Daystar FootingMaster

User Manual

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INTRODUCTION

Daystar FootingMaster calculates a complete analysis and design of concrete wall footings with wall offsets and rectangular spread footings with column offsets using your choice of the UBC, BOCA, SBCCI, or ACI building codes. Soil bearing values, overturning and sliding safety factors, shear stresses, moments and required area of steel are calculated.

Any number of vertical point loads, horizontal point loads, and moments can be applied to the footing. Loads are assignable to any one of six types (dead, floor live, roof live, wind, snow, or seismic). FootingMaster has incorporated seven standard load cases. You can use these load cases, turn some or all of them off and/or create your own. This gives you unmatched flexibility in combining your loads.

All input and output values can be viewed and printed as graphics or text. In addition, graphics can be saved in Windows Metafile format for use in virtually any graphics program. Text values can be saved as a text file for easy export to spreadsheet or word processing programs.

Daystar FootingMaster is a structural design aid and is not to be used as a substitute for experienced engineering judgment. This program should only be used by professional engineers experienced in the field of footing design. The final decision as to the applicability of the information produced by this program is strictly up to the user of this program.

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GETTING STARTED

System Requirements

Daystar FootingMaster is a 32-bit application designed to work with the Windows® 3.1, Windows® 95, and Windows NT™ operating systems. Because Windows 3.1 is a 16-bit operating system, additional files must be installed to upgrade it to Win32s and allow 32-bit applications to run. If Win32s has previously been installed these files will not be needed and will not be installed.

You will need one of the following setups and operating systems to use FootingMaster:

Windows 3.1 running in enhanced mode.
1.0 megabyte of free hard disk space if Win32s is already installed or
6.0 megabytes if not.

Windows 95
1.0 megabyte of free hard disk space.

Windows NT
1.0 megabyte of free hard disk space.

Installation

Before beginning installation exit all running programs. If you use a virus protection program on your computer, override it or turn it off. The setup program may not run properly with virus protection turned on or with other programs running. After running Setup, be sure to restart your virus protection program.

To install FootingMaster for Windows 3.1 using floppy disks:
1. Insert the disk labeled "Disk 1" into drive A.
2. From the File menu in Program Manager, choose Run.
3. Type **a:\setup**
4. Press ENTER.

To install FootingMaster for Windows 95/98/NT using floppy disks:
1. Insert the disk floppy disk into drive A.
2. Choose Run from the Start Menu
3. Type **a:\setup**
4. Press ENTER.

To install FootingMaster using the CD-ROM:
1.	Insert the CD-ROM into the CD-ROM drive.
2.	If the CD-ROM does not automatically start, choose Run from the Start Menu
3.	Type **d:\setup** where **d:** is the CD-ROM drive letter.
4.	Press ENTER.

Files
FootingMaster installs the following files depending on which operating system you are using:

All operating systems:
        FootingMaster directory
                footing.hlp
                footing.exe
                wallft.fwl
                spreadft.fsp

Windows 3.1:
        Windows\System\Win32s directory

win32s.exe	p_037.nls	p_10000.nls	p_10006.nls
p_10007.nls	p_10029.nls	p_10079.nls	p_1026.nls
p_500.nls	p_875.nls	l_intl.nls	p_10081.nls
p_1250.nls	p_1251.nls	p_1252.nls	p_1253.nls
p_1254.nls	p_737.nls	p_855.nls	p_866.nls
p_869.nls	comdlg32.dll	lz32.dllshell32.dll	
version.dll	p_437.nls	p_850.nls	p_852.nls
p_857.nls	p_860.nls	p_861.nls	p_863.nls
p_865.nls	sorttbls.nls	winspool.drv	w32scomb.dll
ctype.nls	netapi32.dll	olesvr32.dll	wsock32.dll
sck16thk.dll	olecli32.dll	unicode.nls	locale.nls
w32s.386	winmm.dll	ntmsg.dll	p_936.nls
p_949.nls	w32skrnl.dll	p_10001.nls	p_932.nls
crtdll.dll	p_950.nls	sortkey.nls	l_trk.nls
riched32.dll	comctl32.dll	ftsrch.dll	stdole32.tlb
oledlg.dll	oleaut32.dll	ole32.dll	ole2thk.dll

        Windows\System directory

w32sys.dll	winmm16.dll	olecli.dll	win32s16.dll
winhlp32.cnt	windows.hlp	winhlp32.hlp	winhlp32.exe
ole2prox.dll	ple2conv.dll	compobj.dll	ole2disp.dll
storage.dll	ole2nls.dll	typelib.dll	ole2.dll
ole2.reg	stdole.tlb	ctl3d32.dll	

BASICS

Toolbar
The toolbar displayed under the menu allows quick one button access to change the footing geometry, add loads, print, etc. If you are unsure what each button does, simply move the cursor over the button and wait about a half second. A small window will appear displaying the menu item associated with the button and a longer description will appear in the status bar at the bottom of the application window.

The toolbar can be attached to the any side of the application window or float free. To cause the toolbar to float free click on it anywhere except on a button and drag it to where you want it to be. To attach it to the bottom, top or sides of the application window, click on it anywhere but on a button and drag it to the side you want it to attach to. When you release the toolbar it will reattach to the window.

Wherever you decide to put the toolbar, the program will remember and place it there every time you start the program.

Double-clicking
Anywhere that the cursor turns into a magnifying glass is a place that you can double-click to either make changes or view data. The status bar at the bottom of the application window will display a message describing what will happen if you double-click. Double-clicking on most objects will bring up a dialog box that allows you to change or delete the object.

Changing and Deleting Loads
Double-clicking on the load arrows or text in the Structure view will present a dialog box that allows you to change the load or delete it. Change the load by entering new magnitudes and/or locations and clicking the OK button. Delete the load by clicking the Delete button. Double clicking on the Soil Overburden load or selecting Soil Overburden under the Loads menu will present the Soil Overburden dialog box. Enter 0 in the Soil Overburden edit box to remove this load.

Dialog Box Graphical Buttons
The Add Vertical Point Load, Add Horizontal Point Load, and Add Moment dialog boxes each have graphical buttons used to indicate the direction of the input loads. These buttons act just like standard radio buttons. Tabbing into a group of buttons or clicking on a button in the group will cause the selected button to show a dotted outline indicating it is the active button. You can use the arrow keys to move from button to button in the group and the TAB key to move out of the group. As you select a button the load diagram will change to indicate the direction of the load.

Help
You can access on-line help at anytime by pressing the F1 button.

MENUS

This chapter describes the various menu commands available to you. The bold face item is the menu command and the item in parenthesis is the keyboard short cut. Not all menu items have key board short cuts.

Please see the TECHNICAL DISCUSSION and DEFINITIONS sections for further information about information contained in the dialog boxes.

FILE MENU

New   (Ctrl+N)
Use this command to create a new document. Select the type of new file you want to create in the File New dialog box.

Open   (Ctrl+O)
Use this command to open an existing document in a new window. You can open multiple documents at once. Use the Window menu to switch among the multiple open documents.

The following options allow you to specify which file to open:
> **File Name**
>> Type or select the filename you want to open. This box lists files with the extension you select in the List Files of Type box.
>
> **List Files of Type**
>> Select the type of file you want to open:
>
> **Drives**
>> Select the drive in which FootingMaster stores the file that you want to open.
>
> **Directories**
>> Select the directory in which FootingMaster stores the file that you want to open.
>
> **Network...**
>> Choose this button to connect to a network location, assigning it a new drive letter.

Close
Use this command to close the window containing the active document. FootingMaster suggests that you save changes to your document before you close it. If you close a document without saving, you lose all changes made since the last time you saved it. Before closing an untitled document, FootingMaster displays the Save As dialog box and suggests that you name and save the document.

Save   (Ctrl+S)
Use this command to save the active document to its current name and directory. When you save a document for the first time, FootingMaster displays the Save As dialog box so you can name

your document. If you want to change the name and directory of an existing document before you save it, choose the Save As command.

Save As
Use this command to save and name the active document. FootingMaster displays the Save As dialog box so you can name your document.

To save a document with its existing name and directory, use the Save command.

The following options allow you to specify the name and location of the file you're about to save:

File Name
Type a new filename to save a document with a different name. A filename can contain up to eight characters and an extension of up to three characters. FootingMaster adds the extension you specify in the Save File As Type box.

Drives
Select the drive in which you want to store the document.

Directories
Select the directory in which you want to store the document.

Network...
Choose this button to connect to a network location, assigning it a new drive letter.

Export As Metafile
Use this command to export the contents of the Structure view to a Windows Metafile. This file can be opened by any program that recognizes metafiles. FootingMaster displays the Save As dialog box so you can name the metafile. Please see Save As above for your options.

Some graphics programs are better at accepting images from the clipboard than importing images from a metafile. You may need to experiment with importation verses pasting to get the results you need. In addition, Windows places restrictions on the size of metafiles. Large footings and/or large scales may cause the metafile to be distorted when exported or copied to the clipboard.

Export As Text
Use this command to export the contents of the Text view to a text file. This file can be opened by any program that recognizes text files. FootingMaster displays the Save As dialog box so you can name the text file. Please see Save As above for your options.

Print   (Ctrl+P)
Use this command to print a document. This command presents a Print dialog box, where you may specify the range of pages to be printed, the number of copies, the destination printer, and other printer setup options.

The following options allow you to specify how the document should be printed:

Printer
This is the active printer and printer connection. Choose the Setup option to change the printer and printer connection.

Setup
Displays a Print Setup dialog box, so you can select a printer and printer connection.

Print Range
Specify the pages you want to print:

All   Prints the entire document.
Selection   Prints the currently selected text.
Pages   Prints the range of pages you specify in the From and To boxes.

Copies
Specify the number of copies you want to print for the above page range.

Collate Copies
Prints copies in page number order, instead of separated multiple copies of each page.

Print Quality
Select the quality of the printing. Generally, lower quality printing takes less time to produce.

Print Preview

Use this command to display the active document as it would appear when printed. When you choose this command, the main window will be replaced with a print preview window in which one or two pages will be displayed in their printed format. The print preview toolbar offers you options to view either one or two pages at a time; move back and forth through the document; zoom in and out of pages; and initiate a print job.

The print preview toolbar offers you the following options:

Print
Bring up the print dialog box, to start a print job.

Next Page
Preview the next printed page.

Prev Page
Preview the previous printed page.

One Page / Two Page
Preview one or two printed pages at a time.

Zoom In
Take a closer look at the printed page.

Zoom Out
Take a larger look at the printed page.

Close
Return from print preview to the editing window.

Print Setup

Use this command to select a printer and a printer connection. This command presents a Print Setup dialog box, where you specify the printer and its connection.

The following options allow you to select the destination printer and its connection.

Printer

Select the printer you want to use. Choose the Default Printer; or choose the Specific Printer option and select one of the current installed printers shown in the box. You install printers and configure ports using the Windows Control Panel.

Orientation

Choose Portrait or Landscape.

Paper Size

Select the size of paper that the document is to be printed on.

Paper Source

Some printers offer multiple trays for different paper sources. Specify the tray here.

Options

Displays a dialog box where you can make additional choices about printing, specific to the type of printer you have selected.

Network...

Choose this button to connect to a network location, assigning it a new drive letter.

1, 2, 3, 4 command (File menu)

Use the numbers and filenames listed at the bottom of the File menu to open the last four documents you closed. Choose the number that corresponds with the document you want to open.

Exit   (Alt+F4)

Use this command to end your FootingMaster session. You can also use the Close command on the application Control menu. FootingMaster prompts you to save documents with unsaved changes.

EDIT MENU

Undo   (Ctrl+Z)

Use this command to reverse the last editing action, if possible. The Undo command is grayed out on the menu if you cannot reverse your last action.

Copy   (Ctrl+C)

Use this command to copy whatever is displayed in the view onto the clipboard. In the Structure view the data is copied as a graphic. In the Text view the data is copied as text.

Copying data to the clipboard replaces the contents previously stored there.

Some graphics programs are better at accepting images from the clipboard than importing images from a metafile. You may need to experiment with importation verses pasting to get the results you need. In addition, Windows places restrictions on the size of metafiles. Large footings and/or large scales may cause the metafile to be distorted when exported or copied to the clipboard.

Heading
Use this command to add a descriptive heading to the document. You are allowed up to four lines for the heading.

Title Block
Use this command to add a title block to the document. Anything entered in this dialog will be saved in the footing.ini file and will be used in all documents. You are allowed up to four lines for the title block.

FOOTING MENU

Change Footing   (Ctrl+F)
Use this command to make changes to the footing. This command presents a Footing Dimensions dialog box where you may specify the footing size, rebar location, and other options.

Wall Footing
The following options allow you to specify the wall footing geometry:

Width
This is the width of the wall footing parallel to the wall thickness.

Thickness
This is the total thickness of the wall footing.

Rebar CL
This is the distance from the bottom of the wall footing to the centerline of the footing rebar.

Wall Thickness
This is the thickness of the wall parallel to the footing width.

Offset
This is the distance from the left edge of the wall footing to the left edge of the wall. You may choose Left, Center or Right or Other and enter a dimension.

Spread Footing
The following options allow you to specify the spread footing geometry:

Width
This is the footing dimension from top to bottom.

Length
This is the footing dimension from left to right.

Thickness

This is the total thickness of the spread footing.

Rebar CL

This is the distance from the bottom of the spread footing to the centerline of the footing rebar.

Pedestal Ht

This is the distance from the top of the spread footing to the top of the pedestal.

Col Width

This is the effective width of the column parallel to the width of the spread footing.

Col Length

This is the effective length of the column parallel to the length of the spread footing.

Col Loc from CL

This is the distance from the centerline of the footing to the centerline of the column measured parallel to the length of the spread footing.

Col Loc Direction

This is the direction from the footing centerline that the "Col Loc from CL" distance is measured.

Physical Properties

Use this command to make changes to the physical properties of the footing. This command presents a Physical Properties dialog box where you may specify f'c, fy and other options.

Wall Footing

The following options allow you to specify the wall footing physical properties:

f'c

This is the compressive strength of the concrete.

fy

This is the yield strength of the reinforcing steel.

% Min Steel

This is the minimum percentage of reinforcing steel to be used in the design.

Concrete Weight

Density of the footing concrete.

Spread Footing

The following options allow you to specify the spread footing physical properties:

f'c

This is the compressive strength of the concrete.

fy

This is the yield strength of the reinforcing steel.

% Min Steel

This is the minimum percentage of reinforcing steel to be used in the design.

Friction
Coefficient of friction between the soil and the bottom of the footing.

Concrete Weight
Density of the footing concrete.

LOADS MENU

Add Vert. Point Load   (Ctrl+L)
Use this command to add vertical point loads to the footing. This command presents an Add Vertical Point Load dialog box where you may specify load magnitude, direction, and type.

The following options allow you to specify the vertical point load information:

Point Load
This is the magnitude of the vertical point load.

Direction
This is the direction of the vertical point load.

Load Type
This is the type of load that this vertical point load represents.

Loads are represented in the Structure view by an arrow and text displaying the load type and magnitude.

Add Horiz. Point Load   (Ctrl+H)   Spread Footing Only
Use this command to add horizontal point loads to the spread footing. This command presents an Add Horizontal Point Load dialog box where you may specify load magnitude, direction, and type.

The following options allow you to specify the horizontal point load information:

Point Load
This is the magnitude of the horizontal point load.

Direction
This is the direction of the horizontal point load.

Load Type
This is the type of load that this horizontal point load represents.

Loads are represented in the Structure view by an arrow and text displaying the load type and magnitude.

Add Moment (Ctrl+M)   Spread Footing Only
Use this command add moment loads to the spread footing. This command presents an Add Moment dialog box where you may specify load magnitude, direction, and type.

The following options allow you to specify the moment information:

Moment
> This is the magnitude of the moment.

Direction
> This is the direction of the moment.

Load Type
> This is the type of load that this moment represents.

Loads are represented in the Structure view by an arrow and text displaying the load type and magnitude.

Soil Overburden
Use this command to add a soil overburden load to the top of the footing. This command presents a Soil Overburden dialog box where you may specify the load magnitude. This load is always applied as a Dead Load.

The following options allow you to specify the soil overburden load information:

Soil Overburden
> This is the magnitude of the soil overburden.

Loads are represented in the Structure view by shaded rectangle and text displaying the load type and magnitude.

CASE MENU

Calculate Now   (F9)
Use this command to immediately analyze and design the footing. You can calculate at any time.

Building Code   (Ctrl+B)
Use this command to select the appropriate building code for this footing design. This command presents a Building Code dialog box, where you may specify the building code.

Select Standard Load Cases
Use this command to selectively turn on and off the standard service and factored load cases built into FootingMaster. This command presents a Select Standard Load Cases dialog box, where you may check which load cases you want to include in this footing design.

These standard load cases are not necessarily applicable to all the building codes available in FootingMaster. They are included as a convenience to aid you in your design.

Add Load Case

Use this command to create service or factored load cases that you want to use in your design. This command presents an Add Load Case dialog box where you may enter the load case name and load multipliers.

The following options allow you to specify the load case information:

Load Case Name

This is the name that will be used for the load case.

Dead, Floor Live, Roof Live, Snow, Wind, Seismic

These are the load types that are to be included in the load case. Enter the multiplier for each in the edit box to the left. Any multipliers that are left blank are considered zero.

After entering the load case name and multipliers, click the Add button to add the load case to the design. After clicking the Add button the load case name will be blanked and the multipliers will be zeroed so that you can add another load case. When you are finished adding load cases, click the Close button to close the dialog box.

The Cancel button will blank the load case name and zero the multipliers and may be used to clear entries you have made in the name and multiplier edit boxes but do not want to keep. This button will not affect any load cases that have already been added by clicking the Add button.

Change Load Case

Use this command to change service or factored load cases that you previously entered using the Add Load Case command. This command presents a Change Load Case dialog box, where you may select an existing load case from the Load Case list box and change the load case name and load type multipliers. Please see the Add Load Case command for a description of the load case name and multipliers options.

After selecting a load case from the Load Case list box, the load case name and multiplier edit boxes will be filled in with the information from the selected load case. After changing the load case information, click the Change button to change the load case. You may then continue selecting load cases and making changes. When you are finished changing load cases, click the Close button to close the dialog box.

The Cancel button will blank the load case name and zero the multipliers and may be used to clear entries you have made in the name and multiplier edit boxes but do not want to keep. This button will not affect any load cases that have already been added by clicking the Change button.

Delete Load Case

Use this command to delete service or factored load cases that you previously entered using the Add Load Case command. This command presents a Delete Load Case dialog box, where you may select an existing load case from the Load Case list box and delete it.

After selecting a load case from the Load Case list box, click the Delete button to delete the load case. You may continue selecting load cases and deleting. When you are finished deleting load cases, click the Close button to close the dialog box.

VIEW MENU

Display Text/Display Structure
Use this command to change the document view from the Structure view to the Text view and back. The command title will change each time you select it.

Toolbar
Use this command to display and hide the Toolbar, which includes buttons for some of the most common commands in FootingMaster, such as File Open. A check mark appears next to the menu item when the Toolbar is displayed.

Status Bar
Use this command to display and hide the Status Bar, which describes the action to be executed by the selected menu item or depressed toolbar button, and keyboard latch state. A check mark appears next to the menu item when the Status Bar is displayed.

Options
Use this command to select the units, numeric format, scale, and display parameters of the document. This command presents a tabbed Options dialog box, where you may set all display parameters for the document.

WINDOW MENU

Cascade
Use this command to arrange multiple opened windows in an overlapped fashion.

Tile
Use this command to arrange multiple opened windows in a non-overlapped fashion.

Arrange Icons
Use this command to arrange the icons for minimized windows at the bottom of the main window. If there is an open document window at the bottom of the main window, then some or all of the icons may not be visible because they will be underneath this document window.

#1, 2, ... command (Window menu)
FootingMaster displays a list of currently open document windows at the bottom of the Window menu. A check mark appears in front of the document name of the active window. Choose a document from this list to make its window active.

HELP MENU

Index

Use this command to display the opening screen of Help. From the opening screen, you can jump to step-by-step instructions for using FootingMaster and various types of reference information.

Once you open Help, you can click the Contents button whenever you want to return to the opening screen.

Using Help

Use this command for instructions about using Help.

About Daystar FootingMaster

Use this command to display the copyright notice and version number of your copy of FootingMaster.

WALL FOOTING EXAMPLE

This example will show you some of the features of the wall footing design portion of FootingMaster and how to use them. The design criteria are as follows:

Building Code = UBC' 94

f'c = 3,000 psi
fy = 60,000 psi
% Min Steel = 0.0018
Allow Soil Bearing = 2000 psf
Concrete Weight = 145 pcf

Width = 3'-0"
Thickness = 12"
Rebar CL = 3 1/2"
Wall Thickness = 12"
Wall Offset = 6"

Vertical Dead Load = 1,500 lbs/ft
Vertical Snow Load = 2,000 lbs/ft
Vertical Wind Load = 1,000 lbs/ft uplift

Soil Overburden = 200 psf

Start up FootingMaster and select the Wall Footing choice in the File New dialog box. Now click the OK button.

Select the Building Code menu item under the Case menu. When the Building Code dialog box appears click the UBC '94 radio button and then click the OK button.

Double-click the footing diagram or select the Change Footing menu item under the Footing menu. When the Footing Dimensions dialog box appears, enter 3 in Width edit box, 12 in the Thickness edit box, 3.5 in the Rebar CL edit box and 12 in the Wall Thickness edit box. Click the Other radio button and enter 6 in the edit box to the right of the Other radio button. Now click the OK button.

Click the Add Vert. Point Load toolbar button or select the Add Vert. Point Load menu item under the Loads menu. When the Add Vertical Point Load dialog box appears, enter 1500 in the Point Load edit box. Now click the OK button.

Click the Add Vert. Point Load toolbar button or select the Add Vert. Point Load menu item under the Loads menu. When the Add Vertical Point Load dialog box appears, enter 2000 in the

Point Load edit box. Click the Snow radio button for the Load Type and then click the OK button.

Click the Add Vert. Point Load toolbar button or select the Add Vert. Point Load menu item under the Loads menu. When the Add Vertical Point Load dialog box appears, enter 1000 in the Point Load edit box. Click the Up arrow for the Direction and click the Wind radio button for the Load Type. Click the OK button.

Click the Soil Overburden toolbar button or select the Soil Overburden menu item under the Loads menu. When the Soil Overburden dialog box appears, enter 200 in the Soil Overburden edit box. Now click the OK button.

Select the Calculate Now menu item under the Case menu to design the footing. Note that the service soil bearing is larger than allowable for the DL+FLL+SNL load case. To take care of this problem we will add 6" to the Width of the footing and offset the wall 12" instead of 6". Double-click the footing diagram and when the Footing Dimensions dialog box appears enter 3.5 in the Width edit box and 12" in the Other edit box. Click the OK button and then select Calculate Now again.

This example is in the directory where you installed FootingMaster and also accessible from the Daystar program group. Open it and experiment with the wide variety of tools at your disposal

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SPREAD FOOTING EXAMPLE

This example will show you some of the features of the spread footing design portion of FootingMaster and how to use them. The design criteria are as follows:

Building Code = UBC' 94

f'c = 3,000 psi
fy = 60,000 psi
% Min Steel = 0.0018
Allow Soil Bearing = 2000 psf
Friction = 0.4
Concrete Weight = 145 pcf

Width = 3'-0"
Length = 5'-0"
Thickness = 12"
Rebar CL = 3 1/2"
Pedestal Ht = 12"
Col Width = 12"
Col Length = 12"
Col Loc from CL = 1'-0"
Col Loc Direction = Left of CL

Vertical Dead Load = 1,500 lbs
Vertical Snow Load = 2,000 lbs
Vertical Wind Load = 1,000 lbs uplift

Horizontal Wind Load = 1,500 lbs

Wind Moment = 10,000 lb-ft

Soil Overburden = 200 psf

Start up FootingMaster and select the Spread Footing choice in the File New dialog box. Now click the OK button.

Select the Building Code menu item under the Case menu. When the Building Code dialog box appears click the UBC '94 radio button and then click the OK button.

Double-click the footing diagram or select the Change Footing menu item under the Footing menu. When the Footing Dimensions dialog box appears, enter 3 in Width edit box, 5 in the Length edit box, 12 in the Thickness edit box, 3.5 in the Rebar CL edit box, 12 in the Pedestal Ht,

Col Width, and Col Length edit boxes, and 1 in the Col Loc from CL edit box. Click the left Col Loc Direction picture button to indicate that the Col Loc is offset to the left. Now click the OK button.

Click the Add Vert. Point Load toolbar button or select the Add Vert. Point Load menu item under the Loads menu. When the Add Vertical Point Load dialog box appears, enter 1500 in the Point Load edit box. Now click the OK button.

Click the Add Vert. Point Load toolbar button or select the Add Vert. Point Load menu item under the Loads menu. When the Add Vertical Point Load dialog box appears, enter 2000 in the Point Load edit box. Click the Snow radio button for the Load Type and then click the OK button.

Click the Add Vert. Point Load toolbar button or select the Add Vert. Point Load menu item under the Loads menu. When the Add Vertical Point Load dialog box appears, enter 1000 in the Point Load edit box. Click the Up arrow for the Direction and click the Wind radio button for the Load Type. Click the OK button.

Click the Add Horiz. Point Load toolbar button or select the Add Horiz. Point Load menu item under the Loads menu. When the Add Horizontal Point Load dialog box appears, enter 1500 in the Point Load edit box. Click the Wind radio button for the Load Type. Now click the OK button.

Click the Add Moment toolbar button or select the Add Moment menu item under the Loads menu. When the Add Moment dialog box appears, enter 10000 in the Moment edit box. Click the Wind radio button for the Load Type. Now click the OK button.

Click the Soil Overburden toolbar button or select the Soil Overburden menu item under the Loads menu. When the Soil Overburden dialog box appears, enter 200 in the Soil Overburden edit box. Now click the OK button.

Select the Calculate Now menu item under the Case menu to design the footing. Note that the service soil bearing is larger than allowable for the DL+FLL+WL load case and that the overturning safety factor is too low for both the DL+FLL+WL and DL+FLL+WL+1/2 SNL load cases. To take care of this problem we will add 1' to the Length of the footing. Double-click the footing diagram and when the Footing Dimensions dialog box appears enter 6 in the Length edit box. Click the OK button and then select Calculate Now again.

This example is in the directory where you installed FootingMaster and also accessible from the Daystar program group. Open it and experiment with the wide variety of tools at your disposal.

TECHNICAL DISCUSSION

General

The sign conventions for the external loads are as follows:

Vert. Point Load	down is positive.
Horiz. Point Load	to the right is positive.
Moment	clockwise is positive.

All suggested rebar sizes are based on ASTM standard bar size designations (i.e. #3 is a 0.375" diameter bar).

FootingMaster does **not** check the required rebar embedment lengths nor minimum and maximum rebar clear dimensions.

Wall Footing

Actual soil bearing values are calculated as follows:

1) Moment about footing centerline is calculated by summing all vertical loads for a particular load case multiplied by the horizontal offset from the footing centerline.
2) Vertical load is calculated by summing all vertical loads for a particular load case.
3) Eccentricity = Moment/Vertical load.
4) If Eccentricity ≤ Footing Width/6
   Bearing = Vertical load*(1±6*Eccentricity/Footing Width)
   If Eccentricity >Footing Width/6
   Bearing = 2*Vertical load/(3*(Footing Width/2-ecc))

Shear values are calculated at a distance d from each side of the wall and are based on factored soil bearing values - any factored footing weight and soil overburden. The larger of the two values is used to determine the actual shear stress in the footing.

Moment values are calculated at each face of the wall and are based on factored soil bearing values * the moment arm - any factored footing weight and soil overburden * the moment arm. The larger of the two values is used to determine the As req'd in the footing.

Temp & Shrink As = % Min Steel *Footing Width * d

Suggested rebar spacing is calculated by determining the spacing for each rebar size from #3 to #11 and removing any rebar sizes that require spacing closer than 2" or greater than 48".

Suggested Temp & Shrink Steel is calculated by determining the number of bars required for each rebar size from #3 to #11 and removing any rebar sizes that require spacing closer than 2" or counts less than 2.

If no rebar size falls within the above parameters, then the program will not suggest a size.

In the instances where some load cases produce errors such as uplift conditions, etc. the program will suggest rebar sizes and spacings based on the remaining legitimate load cases.

FootingMaster uses the following equations from the referenced code books to perform the design.

UBC '91
The Allowable Soil Bearing is increased by 4/3 if the load case includes a wind or seismic load.

$b = 12"$
$vu = Shear/(0.85*b*d)$
$vc = 2*f'c^{1/2}$

$b = 12"$
$m = fy/(0.85*f'c)$
$Ru = Moment/(0.9*b*d^2)$
$rho = [1-(1-2*m*Ru/fy)^{1/2}]/m$
$As\ req'd = rho*b*d$

If As req'd is less than 200/fy then As req'd is multiplied by 4/3. If this new As req'd is greater than 200/fy then As req'd is set to 200/fy. Finally if As req'd is less than the input % Min Steel then the As req'd is increased to the input minimum.

UBC '94
The Allowable Soil Bearing is increased by 4/3 if the load case includes a wind or seismic load.

$b = 12"$
$vu = Shear/(0.85*b*d)$
$vc = 2*f'c^{1/2}$

$b = 12"$
$m = fy/(0.85*f'c)$
$Ru = Moment/(0.9*b*d^2)$
$rho = [1-(1-2*m*Ru/fy)^{1/2}]/m$
$As\ req'd = rho*b*d$

If As req'd is less than 200/fy then As req'd is multiplied by 4/3. If this new As req'd is greater than 200/fy then As req'd is set to 200/fy. Finally if As req'd is less than the input % Min Steel then the As req'd is increased to the input minimum.

UBC '97
The Allowable Soil Bearing is increased by 4/3 if the load case includes a wind or seismic load.

b = 12"
vu = Shear/(0.85*b*d)
vc = 2*f'c$^{1/2}$

b = 12"
m = fy/(0.85*f'c)
Ru = Moment/(0.9*b*d^2)
rho = [1-(1-2*m*Ru/fy)$^{1/2}$]/m
As req'd = rho*b*d

If As req'd is less than the larger of 200/fy or 3(f'c)$^{1/2}$/fy then As req'd is multiplied by 4/3. If this new As req'd is greater than the larger of the above, As req'd is set to the larger of the above. Finally if As req'd is less than the input % Min Steel then the As req'd is increased to the input minimum.

BOCA '93
The Allowable Soil Bearing is increased by 4/3 if the load case includes a wind or seismic load.

b = 12"
vu = Shear/(0.85*b*d)
vc = 2*f'c$^{1/2}$

b = 12"
m = fy/(0.85*f'c)
Ru = Moment/(0.9*b*d^2)
rho = [1-(1-2*m*Ru/fy)$^{1/2}$]/m
As req'd = rho*b*d

If As req'd is less than 200/fy then As req'd is multiplied by 4/3. If this new As req'd is greater than 200/fy then As req'd is set to 200/fy. Finally if As req'd is less than the input % Min Steel then the As req'd is increased to the input minimum.

SBCCI '91
The Allowable Soil Bearing is increased by 4/3 if the load case includes a wind or seismic load.

b = 12"
vu = Shear/(0.85*b*d)
vc = 2*f'c$^{1/2}$

b = 12"
m = fy/(0.85*f'c)
Ru = Moment/(0.9*b*d^2)
rho = [1-(1-2*m*Ru/fy)$^{1/2}$]/m
As req'd = rho*b*d

If As req'd is less than 200/fy then As req'd is multiplied by 4/3. If this new As req'd is greater than 200/fy then As req'd is set to 200/fy. Finally if As req'd is less than the input % Min Steel then the As req'd is increased to the input minimum.

SBCCI '94

The Allowable Soil Bearing is increased by 4/3 if the load case includes a wind or seismic load.

b = 12"
vu = Shear/(0.85*b*d)
vc = 2*f'c$^{1/2}$

b = 12"
m = fy/(0.85*f'c)
Ru = Moment/(0.9*b*d^2)
rho = [1-(1-2*m*Ru/fy)$^{1/2}$]/m
As req'd = rho*b*d

If As req'd is less than 200/fy then As req'd is multiplied by 4/3. If this new As req'd is greater than 200/fy then As req'd is set to 200/fy. Finally if As req'd is less than the input % Min Steel then the As req'd is increased to the input minimum.

ACI 318-95

The Allowable Soil Bearing is increased by 4/3 if the load case includes a wind or seismic load.

b = 12"
vu = Shear/(0.85*b*d)
vc = 2*f'c$^{1/2}$

b = 12"
m = fy/(0.85*f'c)
Ru = Moment/(0.9*b*d^2)
rho = [1-(1-2*m*Ru/fy)$^{1/2}$]/m
As req'd = rho*b*d

If As req'd is less than the larger of 200/fy or 3(f'c)$^{1/2}$/fy then As req'd is multiplied by 4/3. If this new As req'd is greater than the larger of the above, As req'd is set to the larger of the above.

Finally if As req'd is less than the input % Min Steel then the As req'd is increased to the input minimum.

Spread Footing
The weight of the pedestal is not included in the calculations.

Left - Right indicates an axis along the length of the spread footing. Top - Bottom indicates an axis along the width of the spread footing.

Actual soil bearing values are calculated as follows:
   Left - Right
   1) Moment about footing centerline is calculated by summing all vertical loads for a particular load case multiplied by the offset from the footing centerline, all horizontal loads for a particular load case multiplied by the offset from the footing base, and all moment loads for a particular load case.
   2) Vertical load is calculated by summing all vertical loads for a particular load case.
   3) Eccentricity = Moment/Vertical load.
   4) If Eccentricity ≤ Footing Length/6
   Bearing = Vertical load*(1±6*Eccentricity/Footing Length)/(Footing Length*Footing
      Width)
   If Eccentricity >Footing Width/6
   Bearing = 2*Vertical load/(3*(Footing Length /2-ecc)*Footing Length*Footing Width)

   Top - Bottom
   1) Vertical load is calculated by summing all vertical loads for a particular load case.
   2) Bearing = Vertical load/(Footing Length*Footing Width)

Overturning Safety Factor is calculated as follow:
   1) Overturning moments about the left side of the spread footing are calculated by taking all loads for a particular load case that cause counterclockwise rotation about the left side of the footing.
   2) Resisting moments about the left side of the spread footing are calculated by taking all loads for a particular load case that cause clockwise rotation about the left side of the footing.
   3) Overturning Safety Factor about the left side of the footing = Resisting Moment/Overturning Moment.
   4) Overturning moments about the right side of the spread footing are calculated by taking all loads for a particular load case that cause clockwise rotation about the right side of the footing.
   5) Resisting moments about the right side of the spread footing are calculated by taking all loads for a particular load case that cause counterclockwise rotation about the right side of the footing.
   6) Overturning Safety Factor about the left side of the footing = Resisting Moment/Overturning Moment.

7) The controlling Overturning Safety Factor is the maximum of the left or right Overturning Safety Factor.

Sliding Safety Factor is calculated as follows:
1) Sliding forces are calculated by summing all horizontal loads for a particular load case.
2) Vertical forces are calculated by summing all vertical loads for a particular load case.
3) Sliding Safety Factor = Vertical forces*Friction Factor/Sliding forces.

Punching shear values are calculated at a distance d/2 from the column and are based on factored soil bearing values - any factored footing weight and soil overburden.

One way shear values are calculated at a distance d from all sides of the pedestal and are based on factored soil bearing values - any factored footing weight and soil overburden. The larger of these values are used to determine the actual one way shear stress in the footing.

Moment values are calculated at either face of the pedestal and are based on factored soil bearing values * the moment arm - any factored footing weight and soil overburden * the moment arm.

Suggested rebar spacing is calculated by determining the spacing for each rebar size from #3 to #11 and removing any rebar sizes that require spacing closer than 2" or greater than 18".

If no rebar size falls within the above parameters, then the program will not suggest a size.

In the instances where some load cases produce errors such as uplift conditions, etc. the program will suggest rebar sizes and spacings based on the remaining legitimate load cases.

FootingMaster uses the following equations from the referenced code books to perform the design.

UBC '91
The Allowable Soil Bearing is increased by 4/3 if the load case includes a wind or seismic load.

Bo = 2*(Column Length+d)+2*(Column Width+d)
    If the column is closer to the edge than the distance d, Bo is reduced accordingly.
vu Punching = Punching Shear/(0.85*Bo*d)

vu One Way = One Way Shear/(0.85*b*d)

One-way vc=$2*f'c^{1/2}$
Punching vc = $(2+4/(Length/Width)*f'c^{1/2}$ $4*f'c^{1/2}$ max

m = fy/(0.85*f'c)
Ru = Moment/(0.9*b*d^2)
rho = $[1-(1-2*m*Ru/fy)^{1/2}]$/m
As req'd = rho*b*d

If As req'd is less than 200/fy then As req'd is multiplied by 4/3. If this new As req'd is greater than 200/fy then As req'd is set to 200/fy. Finally if As req'd is less than the input % Min Steel then the As req'd is increased to the input minimum.

Minimum Overturning Safety Factor = 1.5
Minimum Sliding Safety Factor = 1.5

Column Band Reinforcement = Total Reinforcement*2/(Long Dim./Short Dim.+1)

UBC '94

The Allowable Soil Bearing is increased by 4/3 if the load case includes a wind or seismic load.

Bo = 2*(Column Length+d)+2*(Column Width+d)
        If the column is closer to the edge than the distance d, Bo is reduced accordingly.
vu Punching = Punching Shear/(0.85*Bo*d)

vu One Way = One Way Shear/(0.85*b*d)

One-way $vc = 2*f'c^{1/2}$
Punching $vc = (2+4/(Length/Width)*f'c^{1/2}$ $4*f'c^{1/2}$ max

$m = fy/(0.85*f'c)$
$Ru = Moment/(0.9*b*d^2)$
$rho = [1-(1-2*m*Ru/fy)^{1/2}]/m$
As req'd = rho*b*d

If As req'd is less than 200/fy then As req'd is multiplied by 4/3. If this new As req'd is greater than 200/fy then As req'd is set to 200/fy. Finally if As req'd is less than the input % Min Steel then the As req'd is increased to the input minimum.

Minimum Overturning Safety Factor = 1.5
Minimum Sliding Safety Factor = 1.5

Column Band Reinforcement = Total Reinforcement*2/(Long Dim./Short Dim.+1)

UBC '97

The Allowable Soil Bearing is increased by 4/3 if the load case includes a wind or seismic load.

Bo = 2*(Column Length+d)+2*(Column Width+d)
        If the column is closer to the edge than the distance d, Bo is reduced accordingly.
vu Punching = Punching Shear/(0.85*Bo*d)

vu One Way = One Way Shear/(0.85*b*d)

One-way vc=2*f'c$^{1/2}$
Punching vc = (2+4/(Length/Width)*f'c$^{1/2}$ 4*f'c$^{1/2}$ max

m = fy/(0.85*f'c)
Ru = Moment/(0.9*b*d^2)
rho = [1-(1-2*m*Ru/fy)$^{1/2}$]/m
As req'd = rho*b*d

If As req'd is less than the larger of 200/fy or 3(f'c)$^{1/2}$/fy then As req'd is multiplied by 4/3. If this new As req'd is greater than the larger of the above, As req'd is set to the larger of the above. Finally if As req'd is less than the input % Min Steel then the As req'd is increased to the input minimum.

Minimum Overturning Safety Factor = 1.5
Minimum Sliding Safety Factor = 1.5

Column Band Reinforcement = Total Reinforcement*2/(Long Dim./Short Dim.+1)

BOCA '93

The Allowable Soil Bearing is increased by 4/3 if the load case includes a wind or seismic load.

Bo = 2*(Column Length+d)+2*(Column Width+d)
       If the column is closer to the edge than the distance d, Bo is reduced accordingly.
vu Punching = Punching Shear/(0.85*Bo*d)

vu One Way = One Way Shear/(0.85*b*d)

One-way vc=2*f'c$^{1/2}$
Punching vc = (2+4/(Length/Width)*f'c$^{1/2}$ 4*f'c$^{1/2}$ max

m = fy/(0.85*f'c)
Ru = Moment/(0.9*b*d^2)
rho = [1-(1-2*m*Ru/fy)$^{1/2}$]/m
As req'd = rho*b*d

If As req'd is less than 200/fy then As req'd is multiplied by 4/3. If this new As req'd is greater than 200/fy then As req'd is set to 200/fy. Finally if As req'd is less than the input % Min Steel then the As req'd is increased to the input minimum.

Minimum Overturning Safety Factor = 1.5
Minimum Sliding Safety Factor = 1.5

Column Band Reinforcement = Total Reinforcement*2/(Long Dim./Short Dim.+1)

SBCCI '91
The Allowable Soil Bearing is increased by 4/3 if the load case includes a wind or seismic load.

Bo = 2*(Column Length+d)+2*(Column Width+d)
      If the column is closer to the edge than the distance d, Bo is reduced accordingly.
vu Punching = Punching Shear/(0.85*Bo*d)

vu One Way = One Way Shear/(0.85*b*d)

One-way vc=2*f'c$^{1/2}$
Punching vc = (2+4/(Length/Width)*f'c$^{1/2}$ 4*f'c$^{1/2}$ max

m = fy/(0.85*f'c)
Ru = Moment/(0.9*b*d^2)
rho = [1-(1-2*m*Ru/fy)$^{1/2}$]/m
As req'd = rho*b*d

If As req'd is less than 200/fy then As req'd is multiplied by 4/3. If this new As req'd is greater than 200/fy then As req'd is set to 200/fy. Finally if As req'd is less than the input % Min Steel then the As req'd is increased to the input minimum.

Minimum Overturning Safety Factor = 1.5
Minimum Sliding Safety Factor = 1.5

Column Band Reinforcement = Total Reinforcement*2/(Long Dim./Short Dim.+1)

SBCCI '94
The Allowable Soil Bearing is increased by 4/3 if the load case includes a wind or seismic load.

Bo = 2*(Column Length+d)+2*(Column Width+d)
      If the column is closer to the edge than the distance d, Bo is reduced accordingly.
vu Punching = Punching Shear/(0.85*Bo*d)

vu One Way = One Way Shear/(0.85*b*d)

One-way vc=2*f'c$^{1/2}$
Punching vc = (2+4/(Length/Width)*f'c$^{1/2}$ 4*f'c$^{1/2}$ max

m = fy/(0.85*f'c)
Ru = Moment/(0.9*b*d^2)
rho = [1-(1-2*m*Ru/fy)$^{1/2}$]/m

As req'd = rho*b*d

If As req'd is less than 200/fy then As req'd is multiplied by 4/3. If this new As req'd is greater than 200/fy then As req'd is set to 200/fy. Finally if As req'd is less than the input % Min Steel then the As req'd is increased to the input minimum.

Minimum Overturning Safety Factor = 1.5
Minimum Sliding Safety Factor = 1.5

Column Band Reinforcement = Total Reinforcement*2/(Long Dim./Short Dim.+1)

ACI 318-95

The Allowable Soil Bearing is increased by 4/3 if the load case includes a wind or seismic load.

Bo = 2*(Column Length+d)+2*(Column Width+d)
       If the column is closer to the edge than the distance d, Bo is reduced accordingly.
vu Punching = Punching Shear/(0.85*Bo*d)

vu One Way = One Way Shear/(0.85*b*d)

One-way vc=2*f'c$^{1/2}$
Punching vc = (2+4/(Length/Width)*f'c$^{1/2}$ 4*f'c$^{1/2}$ max

m = fy/(0.85*f'c)
Ru = Moment/(0.9*b*d^2)
rho = [1-(1-2*m*Ru/fy)$^{1/2}$]/m
As req'd = rho*b*d

If As req'd is less than the larger of 200/fy or 3(f'c)$^{1/2}$/fy then As req'd is multiplied by 4/3. If this new As req'd is greater than the larger of the above, As req'd is set to the larger of the above. Finally if As req'd is less than the input % Min Steel then the As req'd is increased to the input minimum.

Minimum Overturning Safety Factor = 1.5
Minimum Sliding Safety Factor = 1.5

Column Band Reinforcement = Total Reinforcement*2/(Long Dim./Short Dim.+1

DEFINITIONS

% Min Steel   Minimum percentage of reinforcing steel to be used in the design.

As   Area of tension reinforcement.

b   Effective width of rectangular member.

Col Length   Effective length of the column parallel to the length of the spread footing.

Col Loc Direction   Direction from the spread footing centerline that the "Col Loc from CL" distance is measured.

Col Loc from CL   Distance from the centerline of the spread footing to the centerline of the column measured parallel to the length of the spread footing.

Col Width   Effective width of the column parallel to the width of the spread footing.

Concrete Weight   Density of the footing concrete.

d   Distance from the compression face of the element to the centerline of the tension reinforcement.

D   Dead Load.

DL   Dead Load.

f'c   Compressive strength of concrete.

FL   Floor Live Load.

FLL   Floor Live Load.

Friction   Coefficient of friction between the soil and the bottom of the footing.

fy   Minimum yield strength of the reinforcing steel.

Length   Spread footing dimension from left to right.

Offset   Distance from the left edge of the wall footing to the left edge of the wall.

Pedestal Ht   Distance from the top of the spread footing to the top of the pedestal.

Rebar CL   Distance from the bottom of the footing to the centerline of the footing rebar.

rho   Percentage of tension reinforcement.

RL   Roof Live Load.

RLL   Roof Live Load.

Ru   Coefficient of resistance.

SE   Seismic Load.

SEL   Seismic Load.

SF OTM   Safety factor against overturning calculated as shown in the TECHNICAL DISCUSSION section.

SF Slide   Safety factor against sliding calculated as shown in the TECHNICAL DISCUSSION section.

SN   Snow Load.

SNL   Snow Load.

Thickness   Total thickness of the footing.

vc   Maximum ultimate factored shear stress calculated as shown in the TECHNICAL DISCUSSION section.

vu   Actual factored shear stress calculated as shown in the TECHNICAL DISCUSSION section.

W   Wind Load.

Wall Thickness   Thickness of the wall parallel to the wall footing width.

Width   Width of the wall footing parallel to the wall thickness. Also the spread footing dimension from top to bottom.

WL   Wind Load.