displayed. If **User-Defined** scaling is selected (see **Scal** options described above), this becomes the default during this option.

**(b) Window** - This option zooms in or out on a particular subregion of the current display by locating two opposite corners of a window enclosing the desired region. When this suboption is selected, crosshairs are displayed in the middle of the screen. The arrow keys are used to re-locate the crosshairs to one corner of the desired window. Press [ENTER] to lock in this position. The opposite corner of the window is similarly located, and the new region is shown bordered in a box. Press [ENTER] to display only the area delimited by the window.

**(c) Scale** - A scale factor can be entered to enlarge or shrink the existing window in both the X- and Y-directions. For example, a scale factor of 0.5 doubles the window in both the X- and Y-directions. The resulting plot contains the same data mapped into a larger window and gives the effect of *zooming out* on the selected data. Conversely, *zooming in* is achieved by entering a scale factor greater than 1.

**NOTE:** The scale factor entered is applied to both the X- and Y-coordinate system resulting in:

Xmin = Xmin / factor
Xmax = Xmax / factor
Ymin = Ymin / factor
Ymax = Ymax / factor

**(d) Ret** - Program control is returned to the Main Graphics Options Menu.

### Zero

This option switches the optional display of a zero line (y=0.0) on the plot. The zero line contains the following two coordinates: (xmin, 0.0) and (xmax, 0.0).

> **NOTE:** If the zero line is displayed on the plot, selecting this option will remove it. Selecting it again will re-display the zero line.

### Next

This option displays the next plot in the series.

> **NOTE:** Some applications in ACES have multiple plots. If the current application has only one plot and this option is selected, the screen is erased and the user is returned to the current ACES application.

### Quit

This option terminates all graphics options. The screen is erased, and program control is returned to the current ACES application.

# APPENDIX D - INPUT/OUTPUT OPTIONS

| | Applications | Input | | | | Output | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Screen | | File | | Screen | | Printer | | Plots | | Plot Output Files | | | | | |
| | | | | | | | | | | | | 1 | | 2 | | 3 | |
| | | S | M | S | M | S | M | S | M | S | M | S | M | S | M | S | M |
| 1 | **Wave Prediction** | | | | | | | | | | | | | | | | |
| 1-1 | Windspeed Adjustment and Wave Growth | D | D | - | - | D | - | O | D | - | - | - | - | - | - | - | - |
| 1-2 | Beta-Rayleigh Distribution | D | D | - | - | D | - | O | D | O | - | O | - | - | - | - | - |
| 1-3 | Extremal Significant Wave Height Analysis | O | - | O | - | O | - | O | - | O | - | D | - | - | - | - | - |
| 1-4 | Constituent Tide Record Generation | O | - | O | - | - | - | - | - | O | - | O | - | - | - | - | - |
| 2 | **Wave Theory** | | | | | | | | | | | | | | | | |
| 2-1 | Linear Wave Theory | D | D | - | - | D | - | O | D | - | - | - | - | - | - | - | - |
| 2-2 | Cnoidal Wave Theory | D | D | - | - | D | - | O | D | O | - | O | - | - | - | - | - |
| 2-3 | Fourier Series Wave Theory | D | - | - | - | D | - | O | - | O | - | O | - | - | - | - | - |
| 3 | **Wave Transformation** | | | | | | | | | | | | | | | | |
| 3-1 | Linear Wave Theory with Snell's Law | D | D | - | - | D | - | O | D | - | - | - | - | - | - | - | - |
| 3-2 | Irregular Wave Transformation (Goda's Method) | D | D | - | - | D | - | O | D | O | - | O | - | - | - | - | - |
| 3-3 | Combined Diffraction and Reflection by a Vertical Wedge | D | D | - | - | D | - | O | D | - | - | D | - | - | - | - | - |
| 4 | **Structural Design** | | | | | | | | | | | | | | | | |
| 4-1 | Breakwater Design Using Hudson and Related Equations | D | D | - | - | D | - | O | D | - | - | - | - | - | - | - | - |
| 4-2 | Toe Protection Design | D | D | - | - | D | - | O | D | - | - | - | - | - | - | - | - |
| 4-3 | Nonbreaking Wave Forces on Vertical Walls | D | D | - | - | D | - | O | D | O | - | O | - | - | - | - | - |
| 4-4 | Rubble-Mound Revetment Design | D | D | - | - | D | - | O | D | - | - | - | - | - | - | - | - |
| 5 | **Wave Runup, Transmission, and Overtopping** | | | | | | | | | | | | | | | | |
| 5-1 | Irregular Wave Runup on Beaches | D | D | - | - | D | - | O | D | - | - | - | - | - | - | - | - |
| 5-2 | Wave Runup and Overtopping on Impermeable Structures | D | D | - | - | D | - | O | D | - | - | - | - | - | - | - | - |
| 5-3 | Wave Transmission on Impermeable Structures | D | D | - | - | D | - | O | D | - | - | - | - | - | - | - | - |
| 5-4 | Wave Transmission Through Permeable Structures | D | D | - | - | D | - | O | D | - | - | - | - | - | - | - | - |
| 6 | **Littoral Processes** | | | | | | | | | | | | | | | | |
| 6-1 | Longshore Sediment Transport | D | D | - | - | D | - | O | D | - | - | - | - | - | - | - | - |
| 6-2 | Numerical Simulation of Time-Dependent Beach and Dune Erosion | O | - | O | - | - | - | - | - | O | - | O | - | O | - | - | - |
| 6-3 | Calculation of Composite Grain-Size Distribution | O | - | O | - | O | - | - | - | O | - | D | - | - | - | - | - |
| 6-4 | Beach Nourishment Overfill Ratio and Volume | D | - | - | - | D | - | O | - | - | - | - | - | - | - | - | - |
| 7 | **Inlet Processes** | | | | | | | | | | | | | | | | |
| 7-1 | A Spatially Integrated Numerical Model of Inlet Hydraulics | O | - | O | - | - | - | - | - | O | - | D | - | D | - | D | - |

NOTE:
Symbols are defined as follows:

S - Single Case Mode
M - Multiple Case Mode

D - Default
O - Optional
- - Unavailable

# REPORT DOCUMENTATION PAGE

*Form Approved*
*OMB No. 0704-0188*



| 1. AGENCY USE ONLY *(Leave blank)* | 2. REPORT DATE | 3. REPORT TYPE AND DATES COVERED |
|---|---|---|
| | September 1992 | Final report |

**4. TITLE AND SUBTITLE**

Automated Coastal Engineering System: User's Guide

**5. FUNDING NUMBERS**

**6. AUTHOR(S)**

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**7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**

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Coastal Engineering Research Center
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

**8. PERFORMING ORGANIZATION REPORT NUMBER**

**9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)**

US Army Corps of Engineers
Washington, DC 20314-1000

**10. SPONSORING/MONITORING AGENCY REPORT NUMBER**

**11. SUPPLEMENTARY NOTES**

Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

**12a. DISTRIBUTION/AVAILABILITY STATEMENT**

Approved for public release; distribution is unlimited.

**12b. DISTRIBUTION CODE**

**13. ABSTRACT** *(Maximum 200 words)*

The Automated Coastal Engineering System (ACES) is an interactive computer-based design and analysis system in the field of coastal engineering. The general goal of the ACES is to provide state-of-the-art computer-based tools that will increase the accuracy, reliability, and cost-effectiveness of Corps coastal engineering endeavors. Reflecting the nature of coastal engineering, methodologies (called "applications" in this guide) contained in this release of the ACES are richly diverse in sophistication and origin. The contents range from simple algebraic expressions, both theoretical and empirical in origin, to numerically intense algorithms spawned by the increasing power and affordability of computers. Historically, the methods range from classical theory describing wave motion, to expressions resulting from tests of structures in wave flumes, and to recent numerical models describing the exchange of energy from the atmosphere to the sea surface.

(Continued)

**14. SUBJECT TERMS**

ACES
Automated Coastal Engineering System

**15. NUMBER OF PAGES**

372

**16. PRICE CODE**

| 17. SECURITY CLASSIFICATION OF REPORT | 18. SECURITY CLASSIFICATION OF THIS PAGE | 19. SECURITY CLASSIFICATION OF ABSTRACT | 20. LIMITATION OF ABSTRACT |
|---|---|---|---|
| UNCLASSIFIED | UNCLASSIFIED | | |

19. (Concluded).

In a general procedural sense, much has been taken from previous individual programs on both mainframes and microcomputers. The ACES is designed for a current base of PC-AT (including compatibles) class of personal computers resident at many Corps coastal offices. While expected to migrate to more powerful hardware technologies, this current generation of ACES is designed for the above environemnt and is written in FORTRAN 77.

The documentation set for the ACES comprises two manuals: User's Guide and Technical Reference. The User's Guide contains instructions for using the individual applications within the ACES software package. The Technical Reference contains theory and discussion of the various methodologies contained in the ACES.