Chapter 16

Proficient PFGMH Users - Example #2

Introduction

This Chapter will take advantage of what the User has learned over the last 15 Chapters. It will work Example #2 taking advantage of any shortcuts that are available in the Program, and it will not elaborate on how to use commands. It will show the User how Concepts can be quickly selected and easily tested to verify compliance with the Permanent Foundation Criteria found in the "Handbook".

Example #2

- Given: John Smith desires a Permanent Foundation for a Single-Section Unit , nominal 14 foot wide manufactured home to be sited in Tampa, FL. The data on the Owner's Site acceptability Worksheet remains the same as Example #1, with the exception of item #1. The grade elevation is 28 feet. The Manufacturer's Worksheet remains the same with the following Exceptions:

1. Single - Section (Nominal 14' wide unit)
2. Type C
7. Roof Slope = 4 in 12 (not slippery)
8. Unit weight ≈ 16,500 lbs.
10. Type C1
11a. Pier Spacing = 7 ft.
11b. N.A.
11c. N.A.
11d. 7 Tie-down straps at 8'-8" spacing
Note: Tie-downs are required to be 2'-0" in from each end of the unit. (section 601-2.B.)
14. Design Wind = 120 MPH
16b. Uplift capacity = 3,150 lbs./diag. set
16c. Sliding capacity = 4,800 lbs./diag. set
16d. Sliding capacity = 4,800 lbs./diag. set
16e. Vertical X-bracing tension capacity = 5600 lbs./strap

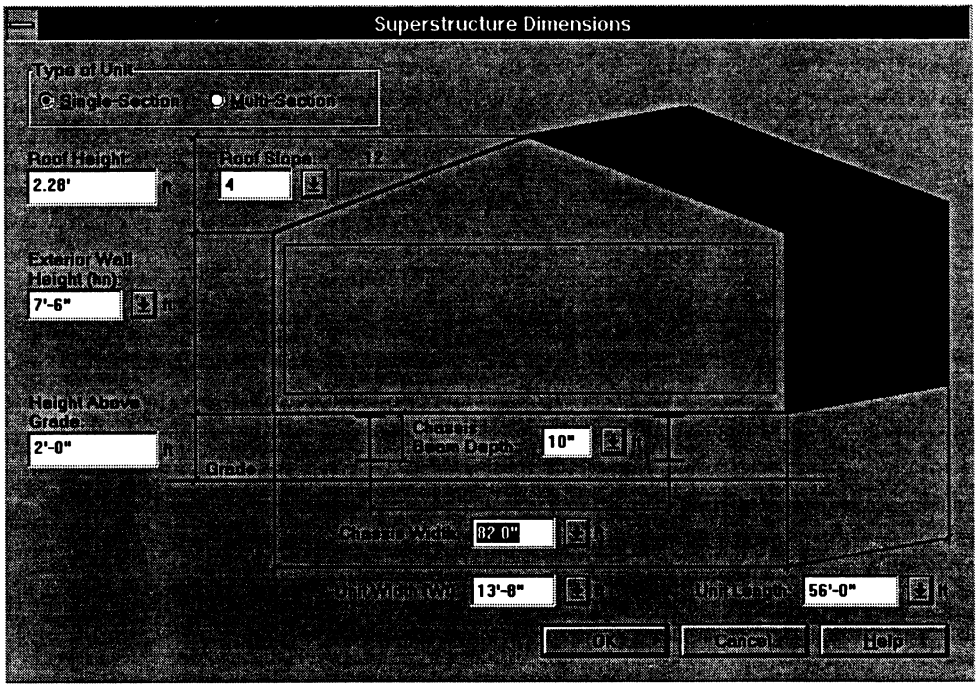
Owner's Site Acceptability Worksheet

- The User should select the **Owner's Site Acceptability Worksheet** from the **Worksheets** pull-down menu. Use the following client information:
  - Name: John Smith
  - Address: 35 Brandywine
  - City,State: Tampa, FL
  - Remainder of information matches that of Example #1, except for grade elevation being = 28'-0".
  - The User can now select Print for a hard copy of the Form. See Appendix B For the completed **Owner's Site Acceptability Worksheet.**

Manufacturer's Worksheet

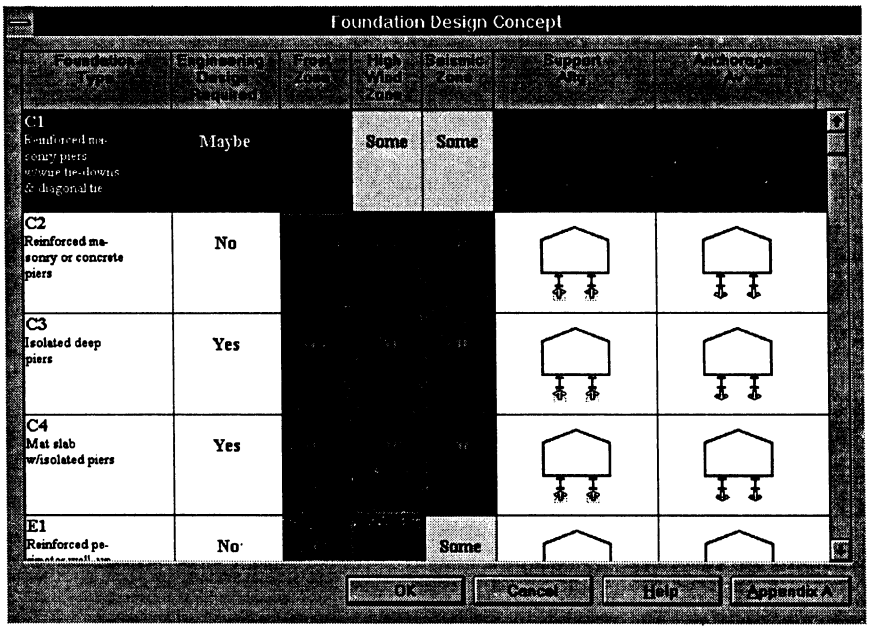
- The User should select the **Manufacturer's Worksheet** from the **Worksheets** pull-down menu. Use the following Manufacturer information:
  - Name: New Homes
  - Address: 39 Peachtree Lane
  - City,State: Atlanta, GA
- Question #1: Select "Single-Section" with the mouse pointer and it will highlight with a black border. Select the button at the far end of the question to bring up the **Superstructure Dimensions** dialog window, fill in all the blanks with data as given and it will look as below:

Note: Do not select the Superstructure Dimensions Icon from the Main Tool Bar, if it is desired to have the dimensional data entered on the Manufacturer's Worksheet. The User must choose the button at the end of question #1 for data to be entered in the boxes on the Form.

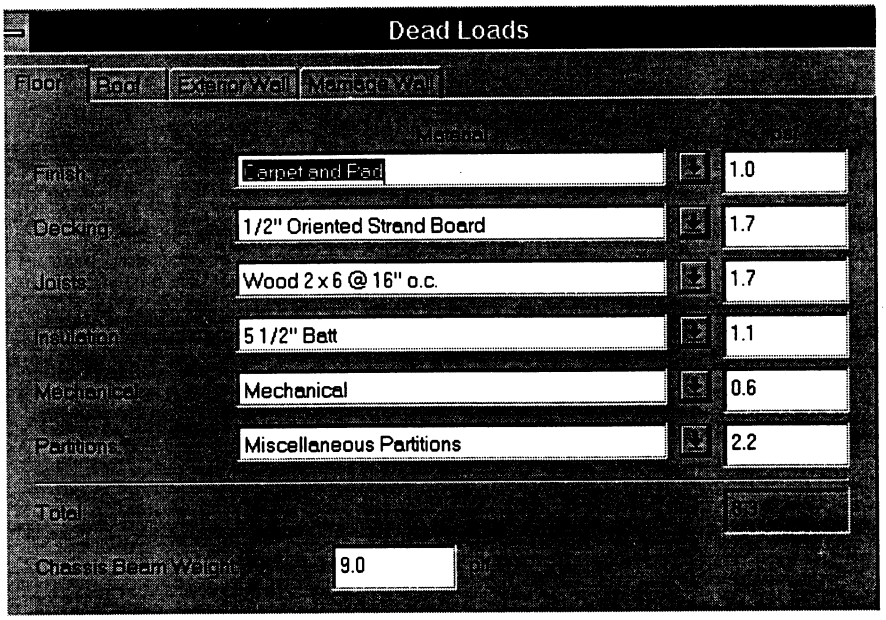


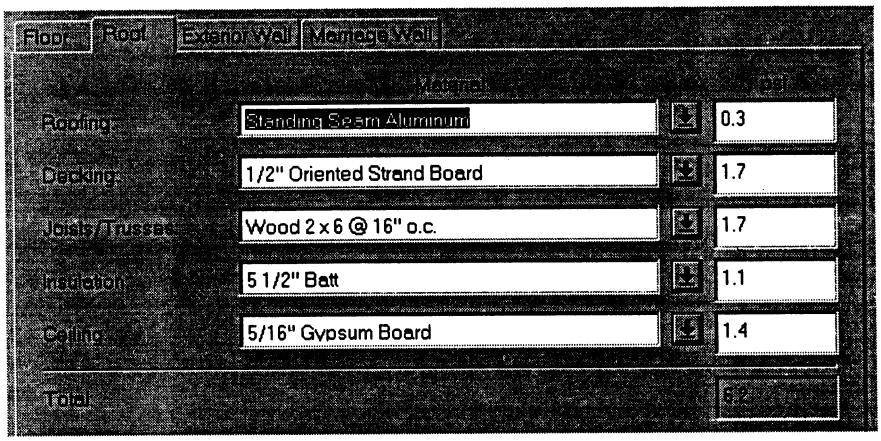
Note: User should always verify that units are typed with the dimensions. for example, if chassis width were typed in as 82, without the inch mark (") the computer will assume it is 82 feet. Thus, the User should always check the **down-arrow button Drop-down list box** first, which always supplies the units.

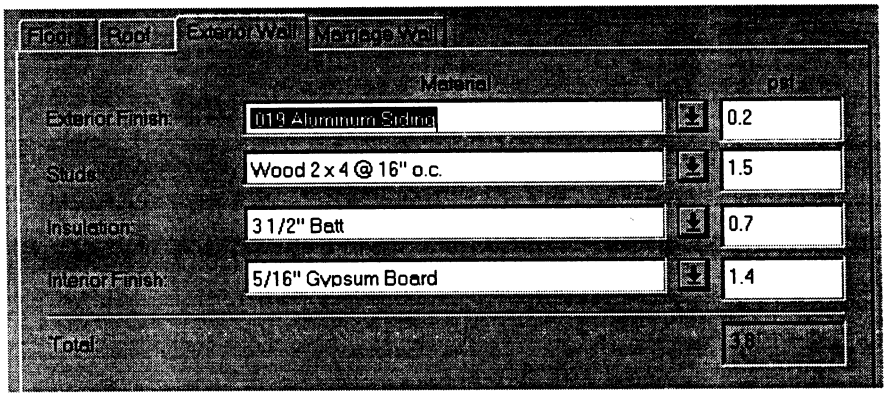
- Question #2: Select the button at the far right of the question. The **Foundation Design Concept** dialog window will appear. Select Type **C1**.



- Question #8: Select the button at the far right of the question. The **Dead Loads** dialog window will appear. Complete the **Floor, Roof** and **Exterior Wall** Tabs to look as follows:







Select **OK** at the completion of these 3 Tabs and return to the Form, where the **Self weight** of the total unit will be entered as **(W) = 16, 452 lbs.**

- Question #10: Foundation Concept Type **C1** will automatically be entered, based on your choice from question #2. Select the green typed and underlined Appendix A from the On-Line "Handbook" and review the **Foundation Selection Table** for suitability of the foundation type **C1** subjected to wind, seismic, and engineering design as shown below:

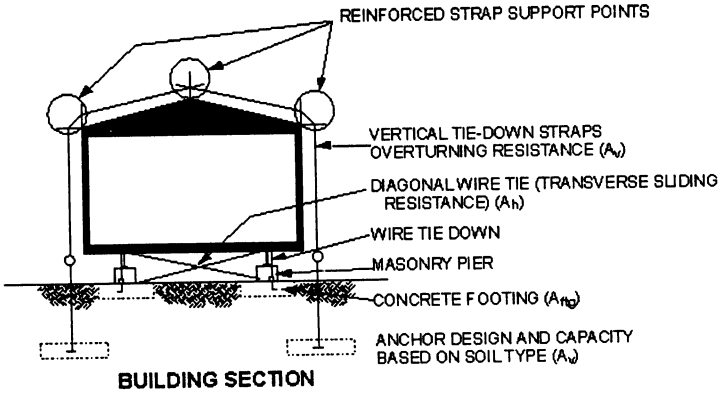
A-100.5. Selection Table

A-100.5. SELECTION TABLE. The table immediately following can be used to select appropriate foundation types for sites with special requirements.

FOUNDATION SELECTION CHART

Foundation Type	High Wind Zone			Engineering Design Required			Seismic Zone		
	All	Some	None	Yes	No	Maybe	All	Some	None
C1 Reinforced masonry piers w/wire tie-downs & diagonal tie		X				X		X	

Engineering design will likely be required for the Hurricane potential of Tampa, FL, while seismic is likely not an issue. Select the green typed and underlined **C1** to bring up typical plan, section and details for this type of Foundation selection. A portion of the information is as follows:

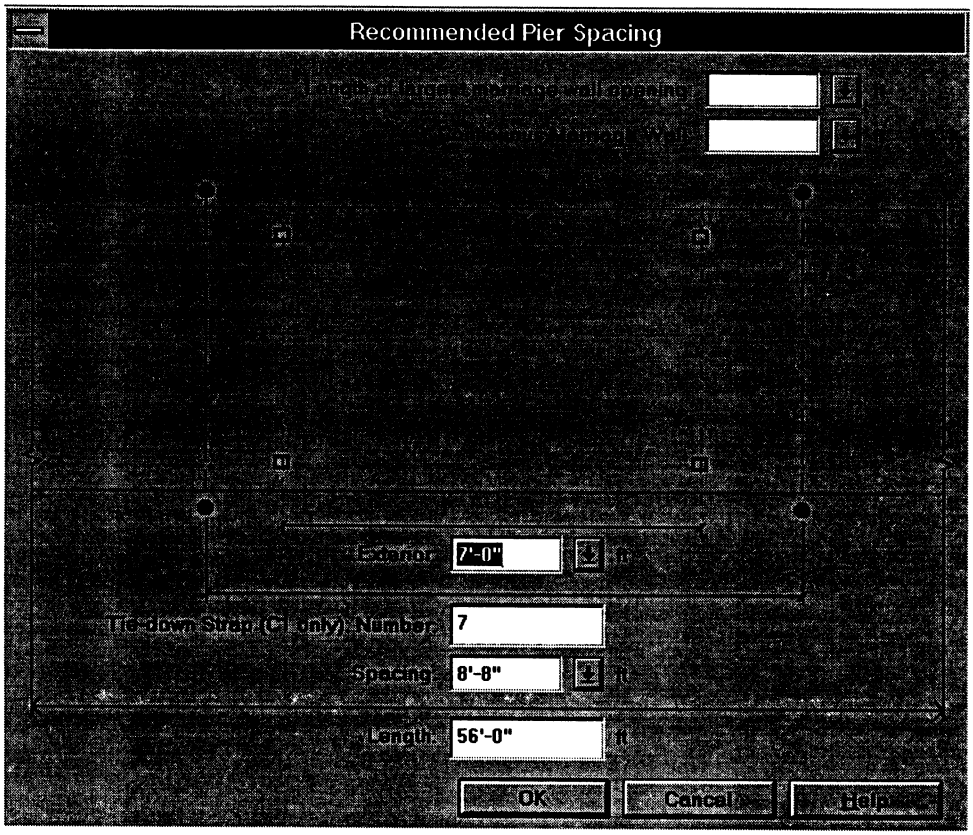


BUILDING SECTION

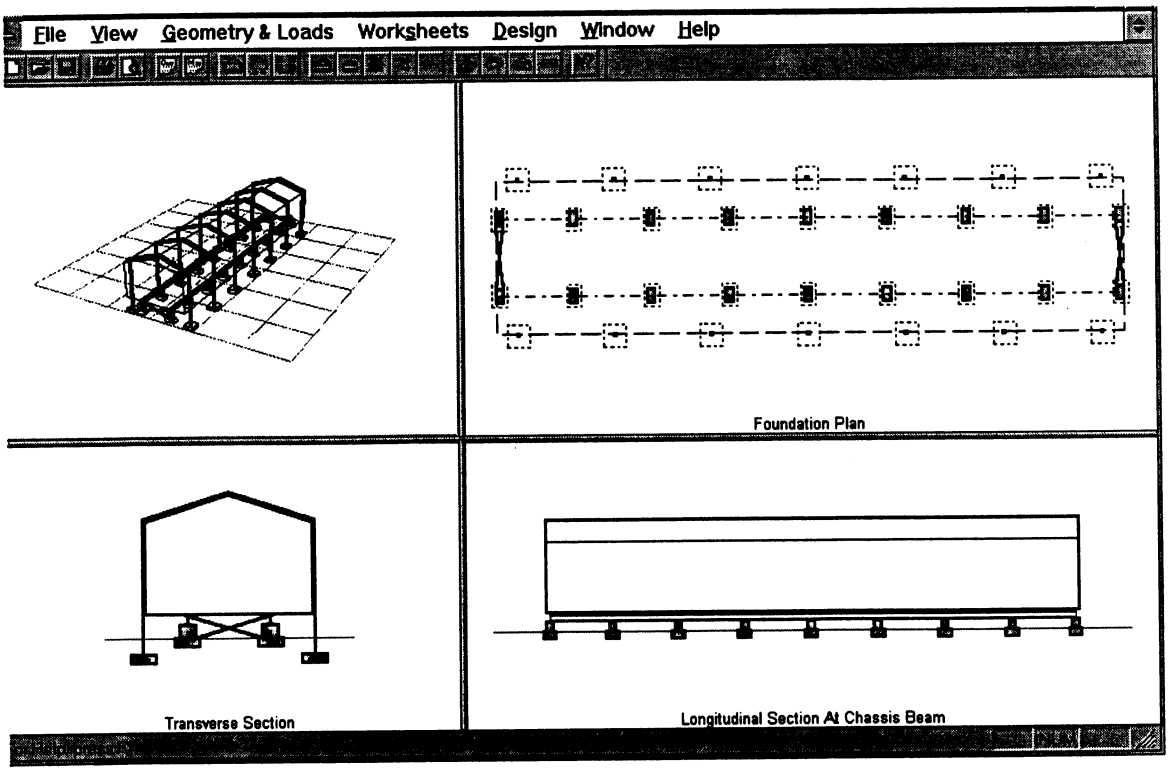
NOTE: TYPICAL STEEL TIE-DOWN STRAP: 1/32" X 1-1/4"
MINIMUM BREAKING TENSION STRENGTH = 4750 LB (ULTIMATE LOAD)
(ASTM D3953-83) OR
FEDERAL QQ-S-781G

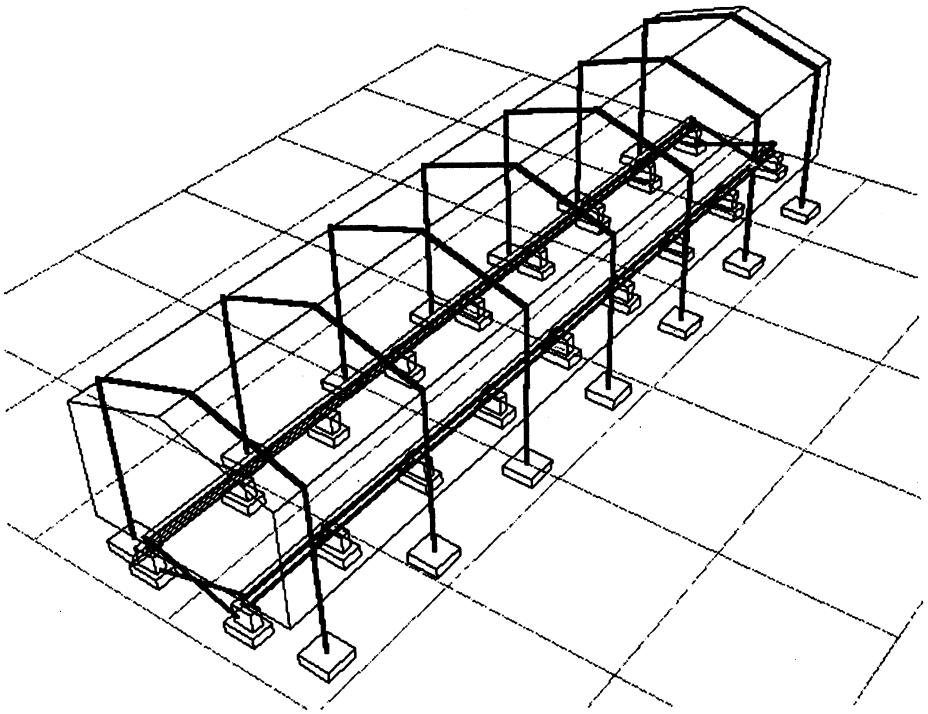
FOUNDATION TYPE	SYSTEM NUMBER
Reinforced masonry piers w/ wire tie downs and diagonal tie	C1
SUPERSTRUCTURE TYPE Chassis supported single-wide	

- Questions #11a and 11d: Select the button at the far right of the question to bring up the **Recommended Pier Spacing** dialog window. Select the given **7'-0"** pier spacing under the chassis beams. Type in the **8'-8"** spacing and the number of tie downs is calculated as **7,** which automatically appears in the box below. Select **OK** and return to the Form, where this information will automatically be entered.



- Questions #12 through #16f: The User can type in each answer according to the Given information that started Example #2.
- This completes the **Manufacturer's Worksheet.** Select **Print** for a hard copy. A sample output is found in Appendix B.
- The User can become acquainted with the Foundation Concept **C1** with the Manufacturer's recommended superstructure geometry and foundation spacings by selecting **Graphics Window** from **View** on the pull-down menu bar as shown below, and using the **View Toolbar** to enlarge the perspective:


File View Geometry & Loads Worksheets Design Window Help
Foundation Plan
Transverse Section
Longitudinal Section At Chassis Beam

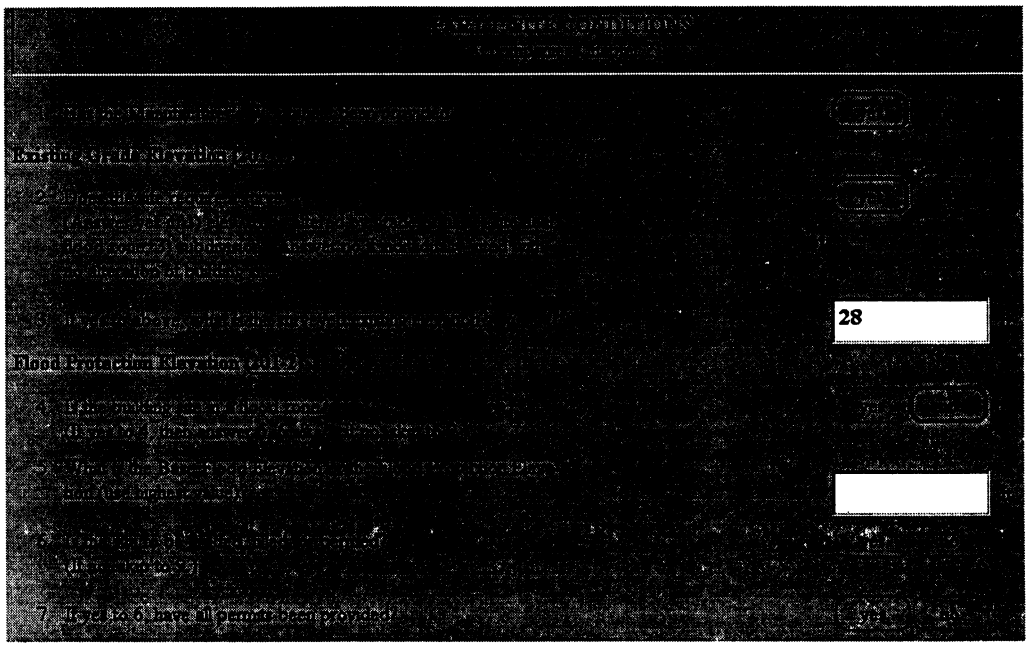


Design Worksheet

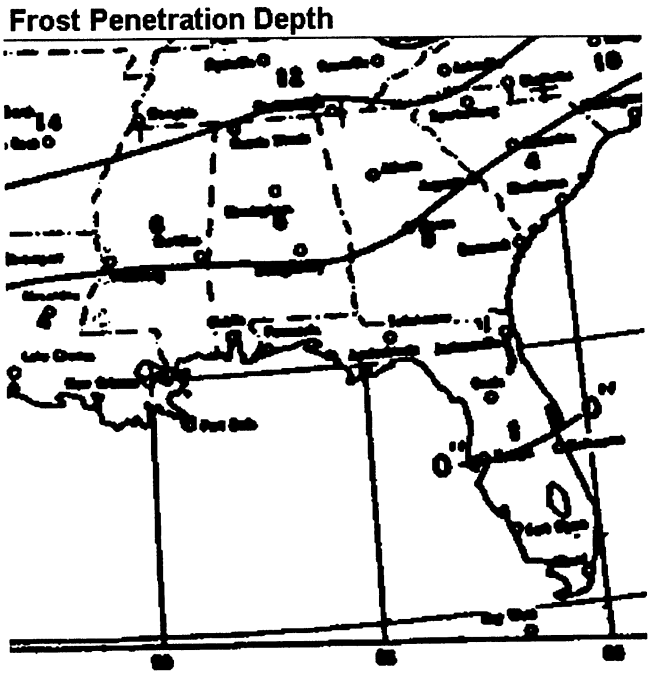
- The User should select the **Design Worksheet - Header Information** from the **Worksheets** pull-down menu. Use the following information:
  - Builder's Name: Grappo Industries.

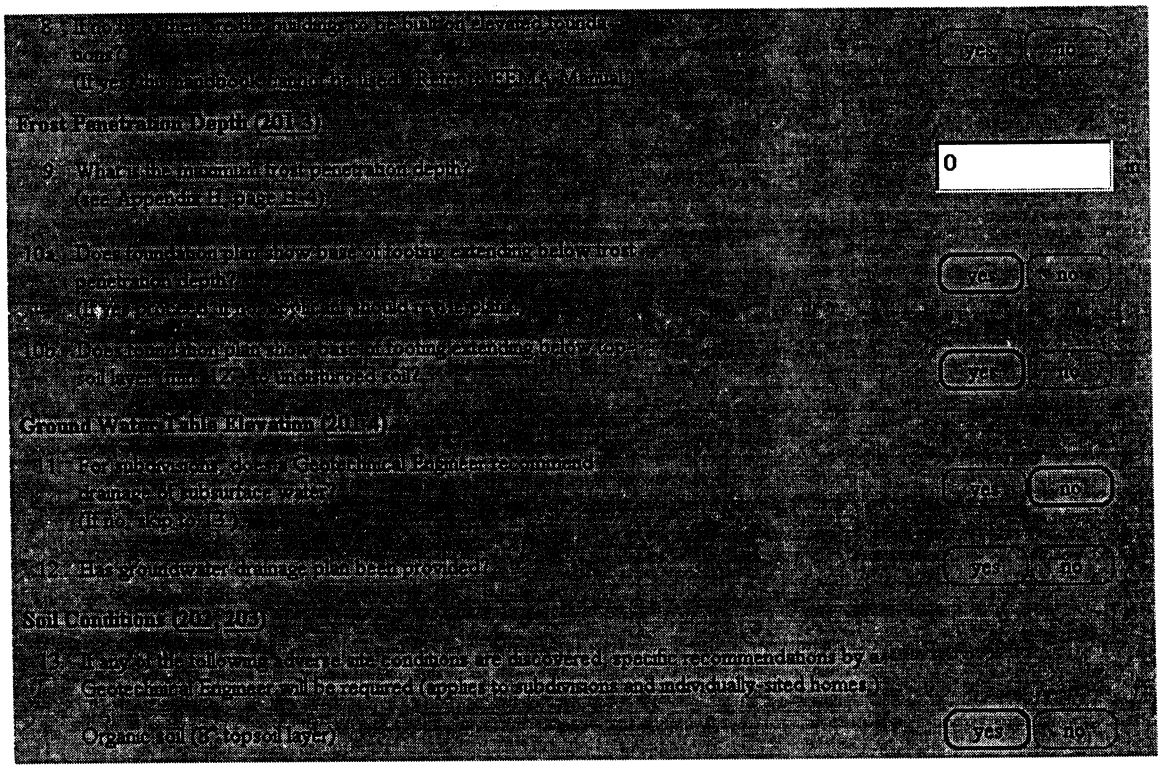
Part 1 - Site Conditions

- The User should select the **Design Worksheet -Part 1 - Site Conditions** from the **Worksheets** pull-down menu. It is shown below completed. Many of the questions are of the "yes/no" type. Only the existing grade elevation = 28' has been automatically inserted.

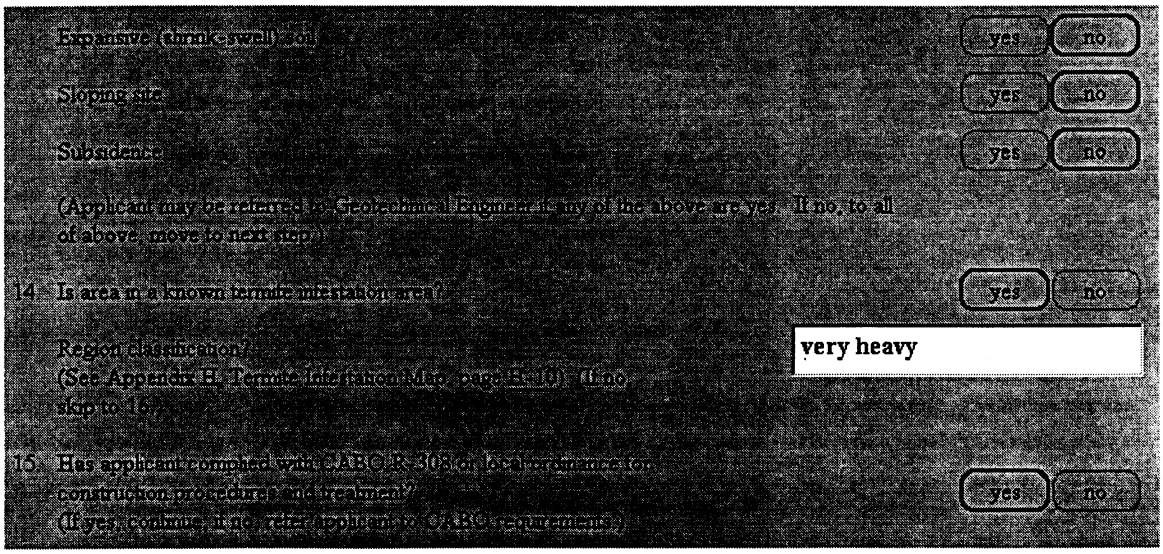


- Question #9: The **Frost Protection Depth** is reviewed from selection of the green typed and underlined map H-4 as shown below. Note the contour shows "zero" for Tampa. Return to the Form and Type (0") in the blank box and answer "yes/no" to questions #10a, #10b, #11 to #13.



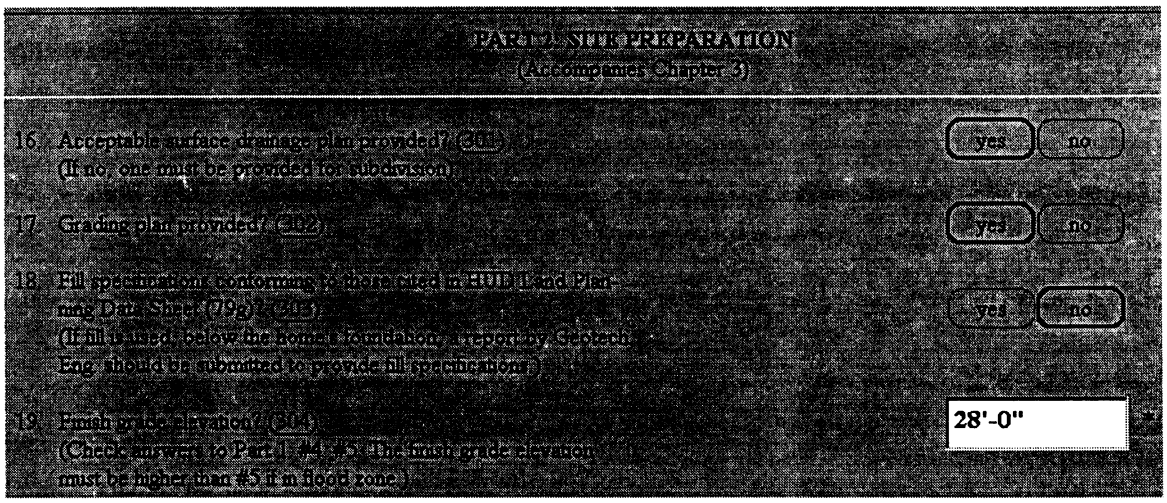


- Question #14: Select the green typed and underlined H-10 **Termite Infestation** map. The entire state of Florida is solid "black" which implies "Very heavy" infestation. Return to the Form and select "yes" and type in "very heavy". Also, answer question #15, "yes/no".



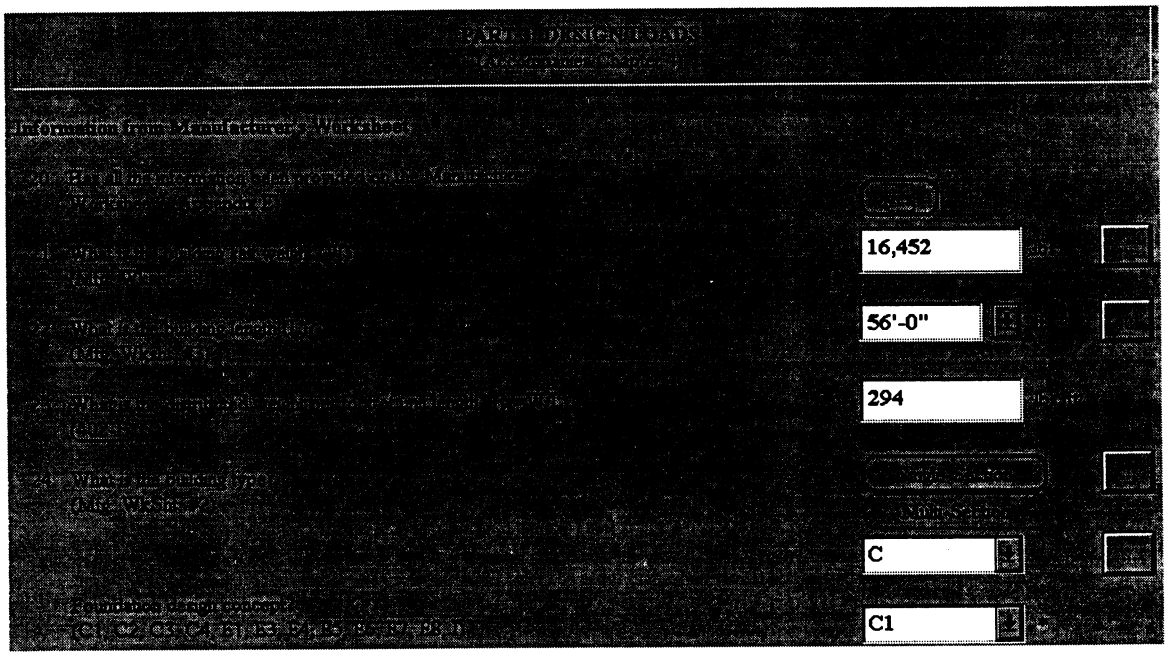
Part 2 - Site Preparation

- The User should select the **Design Worksheet -Part 2 - Site Preparation** from the **Worksheets** pull-down menu. Answer the "yes/no" questions. The completed portion of the Form is shown below.



Part 3 - Design Loads

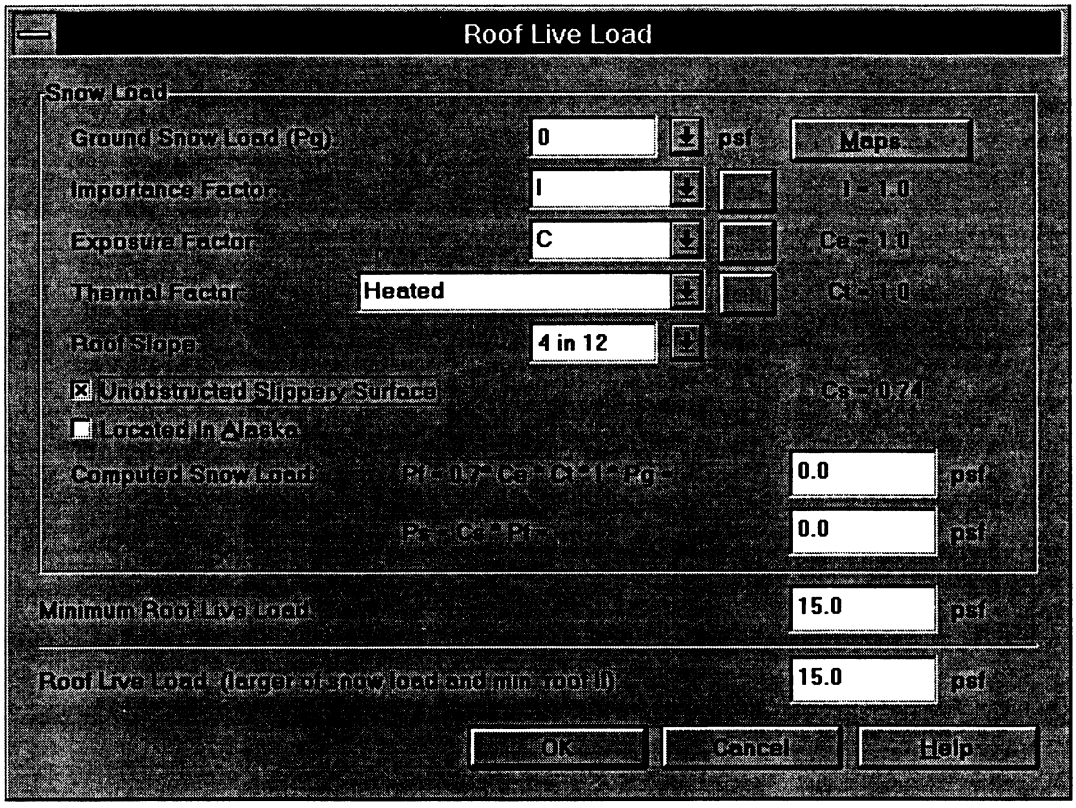
- The User should select the **Design Worksheet -Part 3 - Design Loads** from the **Worksheets** pull-down menu. The first portion is shown below automatically filled in with previously entered data from the **Manufacturer's Worksheet.**

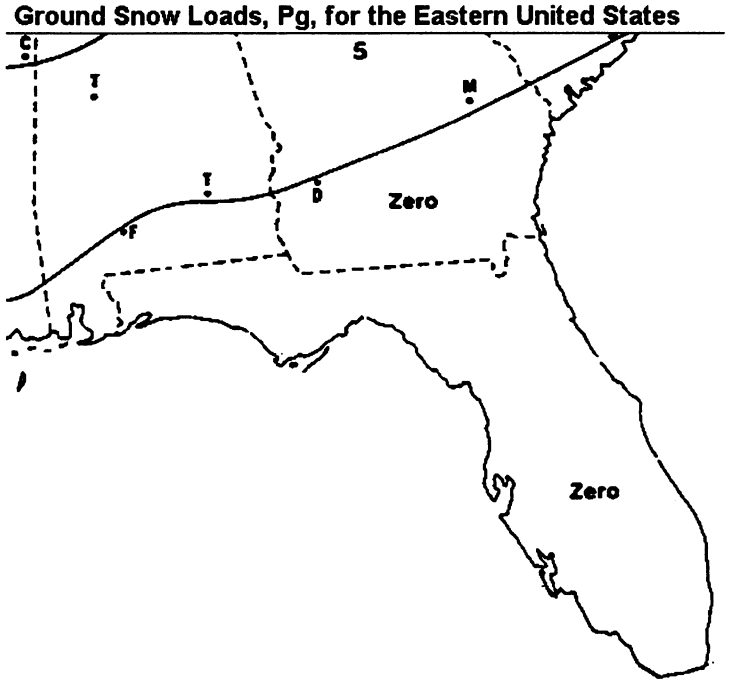


- Questions #25, #26, #27: Can be ignored since they really relate to use of the "Handbook" to proceed.

Snow Load/Minimum Roof Live Load

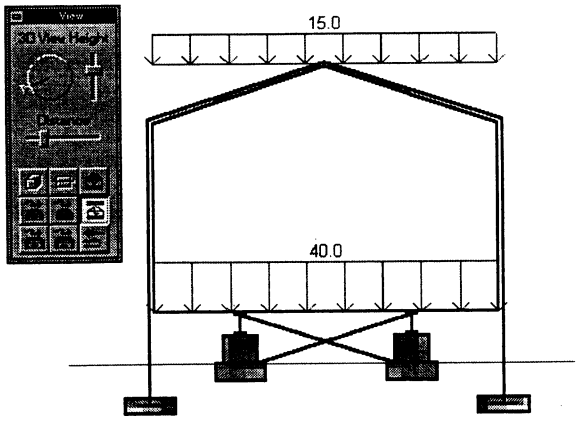
- Question #28a: Select the **Roof LL Icon** to bring up the dialog window. Select the Map button to bring up the **Ground Snow Load Map**. The "zero" appears across the state. Select "Unobstructed Slippery Roof". Select **OK** and the Form will be automatically filled in. Note that snow does not control; the minimum roof live load controls.





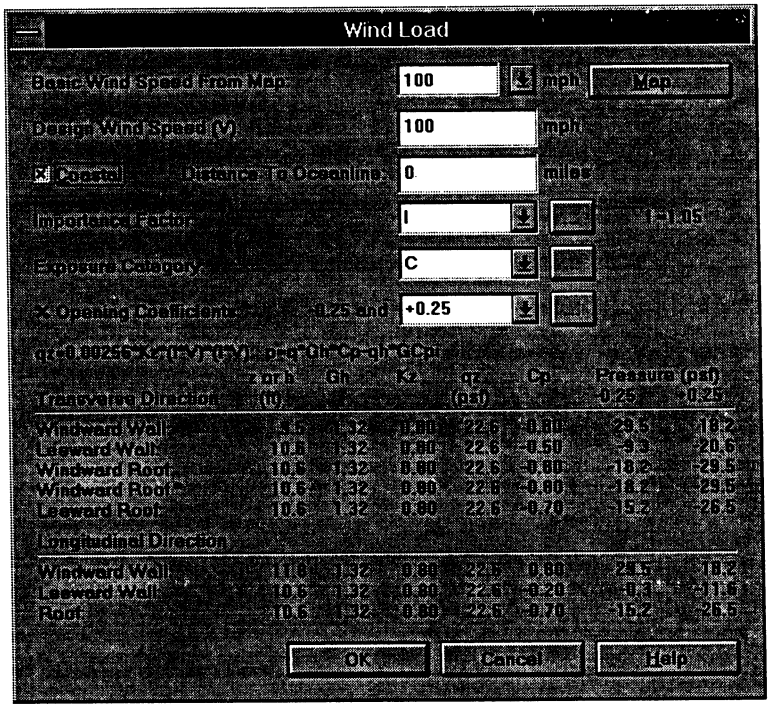
- The User can view the **Live Loads** on the superstructure by selecting the **Graphics Window** from **View** on the Pull-Down Menu Bar and then selecting the **Live Load Icon** on

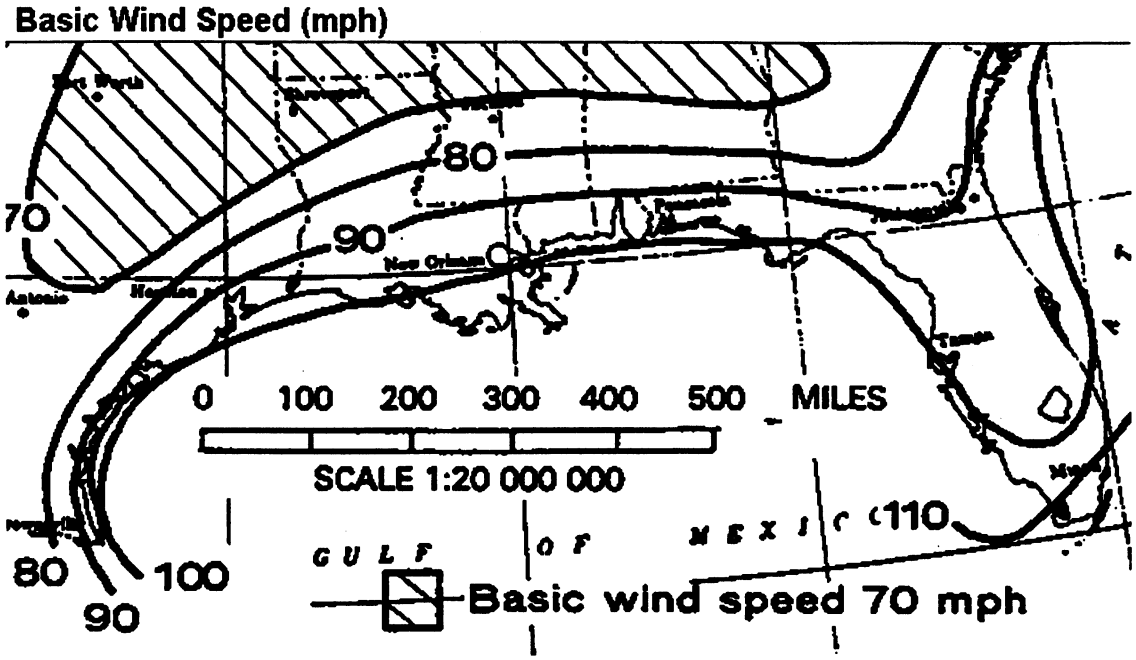
the **View Toolbar** as shown below. The roof live load and the floor live load are both shown.



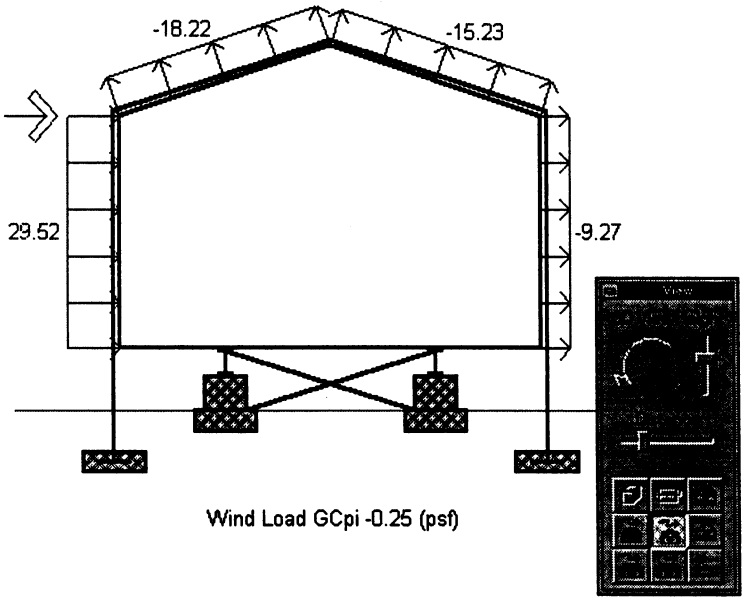
Wind Load

- Question #31a: Select the **Wind Load Icon** to bring up the dialog window. Select the Map button to bring up the **Basic Wind Speed Map** and locate Tampa. Enter the value at the Tampa contour, as shown below, as 100 MPH and select "Coastal". Select **OK** and the Form will automatically be filled in with these values.

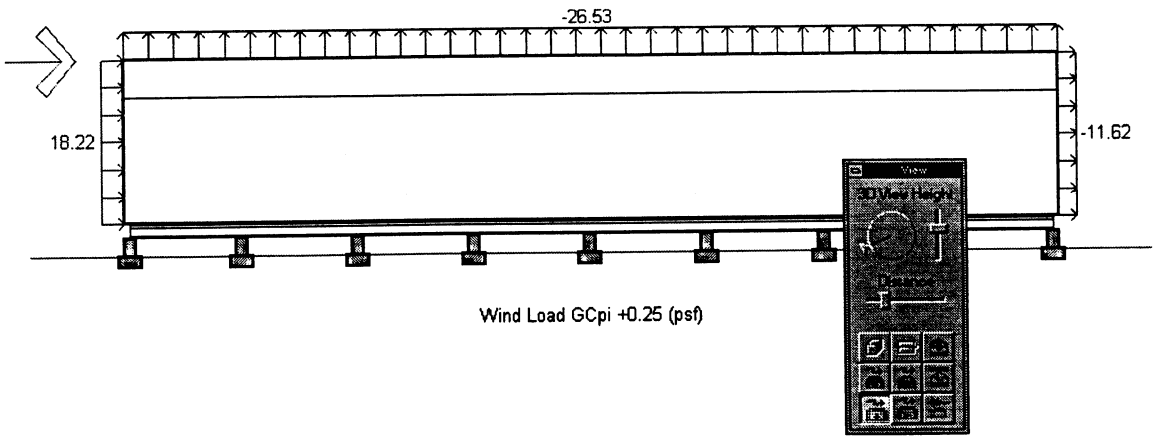




- The User can view the wind loads on the superstructure either in the transverse or longitudinal direction, just as done for the Live Loads, including ± internal pressure values as shown below:



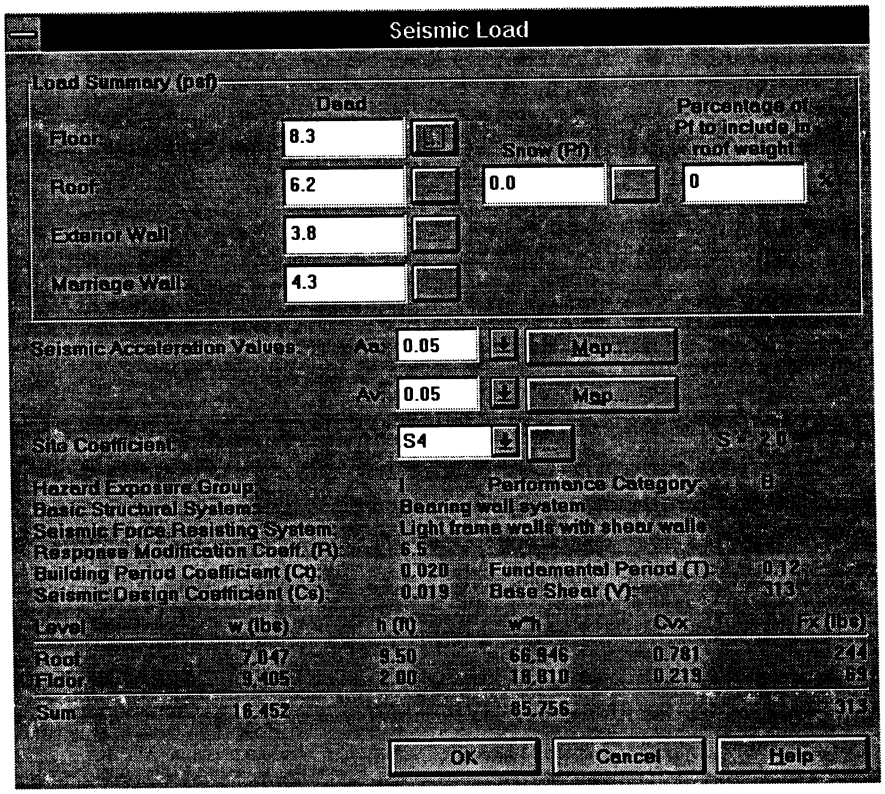
Transverse Section

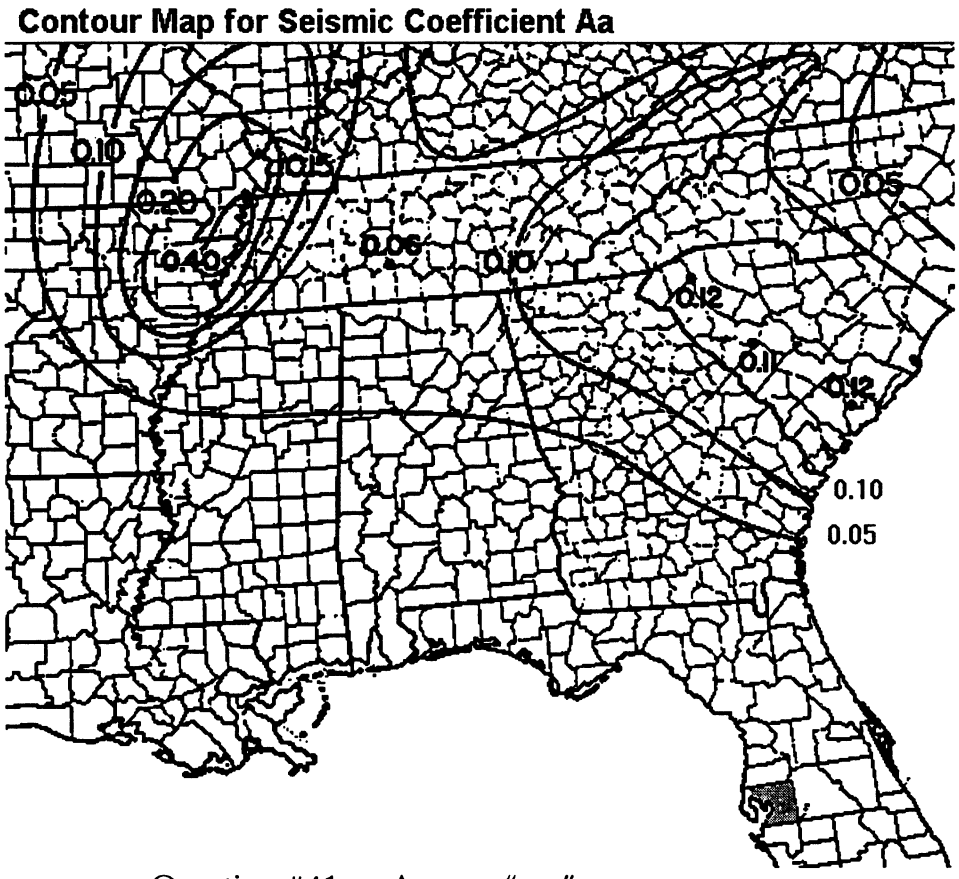


Longitudinal Section At Chassis Beam

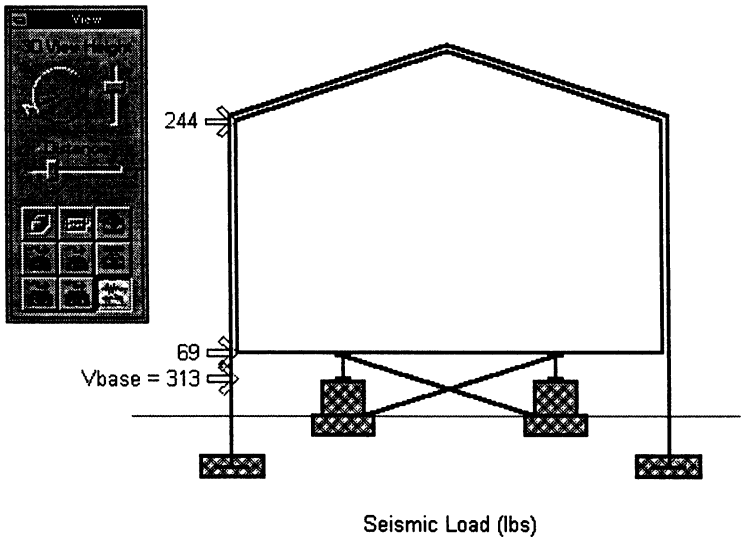
Seismic Load

- Question #38a: Select the **Seismic Load Icon** to bring up the dialog window. Select the Map button to bring up the **Seismic Coefficient Map Aa** and locate the grayed Hillsborough County where Tampa resides. Read the contour as **0.05**, as shown below. Repeat for **Av** and find **0.05** again. Enter these values in the dialog window. Select **OK** and the Form will automatically be filled in with these values.





- Question #41: Answer "yes".
- The User can view the Seismic Inertia Forces on the superstructure either in the transverse or longitudinal direction. The transverse direction is shown below:

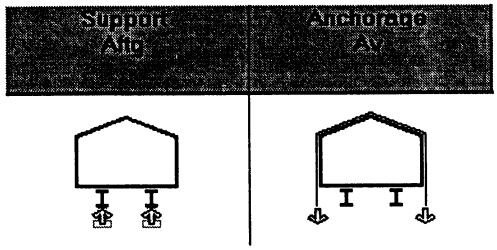


Seismic Load (lbs)

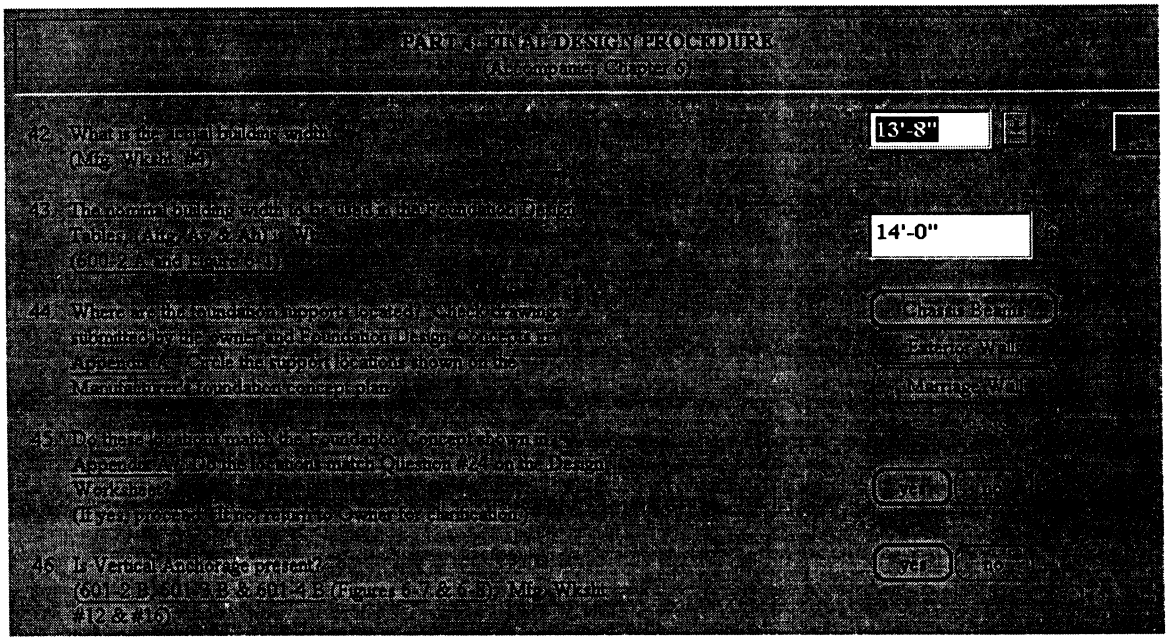
Transverse Section

Part 4 - Final Design Procedure

- Question #42 and #43 will be already filled in.
- Question #44: For the Foundation Concept **C1**, piers will only be located under the "chassis beams". Make that choice and it will highlight with a black border.



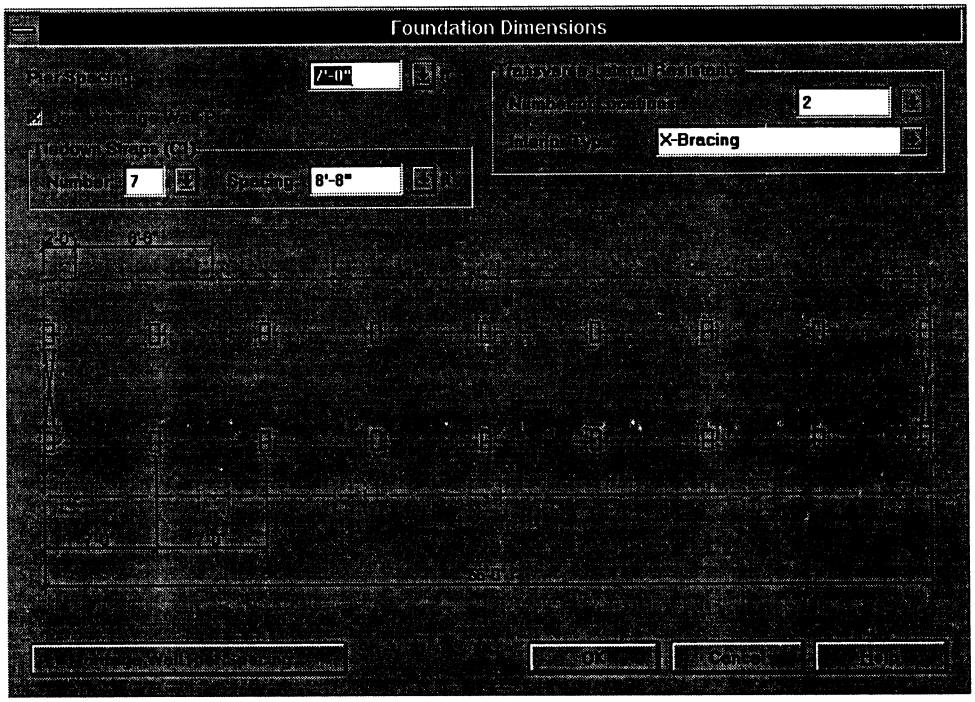
- From the graphic above it is apparent that the **Support** is under the chassis beams and the **Anchorage** comes from tie-down straps that either wrap around the roof of the unit or attach to the side wall of the unit, and then attach to concrete deadmen below grade for ballast.
- Question #45 and #46: Answer "yes" to both, based on the graphic of a Type **C1** shown above.
- The completed **Part 4** is shown below.

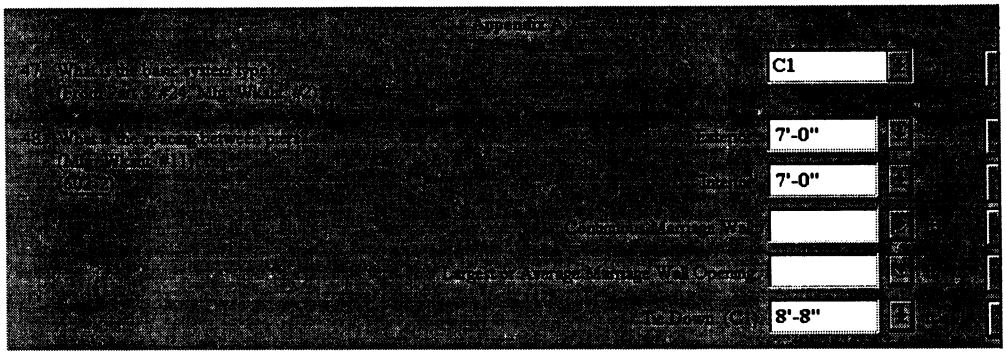


Required Footing Size - Appendix A

- Question #47 and #48 are already filled in with the preliminary recommendations made by the Manufacturer. Select the **Foundation Dimensions Icon** to bring up the dialog window to visually see the arrangement of pier footings and dead-men anchor footings. Various options are available here to re-arrange the spacings within the dialog window. Select **OK** and return to the Form, which will be filled in automatically.

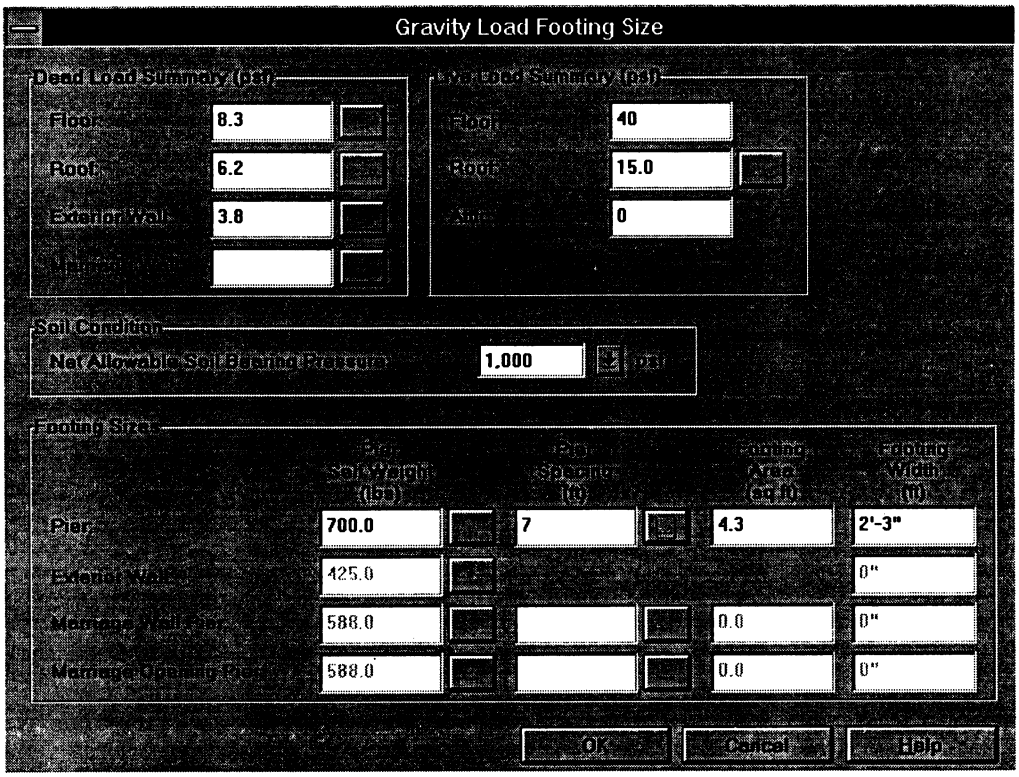
Note: The Transverse Lateral Resistance system has already been set up for Vertical X-Bracing Planes, since this is the most likely transverse sliding resistance option. Also, the minimum number of such bracing planes is shown as two, which starts the User on the trial-and-error process for required (Ah).



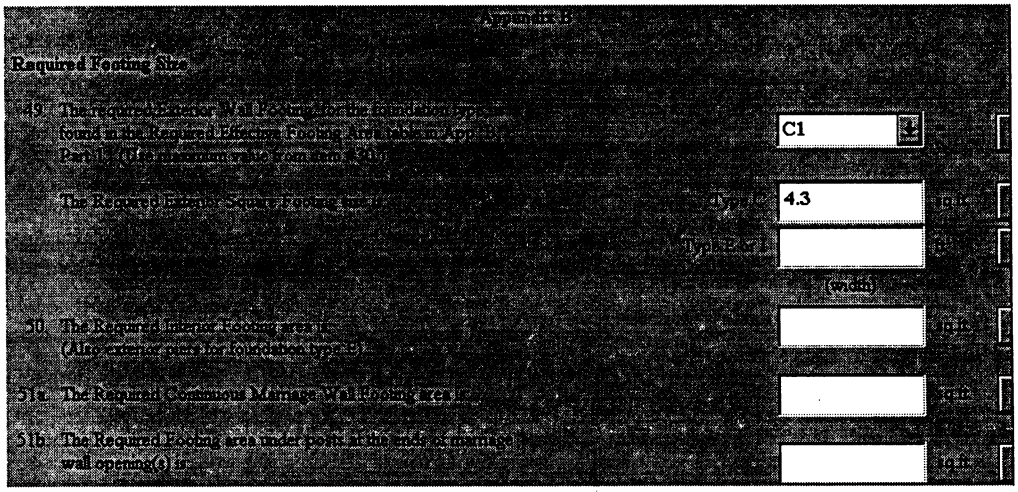


Required Footing Size - Appendix B

- Question #49: Select the **Gravity Load Footing Size Icon** to bring up the dialog window. The Preliminary spacing of 7′-0″ produces a square footing 2′-3″ on a side based on a net allowable soil bearing pressure of 1000 psf. If this is satisfactory select **OK** and return to the Form, where the information will automatically be entered in the boxes.

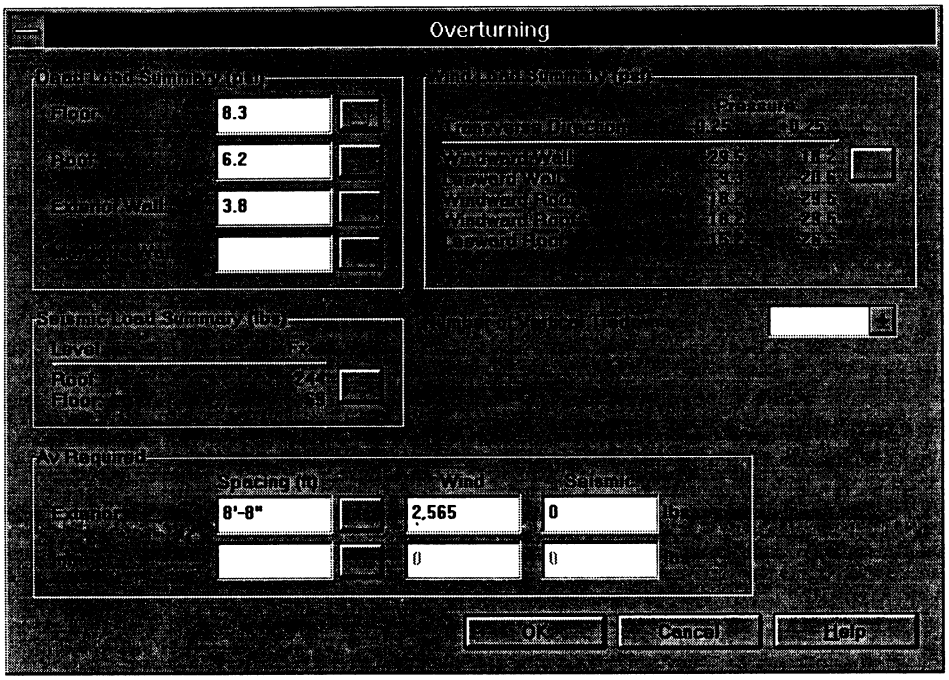


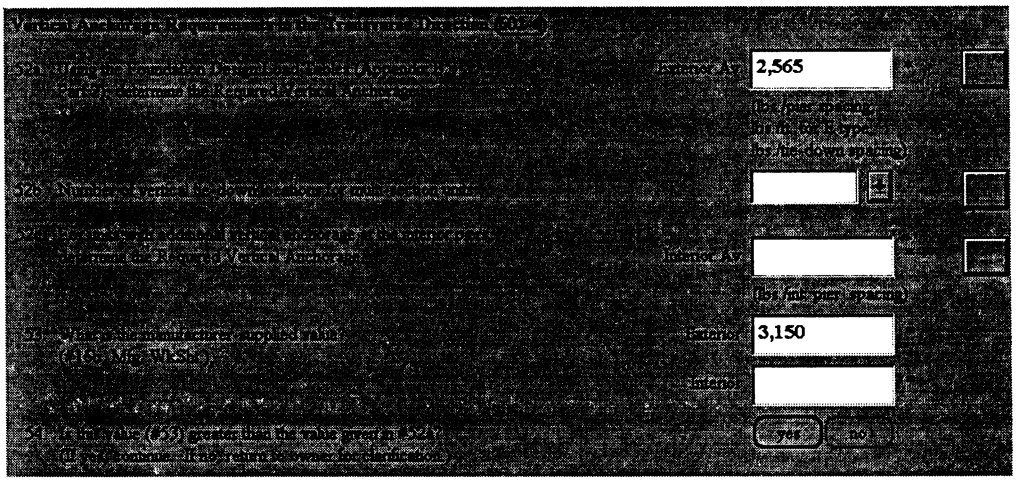
- Questions #50, #51a & #51b do not apply to a Type **C1** foundation option.



Vertical Anchorage Requirements in the Transverse Direction - Av - Overturning & Uplift

- Question #52a: Select the **Overturning Icon** to bring up the dialog window. Using tie-down straps at **8'-8"** on center, will produce a vertical anchorage force **Av = 2,570 lbs.** Select the button next to the spacing to bring up the **Foundation Dimensions** dialog window to revise the spacing as required. Review the loads summary. Select **OK**, if satisfied, and return to the Form where choices made will automatically be filled in.

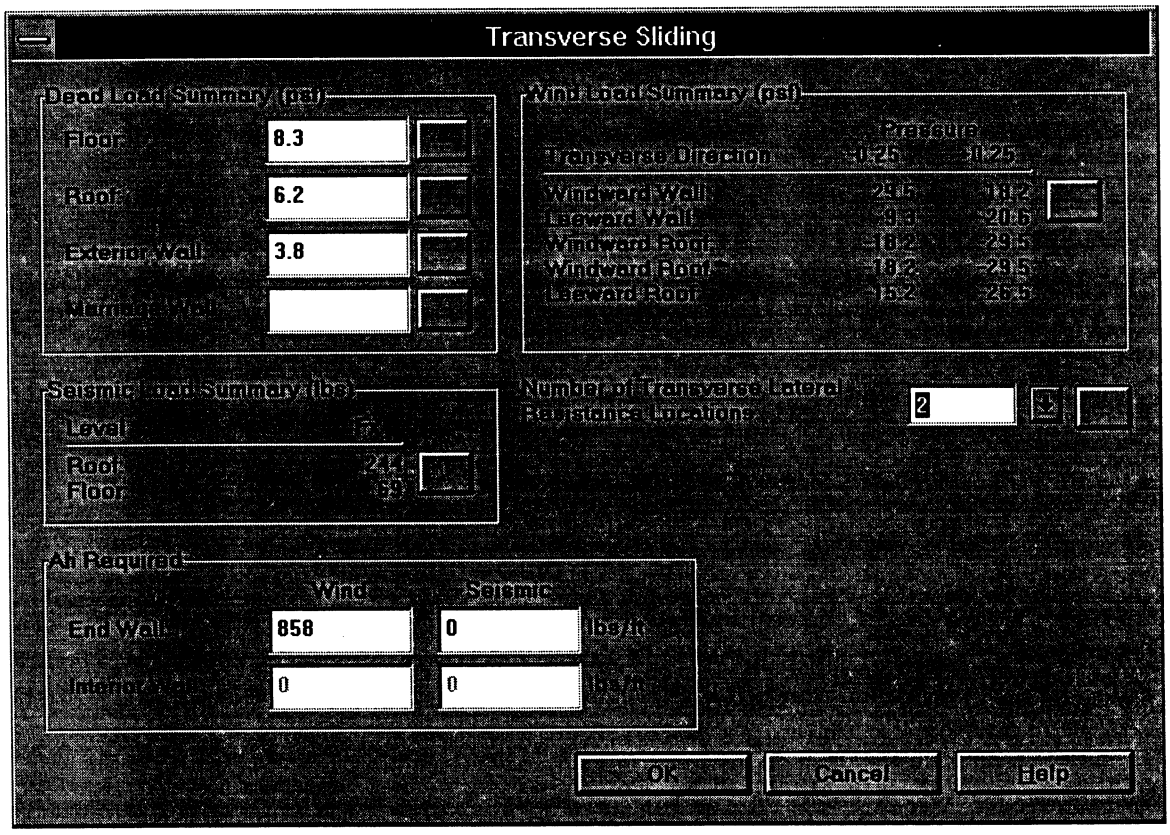


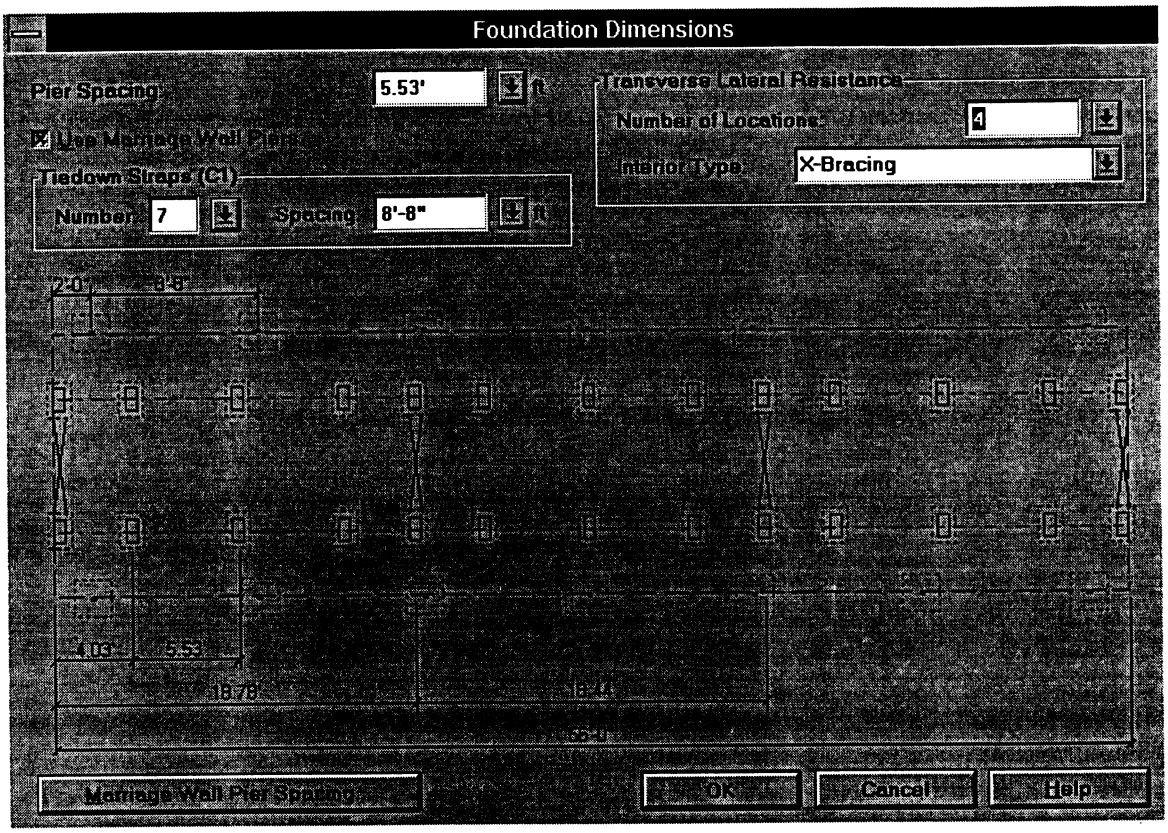


Note: The Required (Av) is less than the manufacturer's rated connection capacity for uplift and overturning. If the Required (Av) was greater than the manufacturer's rated connection capacity, a closer spacing of deadman tie-downs would have been required, meaning more than 7 anchor locations.

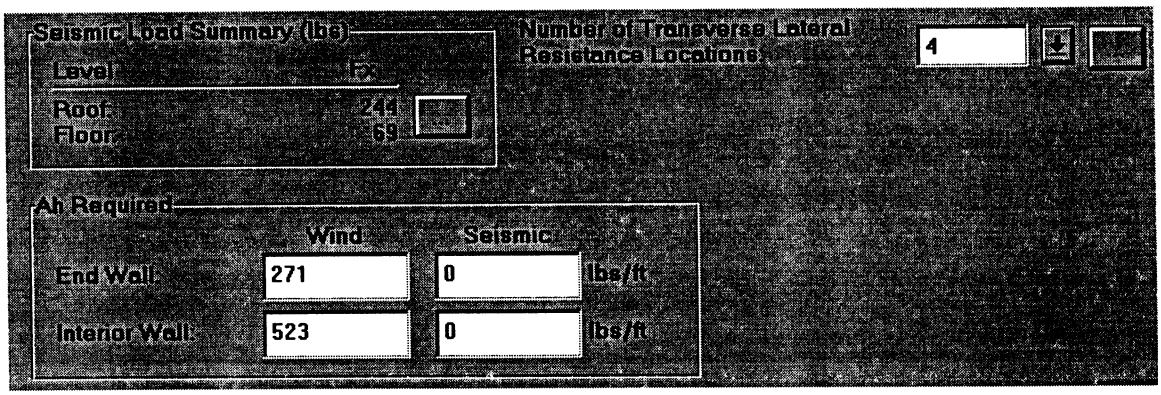
Horizontal Anchorage Requirements in the Transverse Direction - Ah - Sliding

- Question #55a & #56: Select the **Transverse Sliding Icon** to bring up the dialog window. Start with **two** vertical X-bracing planes and find the horizontal anchorage force/foot as **(Ah) = 858 lbs/ft**. Select the button next to the "number of transverse lateral resistance locations" to bring up the **Foundation Dimensions** dialog window to revise and view in plan the layout of the foundation if the number of **Vertical X-bracing Planes** is changed to **4**.

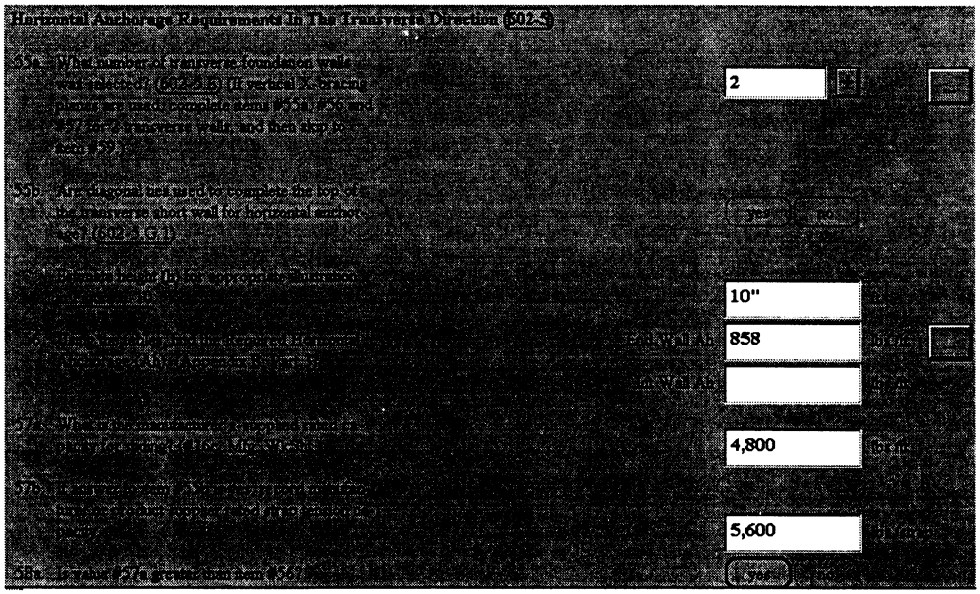




Note: PFGMH always maintains symmetry in lateral load resistance planes and re-spaces pier footings under the chassis beams likewise in a symmetrical arrangement. This results in more piers and pier footings. Thus, always use the least number of lateral resistance planes for economy. Note that the exterior and interior planes carry less horizontal force per foot than if two vertical X-Bracing Planes are used. This would be the process if the Manufacturer's rated connection capacity for sliding was less than (Ah).

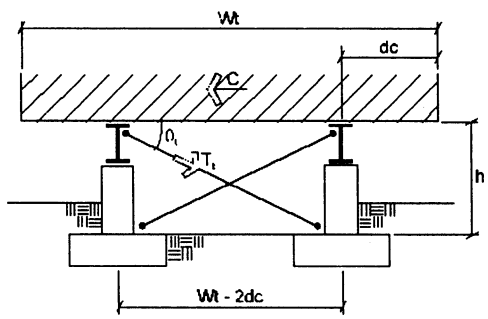


- Return to the choice of two vertical X-bracing planes, since the Required (Ah) is less than the 4800 lbs/ft. supplied by the Manufacturer. Select **OK**, and return to the Form where final choices made will automatically be filled in.



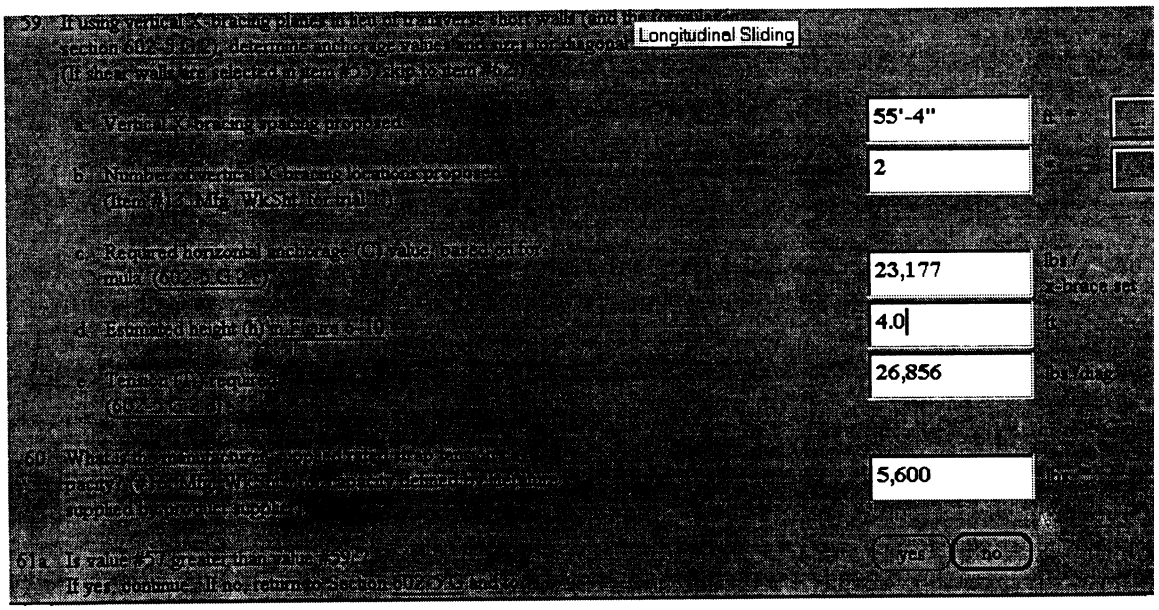
- Question #59: The vertical X-Bracing straps or rods must be checked for sufficient tensile capacity. Even though the superstructure can withstand horizontal connection forces per foot of 4800 lbs/ft, the straps that the manufacturer or supplier suggests have a rated allowable tensile capacity of 5600 lbs. (not lbs/ft). The equations the program uses to convert the horizontal force per foot into a diagonal force to each strap are developed in the On-Line "Handbook". This is accessible through the green typed and underlined sections. The User should type in an estimated (h) for question #59d, say 4'-0", and the Form will supply the (T_t).

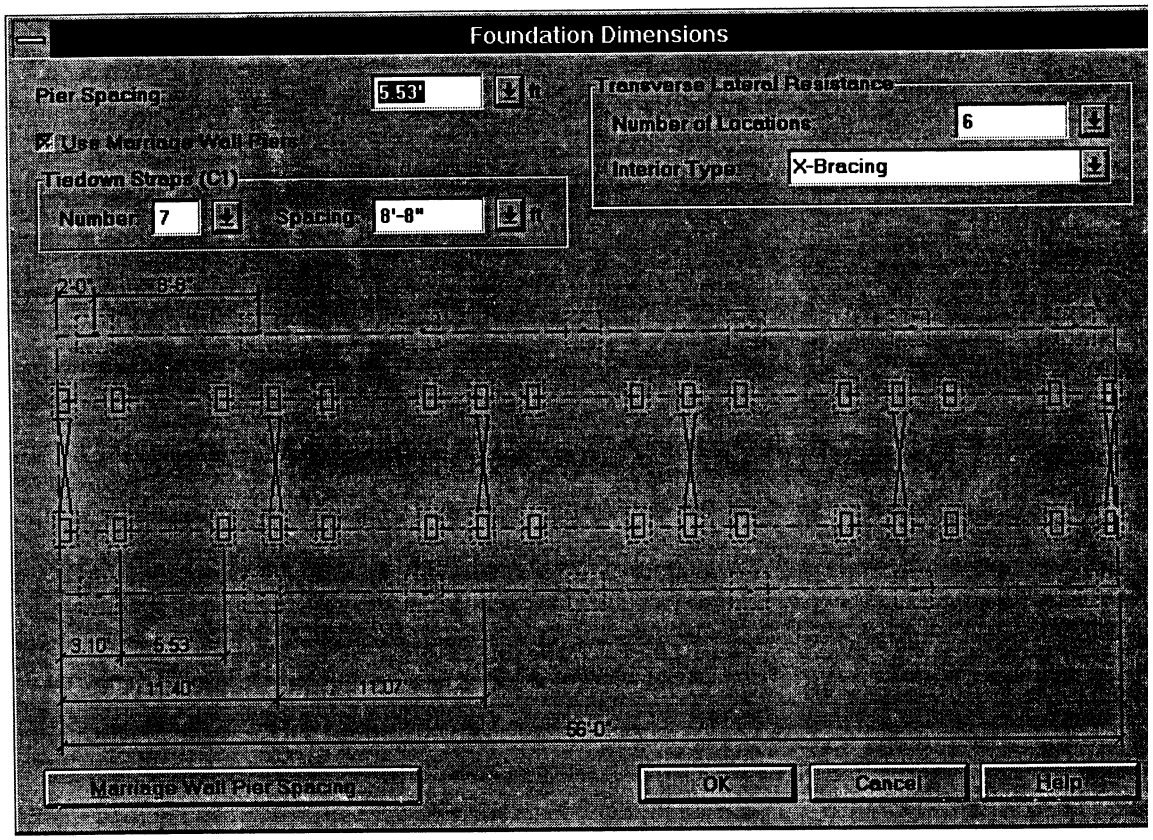
Figure 6-10



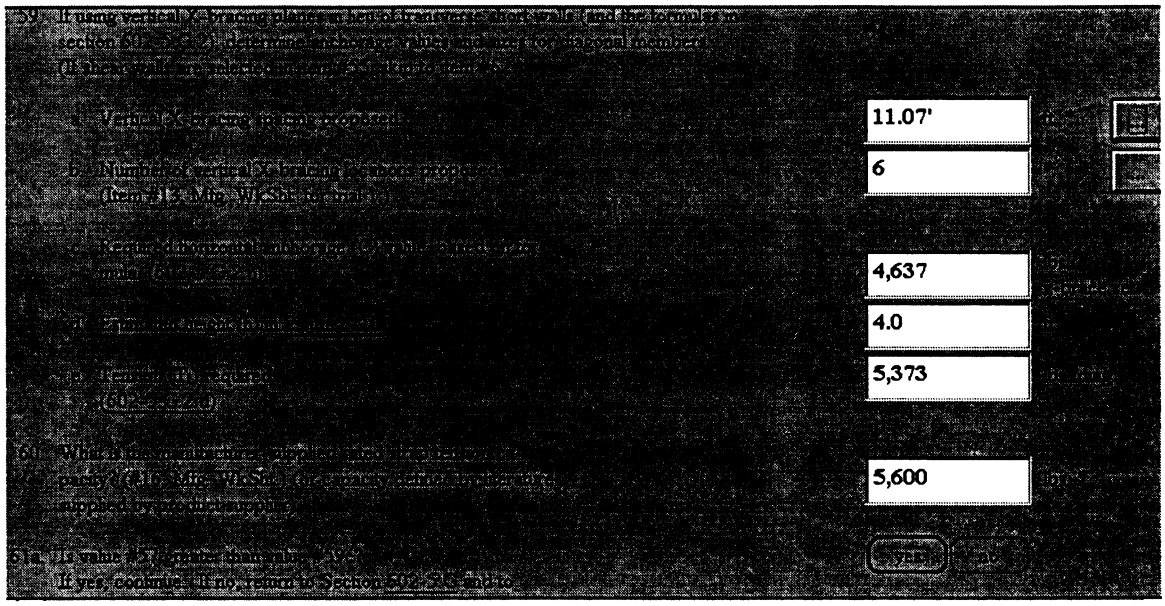
Vertical X-Bracing Plane

- Question #61a: The answer is "no" and the iteration process begins. Return to question #59 and try more Vertical X-Bracing Planes, say **6**.



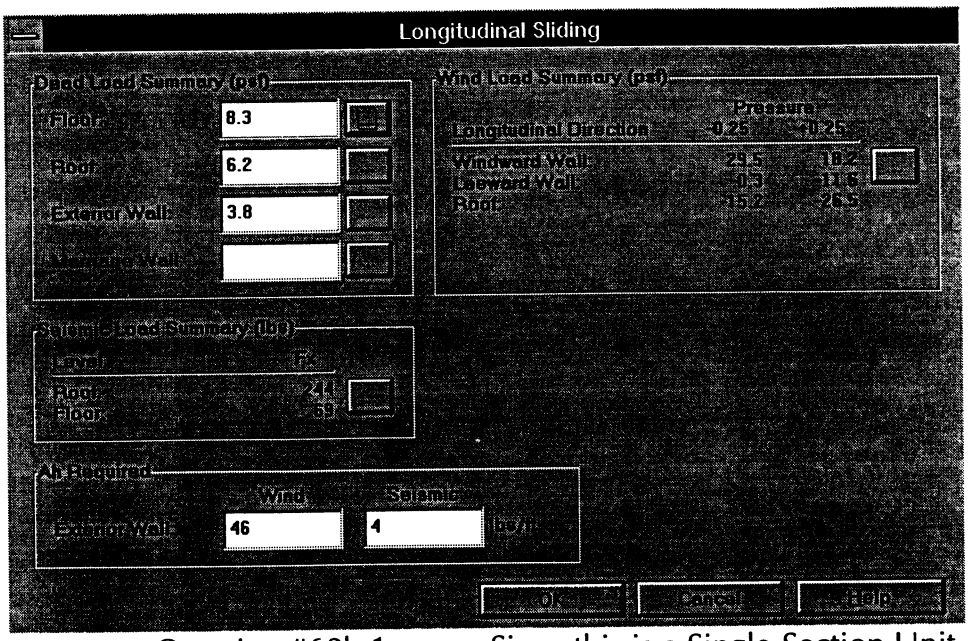


Six Vertical X-Bracing Planes, as shown above in the **Foundation Dimensions** dialog window will produce a strap tensile force less than the allowable of 5600 lbs. The answer to question #61a is now "yes". This is shown below upon return to the Form.

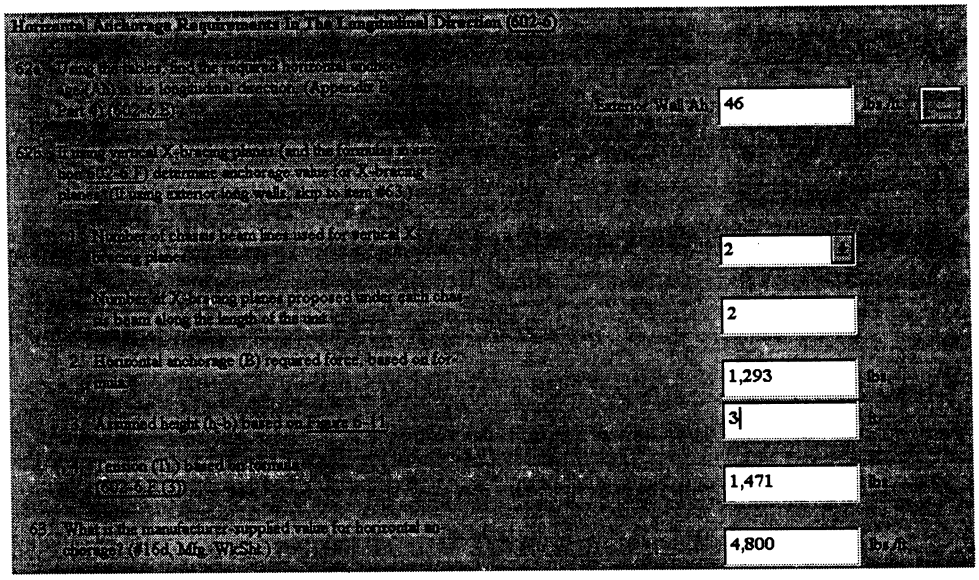


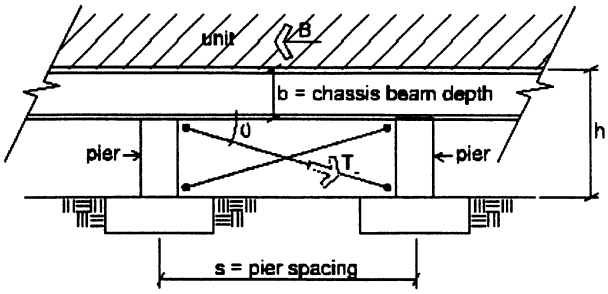
Horizontal Anchorage Requirements in the Longitudinal Direction - Ah - Sliding

- Question #62a: Select the **Longitudinal Sliding Icon** to bring up the dialog window. Using Vertical X-Bracing Planes under the chassis beam lines requires manipulation of the calculated horizontal anchorage force **Ah = 46 lbs/ft** to a value in pounds (B). Seismic inertia force can be ignored, but it is interesting that 4 lbs/ft would be produced. Select **OK**, if satisfied, and return to the Form where the (Ah) value has already been inserted in the box.



- Question #62b.1: Since this is a Single-Section Unit, only two chassis beam lines are available for vertical X-Bracing Planes. The (**2**) is automatically placed in the box. Also, it is typical to begin with the least number of Vertical X-Bracing planes under each chassis beam, thus (**2**) should be typed in the Box.
- Question #62b.2: Once the (2) is typed in the box above, the Required Horizontal Anchorage Force (B) is automatically calculated based on the formula found in the On-Line "Handbook". Section 602-6.F is green typed and underlined and therefore can be selected. The green typed and underlined Figure 6-11 helps visualize the process and shows the variables as shown below:





Longitudinal Direction

$$\cos \theta_L = \frac{s}{\sqrt{(h-b)^2 + s^2}}$$

Horizontal Anchorage with X-bracing - Longitudinal Direction

Figure 6 - 11

- Question #62b.3: The (h-b) dimension is selected based on h = 4′ and the chassis beam depth (b) being about one foot. Thus, (h-b) = 3′-0″ and once this is typed in the box the required tension force (T_L) is automatically calculated according the formula in Section 602-6.F(3).
- Question #63: The manufacturer's supplied value for horizontal anchorage to the superstructure is automatically inserted in the box as **4800 lbs/diag. set**. The User continues to scroll down the Form as shown below:

- Question #64b.: The box already contains the answer "yes", since the computer makes the comparison, and finds that (**B**) is smaller than the manufacturer's supplied value of **4800 lbs**.
- Question #65 and #66: The required tension in a strap was calculated to be (T_L) = 1471 lbs., which is far less than the Manufacturer's supplier value of 5600 lbs. The Form automatically shows the answer "yes" and this completes the Required Longitudinal Anchorage Force discussion.

Withdrawal Resistance Verification - Appendix C

- Select **Part 4 - Withdrawal Resistance** from the Worksheets pull-down menu and skip question #67(a) of the Form that deals with Exterior long foundation walls. Scroll down to question #67(b) - **Withdrawal Resistance for Piers.** This section also deals with Foundation Type **C1** Concrete "Deadman" withdrawal resistance, as shown below. Note that frost depth of "zero" is in the box. The program has automatically selected a depth (h_P) = **32** inches and a square deadman of side (W_f) = **36** inches. Select the green typed and underlined Table C-2 to access the On-Line "Handbook" and verify the program's choice, knowing that the Required (**Av**) = **2570** lbs. Also, "Reinforced Concrete Deadman" has been highlighted automatically for the Type **C1** foundation system on the Form.

Note: The User does not select a value from the table and highlight it to make a selection. The program does this automatically. The highlight is merely to make the value easier to find.

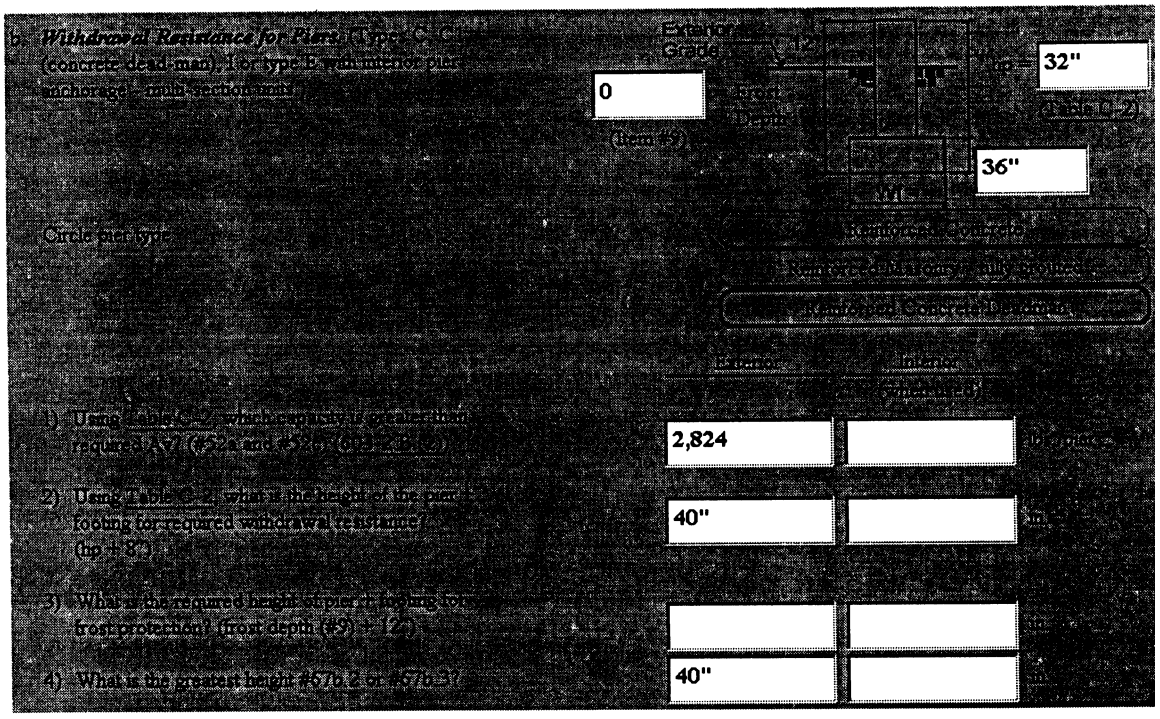
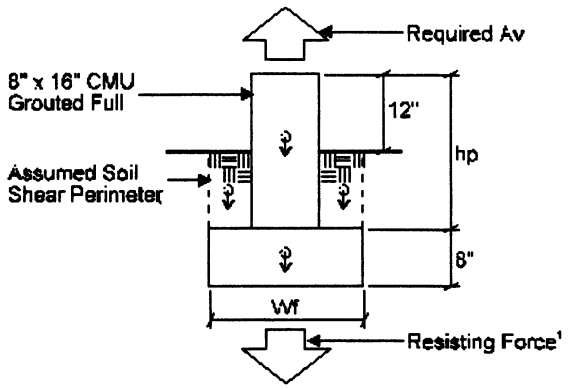
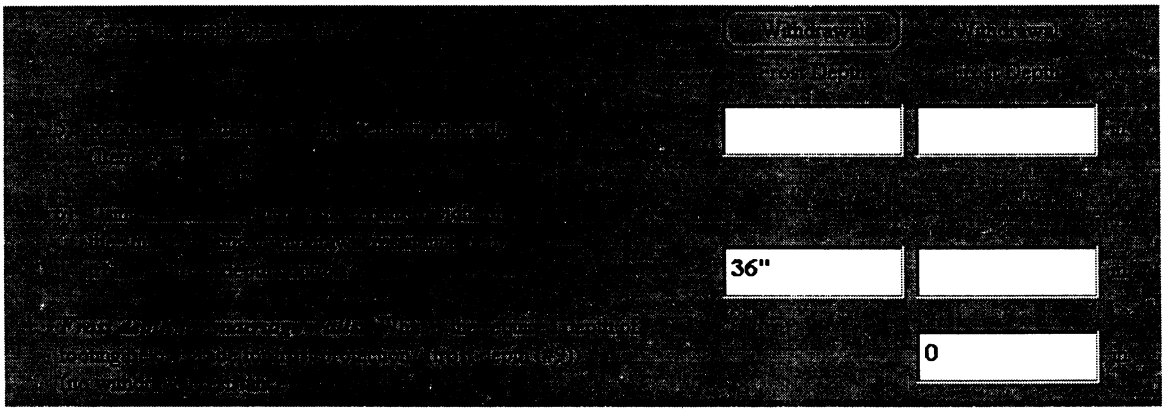


Table C-2
Withdrawall Resistance For Piers (2, 3)
(In pounds per pier)



Hp Depth	Width of Square Footing: Wf			
	1'-0" (4)	2'-0"	3'-0"	4'-0" (4)
2'-0"	279	997	2097	3755
2'-8"	361	1322	2824	5049
3'-4"	442	1643	3541	6325
4'-0"	525	1967	4267	7617
4'-8"	607	2292	4994	8911

- Continue to scroll down the Form to reveal the remainder of the information automatically filled in the boxes. This tells you that "withdrawal" controls over frost depth and that the "deadman" width is 36" for a square concrete anchor.



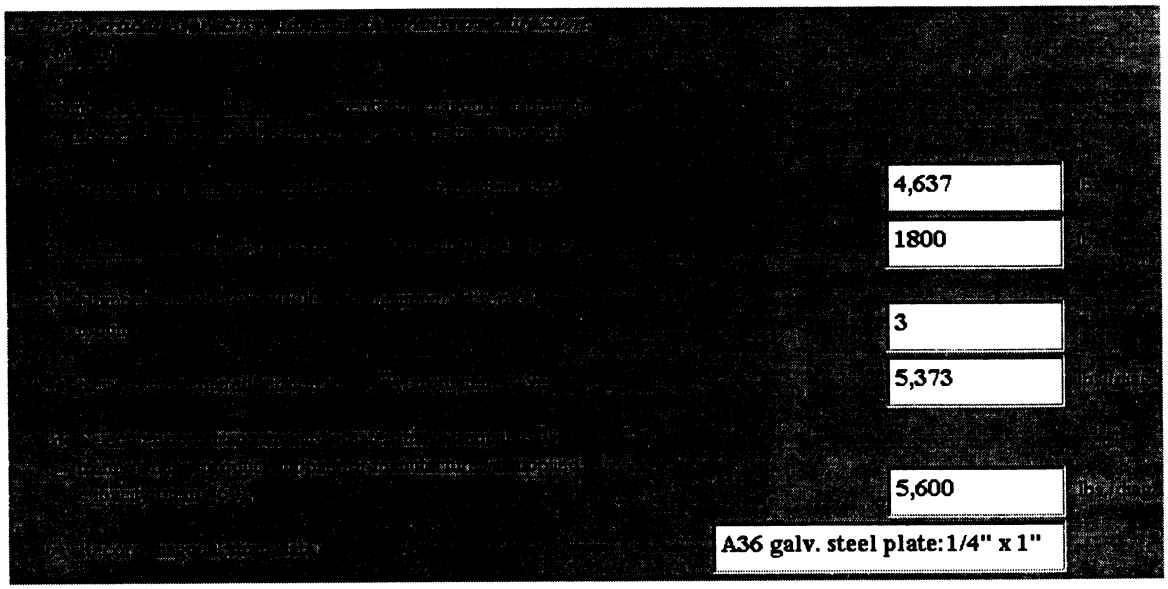
Vertical Anchorage and Reinforcement for Longitudinal Foundation Walls and Piers

- This portion of the **Design Worksheet** is not needed for a Type **C1** Foundation Concept. Vertical anchorage for

overturning and uplift is provided by the straps and "concrete deadman" anchors.

Horizontal Anchorage and Reinforcement for Transverse Foundation Walls

- Parts #69a and #69b of the **Design Worksheet** are not needed for a Type **C1** Foundation Concept. Horizontal anchorage for sliding is provided by the Vertical X-Bracing Planes, thus Part #69c is required, as shown below:

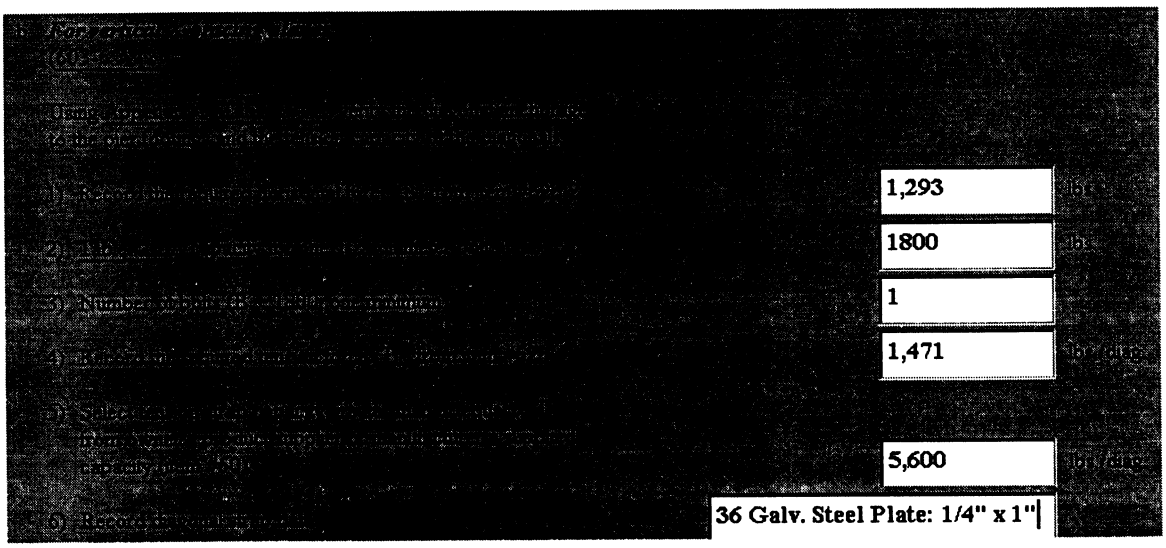


- Question #69c.(1) to (5): Item (1) is the horizontal force (C) brought forward from question #59c. Item (2) is the 1800 lbs, which is the shear capacity of one 1/2"ϕ anchor bolt from Table C-5A in Appendix C of the "Handbook". Item (3) is the number of bolts required to resist the horizontal shear : (C) ÷ 1800, rounded to the next highest whole number. Thus, 3 bolts are required. Item (4) is the required tension force (T_t) in a diagonal strap, which was brought forward from question #59e. Item (5) is the manufacturer's supplier's allowable tension capacity, which is larger than required so it is OK. Item(6) is typed in by the User, based on the size provided by the supplier's catalog.

Note: This must be galvanized steel for the corrosive nature of steel adjacent to ground.

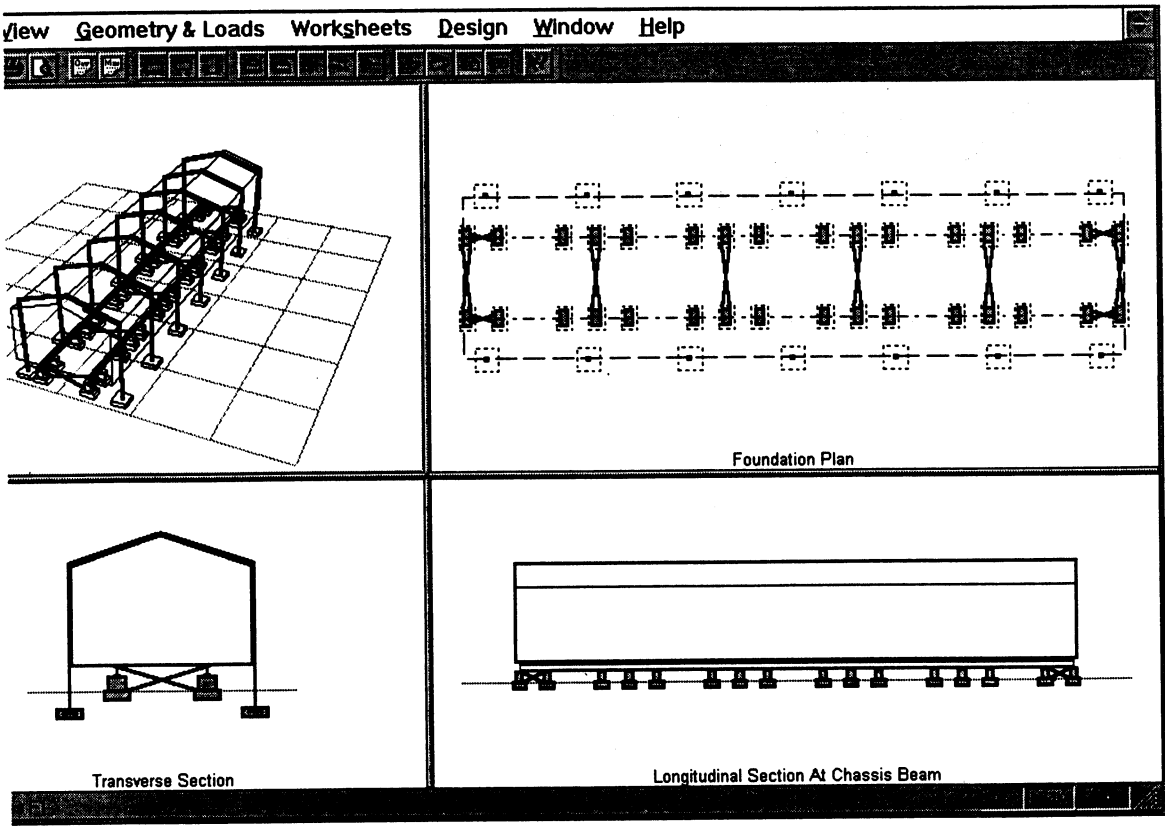
Horizontal Anchorage for Longitudinal Foundation Walls

- Question #70a.1 and 2: This portion of the **Design Worksheet** is not needed for a Type **C1** Foundation Concept. Horizontal anchorage for sliding in the longitudinal direction is provided by Vertical X-Bracing Planes under the chassis beams. Scroll down to that topic.
- Question #70b.(1) to (6): Item (1) is the required horizontal force (B) brought forward from question #62b.2. Item (2) and item (3) were discussed above. Item (4) is the required diagonal tension force (T_L) calculated in question #62b.4. The remaining two items were also discussed above.

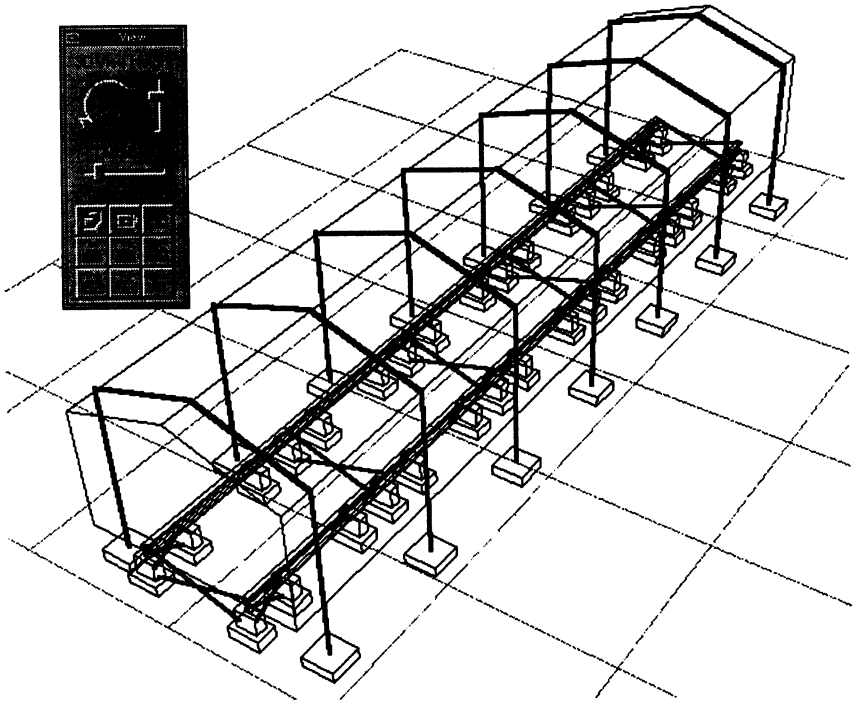


Summary Sheet

- The **Summary Sheet** is selected from the Worksheets pull-down menu. It is filled in with the results and decisions made and entered in the boxes of the Form for the Type **C1** Foundation Concept located in Tampa, FL.
- Select the Print Icon while in any of the parts of the Design Worksheet and create a hardcopy output. See Appendix B for a sample output.
- Select **Graphics Window** from the **View** pull-down menu to see the final views of the Foundation Type **C1** selected.



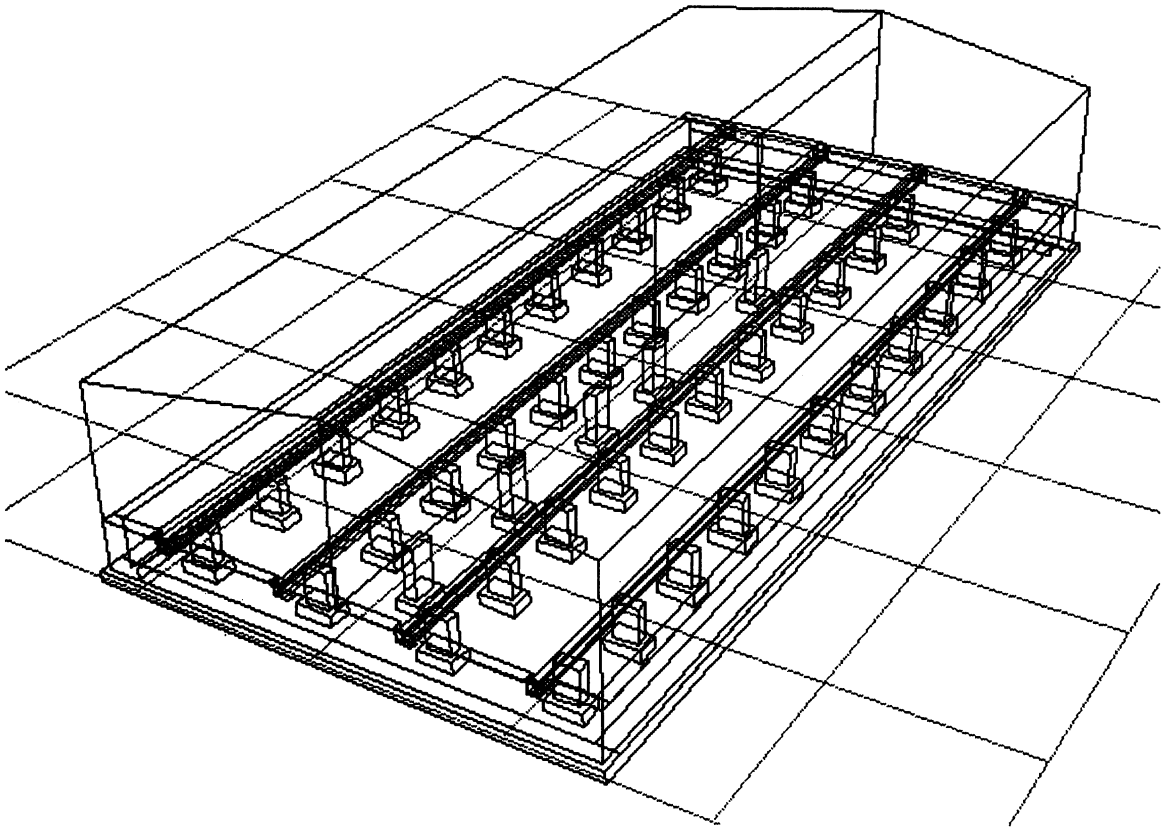
- Use the View Toolbar to manipulate the perspective view.

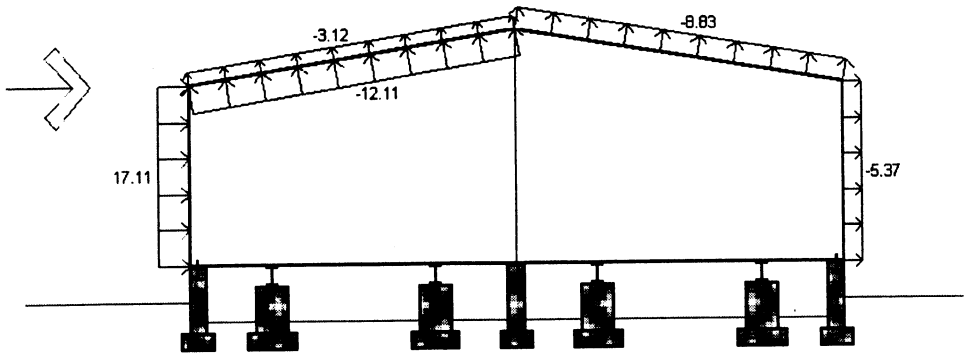


Appendix A

Example #1 - Foundation Concept Type E1

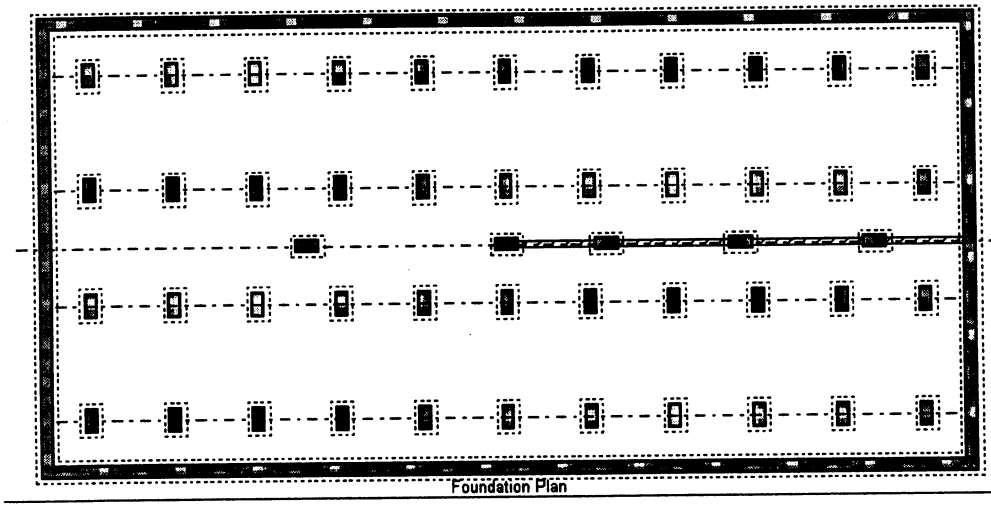
Multi-Section Unit



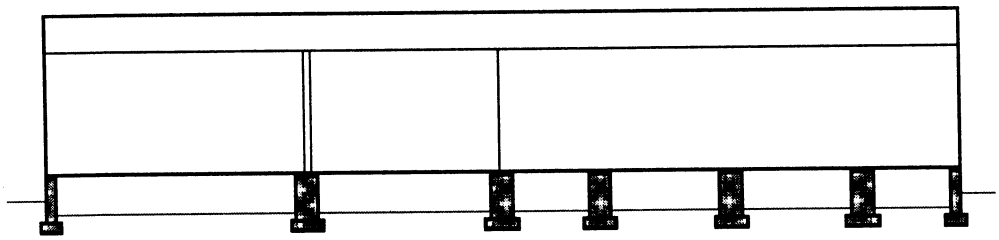


Wind Load GCpi -0.25 (psf)

Transverse Section



Foundation Plan



Longitudinal Section At Marriage Wall

APPENDIX E
OWNER'S SITE ACCEPTABILITY WORKSHEET

Owner's Name: **John Doe**

Address: **1600 S. First Street**

Champaign, IL

Telephone: **217/345-4856**

Site Location: **Champaigh, IL**

Legal Description: _____

Have you provided a copy of a map pinpointing the site? (yes) no

Have you submitted a foundation plan? (yes) no
(See #10 of Manufacturer's Worksheet)

Preliminary Site Information

Before approval of the site can begin, the applicant must provide preliminary site information to the field office. Refer to Chapter 2, "Site Acceptability Criteria" for clarification.

1. Provide survey results showing existing grade elevation. (201-1) **N.A.** ft.

2. Is the building in a flood-prone area? (201-2) yes (no)
   If the answer to 2 is Yes, answer 3, 4, & 5.
   If the answer to 2 is No, answer 6, below.

3. What is the Base Flood Elevation? _____ ft.

   What is the Flood Protection Elevation? _____ ft.

4. Has approval for drainage, grading and berming been approved for flood-prone sites? yes no

5. Have permits been provided? yes no
   (Permits must be obtained for any alteration of the building site in a flood protection area.)

6. Provide geotechnical report in areas of known high water table. (201-4) yes (no)

7. Provide geotechnical report if adverse site conditions are found or suspected. (203) yes (no)

8. Provide site-drainage plan complying with CABO R301.3 or local requirements. (301) (yes) no

9. Provide fill specifications if site is to be prepared with earth fill. (303-2) yes (no)

10. If a geotechnical report is required, what is the net allowable soil bearing pressure? (202) **0** psf.

11. If no adverse soil conditions are known or suspected, and if the home is individually sited, assume a soil bearing pressure of 1,000 psf. and use this value when a determination of soil bearing pressure is called for. 1,000 psf.

APPENDIX E
MANUFACTURER'S WORKSHEET

Manufacturer's Company Name: **Howard Smith Co, Inc.**

Address: **1904 W. 75th Street**

New York, N.Y.

Telephone: **314/329-xxxe**

Determination of Building Structure and Size

The manufacturer shall provide the following information:

1.	Type of unit	Single-Section / (Multi-Section)
2.	Method, location and types of support: Refer to Figures 6-7 and 6-8 and Section 601-4. Is the home a **C, E, or I**?	**E**
3.	Length of unit L	**56'-0"** ft.
4.	Actual width of unit Wt	**13'-8"** ft.
5.	Height of exterior wall **	**7'-6"** ft.
6.	Height of roof peak **	**2.28'** ft.
7.	Roof slope **	**2 in 12**
8.	Self weight of total unit (W) including mechanical equipment **	**38,766** lbs.
9.	Distance between chassis members	**82.0"** ft.
10.	One foundation design concept (See Appendix A) **(C1-C4; E1-E8; or I)**	**E1**

11. Recommended pier spacing **

    a. Exterior — **5'-0"** ft.

    b. Interior — **5'-0"** ft.

    c. Continuous Marriage Wall — **8'-0"** ft.

    Length of largest isolated marriage wall opening or average of largest two adjacent openings — **14'-0"** ft.

    d. Tie-down Strap (C1 concept only) — _____ (Number) _____ (Spacing) ft.

12. One installation method recommendations (include documentation showing connection details pertinent to geographic area for seismic or wind). ** — (yes) no

13. Interior shear wall locations (include documentation showing locations). ** — yes no

14. Design wind speed used in designing connection details for horizontal anchorage (Ah) and vertical anchorage (Av) in the transverse direction. ** — **100** mph.

15. Seismic acceleration values used in designing connection details for horizontal anchorage (Ah) in the transverse and longitudinal directions. ** — Av **0.05**; Aa **0.05**

16. Shear wall connection details with rated capacity for wind and seismic are provided. ** † — (yes) no

    a. Connection locations at foundation end and interior walls shown? ** — (yes) no

    b. Rated connection capacity for uplift and overturning ** — **200** lbs./ft. (or lbs./tie-down)

    c. Rated connection capacity for sliding in transverse direction ** — **400** lbs./ft. (or lbs./diag. strap)

    d. Rated connection capacity for sliding in longitudinal direction ** — **400** lbs./ft.

    e. Vertical X-bracing tension strap capacity ** — **N.A.** lbs./diag. strap

f. Engineering calculation by licensed structural engineer? ** (yes) no

** **Optional values:** It is optional for the manufacturer to provide these values. If the manufacturer does not provide the values, it is the responsibility of the owner to supply values, based on engineering analysis by a licensed structural engineer.

† Item 16 is provided in California.

APPENDIX F
DESIGN WORKSHEET

Owner's Name: **John Doe**

Address: **1600 S. First Street, Champaign, IL**

Builder's Name: **ACME LTD.**

Site Location: **Champaign, IL**

PART 1: SITE CONDITIONS
(Accompanies Chapter 2)

1. Has the Manufacturer's Worksheet been provided? (yes) no

Existing Grade Elevation (201-1)

2. Does the site require a survey? yes (no)
(Answer yes if: 1) elev. to be altered by grade or fill; 2) site near flood zone; 3) subdivision. Answer no if individually-sited with no alteration of building site.)

3. If yes to above, what is the surveyed existing elevation? **N.A.** ft.

Flood Protection Elevation (201-2)

4. Is the building site in a flood zone? yes (no)
(If yes to 4, then answer 5, 6, & 7. If no, skip to 9.)

5. What is the Base Flood Elevation or the Flood Protection Elevation (use highest value)? _____ ft.

6. Is the site to be graded, filled, or bermed? yes no
(If no, skip to 9.)

7. If yes to 6, have all permits been provided? yes no

8. If no to 6, then are the buildings to be built on elevated foundations? yes no
(If yes, this handbook cannot be used. Refer to FEMA Manual.)

Frost Penetration Depth (201-3)

9. What is the maximum frost penetration depth? (see Appendix H, page H-4) — **30** in.

10a. Does foundation plan show base of footing extending below frost penetration depth? (If yes proceed; if no, applicant should revise plans.) — (yes) no

10b. Does foundation plan show base of footing extending below top-soil layer (min. 12") to undisturbed soil? — (yes) no

Ground Water Table Elevation (201-4)

11. For subdivisions, does a Geotechnical Engineer recommend drainage of subsurface water? (If no, skip to 13.) — yes (no)

12. Has groundwater drainage plan been provided? — yes no

Soil Conditions (202, 203)

13. If any of the following adverse site conditions are discovered, specific recommendations by a Geotechnical Engineer will be required (applies to subdivisions and individually-sited homes.)

Organic soil (8" topsoil layer) — (yes) no

Expansive (shrink-swell) soil — yes (no)

Sloping site — yes (no)

Subsidence — yes (no)

(Applicant may be referred to Geotechnical Engineer if any of the above are yes. If no, to all of above, move to next step.)

14. Is area in a known termite infestation area? — (yes) no

Region classification? (See Appendix H, Termite Infestation Map, page H-10) (If no, skip to 16.) — **Moderate to heavy**

15. Has applicant complied with CABO R-308 or local ordinance for construction procedures and treatment? (If yes, continue; if no, refer applicant to CABO requirements.) — (yes) no

PART 2: SITE PREPARATION
(Accompanies Chapter 3)

16. Acceptable surface drainage plan provided? (301) — (yes) no
(If no, one must be provided for subdivision)

17. Grading plan provided? (302) — (yes) no

18. Fill specifications conforming to those cited in HUD Land Planning Data Sheet (79g)? (303) — yes (no)
(If fill is used, below the home's foundation, a report by Geotech. Eng. should be submitted to provide fill specifications.)

19. Finish grade elevation? (304) — _____ *
(Check answers to Part 1: #4 & #5. The finish grade elevation must be higher than #5 if in flood zone.)

PART 3: DESIGN LOADS
(Accompanies Chapter 4)

Information from Manufacturer's Worksheet

20. Has all the information been provided on the Manufacturer's Worksheet? (Appendix E) — (yes) no

21. What is the building self weight (W)? (Mfg. Wksht. #8) — **38,525** lbs.

22. What is the building length (L)? (Mfg. Wksht. #3) — **56'-0"** ft.

23. What is the distributed weight per foot of unit length? (w=W/L) (402-B, C) — **688** lbs./ft.

24. What is the building type? (Mfg. WkSht. #2) — Single-Section (Multi-Section)

C, (E), or I

Foundation design concept? (C1, C2, C3, C4, E1, E3, E4, E5, E6, E7, E8, I) — **E1** *

Dead Load (402-1)

25. What is the light dead load value from Table 4-1? (402-1.A.1) — **560** (lbs./ft.) *

26. What is the heavy dead load value from Table 4-1? (402-1.A.2) — **805** (lbs./ft.) *

27. Does the answer from Question #23 fall within the values in #25 and #26? (402-1.D) (If the answer is yes, continue. If no, the foundation is not within the limits of this document and must be redesigned by a structural engineer.) — (yes) no

Snow Load (402-2) / Minimum Roof Live Load (402-2.C)

28a. What is average annual ground snowfall (Pg)? (See Ground Snow Load map, pages H-11, H-12 and H-13.) — **20** (lbs./sq.ft.) *

28b. What is 0.7 multiplied by Pg? — **14.0** psf.

29a. What is the roof slope? (Mfg. Wksht. #7) — **2 in 12**

29b. What is the minimum roof live load for the roof slope? (D-200.2.B) — **20.0** psf.

30. Record the larger magnitude of item 28b or item 29b. Use this magnitude for roof load where required. — **20.0** psf.

Wind Load (402-3)

31a. What is the basic wind speed (V)? (See Wind Speed map, page H-14.) — **70** mph

31b. If V is less than 80 mph, record MPS min. 80 mph for wind design. (402-3.A) — **80** mph

32. Is the site inland or coastal? (402-3.B) (If inland, skip to question #38.) — (Inland) ~~Coastal~~

33. If a coastal area, has the manufacturer provided connection details? (402-3.D) (Mfg. Wksht. #12) — yes no

34. If yes to #33, what design wind speed has the manufacturer used in designing connection details? (Mfg. Wksht. #14)

100 mph.

35. Are the connection locations shown? (Mfg. Wksht. #16a)

(yes) no

36. Are connection details provided for foundation shear walls? (For an answer of yes, all questions under Mfg. Wksht #16 must be answered satisfactorily.)

(yes) no

37. Is the value for Question 34 equal to or greater than the number given in Question 31? (If yes, proceed. If no, return design to manufacturer for clarification.)

yes no

Seismic Load

38a. What are the seismic acceleration values? (See Seismic maps, pages H-15 and H-16)

Aa **0.05** *

Av **0.05** *

38b. Is Av < 0.15? (If no, proceed. If yes, seismic need not be considered, skip questions 39 to 41.)

(yes) no

39. Seismic performance category. (See H-300 for Special Requirements of Foundation Design.)

B

40. What is the applicant's proposed design concept? (Design Wksht. #24)

E1 *

41. Do the Foundation Design Concept Tables approve the foundation system for use in seismic areas of Question #38 above? (See Appendix A) (If yes, proceed. If no, return to applicant for foundation design choice more suited to high seismic areas.)

yes no

PART 4: FINAL DESIGN PROCEDURE
(Accompanies Chapter 6)

42. What is the actual building width? (Mfg. Wksht. #4)

13'-8" ft.

43. The nominal building width to be used in the Foundation Design Tables, (Aftg, Av & Ah) is Wt: (600-2.A and Figure 6-1) **14'-0"** ft.

44. Where are the foundation supports located? Check drawings submitted by the owner and Foundation Design Concepts in Appendix A. Circle the support locations shown on the Manufacturer's foundation concept plan. (Chassis Beams) ~~Exterior Walls~~ ~~Marriage Wall~~

45. Do these locations match the Foundation Concept shown in Appendix A? Do the locations match Question #24 on the Design Worksheet? (If yes, proceed. If no, return to Owner for clarification.) (yes) no

46. Is Vertical Anchorage present? (601-2.B, 601-3.B & 601-4.B (Figures 6-7 & 6-8); Mfg. Wksht. #12 & #16) (yes) no

APPENDIX A

47. What is the basic system type? (From Part 3: #24; Mfg. Wksht. #2) **E1** *

48. What is the spacing between piers? (Mfg. Wksht. #11) (602-2)

Exterior: **5'-0"**

Interior: **5'-0"**

Continuous Marriage Wall: **8'-0"**

Largest or Average Marriage Wall Opening: **14'-0"** ft.

Tie Down (C1) _____ ft.

APPENDIX B

Required Footing Size

49. The required Exterior Wall Footing, for the foundation type, is found in the Required Effective Footing Area table in App. B, Part 1. (Use maximum value from item #30.) **E1** *

The Required Exterior Square Footing size is:

Type C _____ sq.

Type E or I **1.0** ft. (width)

50. The Required Interior Footing area is: (Also exterior piers for foundation type E) **2.0** sq.ft.

51a. The Required Continuous Marriage Wall Footing area is: **6.8** sq.ft.

51b. The Required Footing area under posts at the ends of marriage wall opening(s) is: **11.0** sq.ft.

Vertical Anchorage Requirements in the Transverse Direction (602-4)

52a. Using the Foundation Design Load Tables (Appendix B, Part 2), determine the Required Vertical Anchorage. Exterior Av **65** * (lbs./pier spacing; lbs./ft. for E type; lbs./tie-down spacing)

52b. Number of vertical tie-down locations for multi-section units: (2) or 4 or 6

52c. For units with additional vertical anchorage at the interior piers, determine the Required Vertical Anchorage. Interior Av _____ * (lbs./int. pier spacing)

53. What is the manufacturer-supplied value? (#16b, Mfg. WkSht.) Exterior **200** *

Interior _____ *

54. Is this value (#53) greater than the value given in #52a? (If yes, continue. If no, return to owner for clarification.) (yes) no

Horizontal Anchorage Requirements In The Transverse Direction (602-5)

trial 1	trial 2	trial 3
2		
yes no	yes no	yes no
10"		

55a. What number of transverse foundation walls was selected? (602-5.E) (If vertical X-bracing planes are used, complete items #55a, #56 and #57 for 2 transverse walls, and then skip to item #59.)

55b. Are diagonal ties used to complete the top of the transverse short wall for horizontal anchorage? (602-5.G.1)

Estimate height (h) for appropriate illustration in Figure 6-10. ft.

		trial 1	trial 2	trial 3	
56. Using the tables, find the Required Horizontal Anchorage (Ah). (Appendix B; Part 3)	End Wall Ah	**267**			lbs./ft.
	Int Wall Ah				lbs./ft.
57a. What is the manufacturer's-supplied rated capacity for sliding? (#16c, Mfg. WkSht.)		**400**			lbs./ft.
57b. If answer to item #55b is yes, record manufacturer or product supplier rated strap tension capacity.		**N.A.**			lbs./stra
58a. Is value #57a greater than item #56? If yes, continue. If no, return to section 602-4.C and to question #55a and select a larger number of transverse foundation walls. If the maximum number selected (6) does not work, return to owner (who may wish to contact the manufacturer for clarification).		(yes) no	yes no	yes no	
58b. If answer to #55b is yes, required tension in diagonal (T_t). (Complete procedure in Section 602-5.G.1.)					lbs.
58c. Is value #57b greater than #58b? If yes, continue to item #62. If no, return to owner for product with greater capacity.		yes no	yes no	yes no	

59. If using vertical X-bracing planes in lieu of transverse short walls (and the formulas in section 602-5.G.2), determine anchorage values and sizes for diagonal members. (If shear walls are selected in item #55, skip to item #62.)

	trial 1	trial 2	trial 3	
a. Vertical X-bracing spacing proposed.				ft. *
b. Number of vertical X-bracing locations proposed. (Item #13, Mfg. WkSht. for trial 1.)				*

	trial 1	trial 2	trial 3	
c. Required horizontal anchorage (C) value, based on formula. (602-5.G.2.c)				lbs./ x-brace set
d. Estimated height (h) in Figure 6-10.				ft.
e. Tension (T_t) required. (602-5.G.2.d)				lbs./diag.
60. What is the manufacturer-supplied rated strap tension capacity? (#16, Mfg. WkSht.) (or capacity defined by literature supplied by product supplier)	**N.A.**			lbs. *
61a. Is value #57 greater than value #59c? If yes, continue. If no, return to Section 602-5.G and to question #59 and select a greater number of X-brace locations as a next trial. Repeat until answer is yes, then continue.	yes no	yes no	yes no	
61b. Is value #60 greater than value #59e? If yes, continue. If no, return to section 602-5.G and to question #59 and select a greater number of X-bracing locations. If the maximum number selected does not work, return to owner (who may wish to contact the manufacturer for clarification or product supplier for clarification).	yes no	yes no	yes no	

Horizontal Anchorage Requirements In The Longitudinal Direction (602-6)

62a. Using the tables, find the required horizontal anchorage (Ah) in the longitudinal direction. (Appendix B, Part 4) (602-6.E)

Exterior Wall Ah **48** lbs./ft.

62b. If using vertical X-bracing planes (and the formulas in section 602-6.F) determine anchorage value for X-bracing planes. (If using exterior long walls, skip to item #63.)

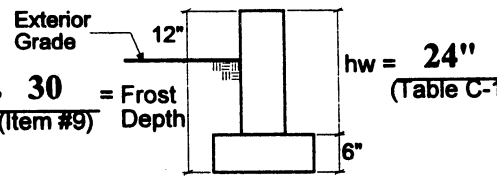
	trial 1	trial 2	trial 3
1. Number of chassis beam lines used for vertical X-bracing planes.	2 or 4	2 or 4	2 or 4

	trial 1	trial 2	trial 3	
Number of X-bracing planes proposed under each chassis beam along the length of the unit.				
2. Horizontal anchorage (B) required force, based on formula.				lbs.
3. Assumed height (h-b) based on Figure 6-11.				ft.
4. Tension (T_L) based on formula. (602-6.F.(3))				ft.
63. What is the manufacturer-supplied value for horizontal anchorage? (#16d, Mfg. WkSht.)	**400**			lbs./ft.
64a. For shear walls: is value #63 greater than #62a? If yes, skip to item #67. If no, contact owner for clarification.	(yes) no	yes no	yes no	
64b. For X-bracing: is value #63 greater than value #62b.2? If yes, return to item #62b.3. If no, increase number of vertical X-bracing planes and repeat items 62b.1 and 62b.2 until answer is yes. For multi-section units consider 4 lines of vertical X-bracing under all chassis beams.	yes no	yes no	yes no	
65. What is the manufacturer-supplied rated strap tension? (#16e, Mfg. WkSht. or product supplier)	**N.A.**			lbs.
66. Is value #65 greater than #62b.4? If yes, continue. If no, contact owner to obtain straps with greater capacity, or return to item #62b.1 and increase the number of vertical X-bracing planes until answer is yes.	yes no	yes no	yes no	

APPENDIX C

Withdrawal Resistance Verification (603-2.2)

67. Using Appendix C, Table C-1 or C-2, verify that the foundation system will resist withdrawal. Answer question #67a for type E. Answer question #67b for types C, I, or type E with interior pier anchorage.



a. ***Withdrawal Resistance for long foundation wall.*** (Type E)
Circle the type of material that is to be used.

Reinforced Concrete
(Masonry-Fully Grouted)
~~Masonry-Grouted @ 48"~~ o.c.
All-Weather Wood / Footing

1) Using Table C-1, which capacity is greater than required Av? (603-2.B.(1)) (#52a) **231** lbs./ft.

2) Using Table C-1, what is the height of the wall + footing for required withdrawal resistance? (hw + 6") **30"** in.

3) What is the height of the wall + footing for frost protection? (frost depth (#9) + 12") **42"** in.

4) What is the greatest height #67a.2 or #67a.3? **42"** in.

Circle the height which controls. Withdrawal / (Frost Depth)

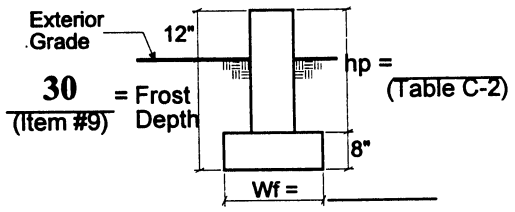
5) Record the bottom of footing depth from grade. (Item #67a.4 - 12") **30"** in.

6) Using Table C-1, what is the required width of the wall footing for withdrawal? **12"** in.

7) Is item #67a.6 greater than or equal to item #49? If yes, continue. If no, change footing width to item #49. (yes) no

8) Record design exterior wall footing width. **12"** in.

b. ***Withdrawal Resistance for Piers.*** (Types C, C1 (concrete dead-man), I or type E with interior pier anchorage - multi-section units.)



Circle pier type:

Reinforced Concrete
Reinforced Masonry - fully grouted
Reinforced Concrete Dead-man

	Exterior	Interior (when used)	
1) Using Table C-2, which capacity is greater than required Av? (#52a and #52c) (603-2.B.(2))	_____	_____	lbs./p
2) Using Table C-2, what is the height of the pier + footing for required withdrawal resistance? (hp + 8")	_____	_____	in. *
3) What is the required height of pier + footing for frost protection? (frost depth (#9) + 12")	_____	_____	in.
4) What is the greatest height #67b.2 or #67b.3?	_____	_____	in.
Circle the height which controls.	Withdrawal Frost Depth	Withdrawal Frost Depth	
5) Record the bottom of footing depth from grade. (Item #67b.4 - 12")	_____	_____	in.
6) Using Table C-2, what is the required width of the square footing if withdrawal resistance controls or if frost depth controls?	_____	_____	in. *

c. ***Frost depth for marriage walls.*** What is the required depth of footing below grade for frost protection? (frost depth (#9)) (no withdrawal resistance) **30** in.

Vertical Anchorage and Reinforcement for Longitudinal Foundation Walls and Piers (603-2.D)

68. Using Appendix C, Table C-3, C-4A or C-4B, verify that the foundation anchors will resist uplift. Answer question #68a for type E. Answer question #68b for types C, I, or type E with interior pier anchorage.

a. ***Vertical Anchor Capacity for longitudinal foundation wall*** (type E). (603-2.D.2)

1) Using Table C-4A (concrete & masonry), which capacity is greater than the required Av? (#52a, Design Wksht.) If treated wood wall, skip to item #68a.3. **146** lbs./lineal ft. of wall

Circle correct washer choice for the capacity selected — (Standard Washer) ~~Oversized Washer~~

2) Using Table C-4A (masonry and concrete):

a) Required anchor bolt diameter — **1/2"** in.

b) Required anchor bolt spacing — **6'-0"** in.

c) Using Table C-3A:

(1) Rebar size — **#4** *

(2) Lap splice — **16"** in.

(3) Rebar hook length — **6"** in.

3) Using Table C-4B (wood), which capacity is greater than the required Av? (#52a, Design Wksht.)
If using concrete or masonry wall, skip to item #68b. _____ lbs./~~lineal ft. of wall~~

4) Using Table C-4B (wood):

a) Required nailing _____ *

b) Minimum plywood thickness _____ in.

c) Required anchor bolt diameter _____ in.

d) Required anchor bolt spacing _____ in.

b. ***Vertical Anchor Capacity for Piers***
(Types C, I, or type E with interior pier anchorage)
(603-2.D.1)

	Exterior	Interior (when used for anchorage in multi-section units)	
1) Using Table C-3, which capacity in the table is greater than the required Av? (From #52a, Design Wksht.)	_____	_____	lbs./pier

	Exterior	Interior	
2) Using Table C-3:			
a) Number of anchor bolts	1 or 2	1 or 2	
b) Anchor diameter	1/2" or 5/8"	1/2" or 5/8"	
3) Using Table C-3A:			
a) Rebar size	#4 or #5	#4 or #5	
b) Lap splice	_____	_____	in.
c) Rebar hook length	_____	_____	in.

Horizontal Anchorage and Reinforcement for Transverse Foundation Walls (603-3)

69. Using Appendix C, Table C-5A or C-5B, verify that the foundation anchorage will resist sliding at the transverse end foundation walls. Use for types C, E, or I.

	End Wall	Interior Wall	
a. ***For continuous foundations.***			
Using Table C-5A (concrete & masonry) or C-5B (wood), which capacity is greater than the required (Ah) (603-3) (item #56)?	**300**	_____	lbs./f
1) Using Table C-5A, find:			
a) Required anchor bolt diameter	**1/2"**	_____	in.
b) Required anchor bolt spacing	**72" o.c.**	_____	in.
c) Using Table C-3A:			
(1) Rebar size	**#4**	_____	*
(2) Lap splice	**16"**	_____	in.
(3) Rebar hook length	**6"**	_____	in.
2) Using Table C-5B, find:			
a) Required nailing	_____	_____	*

	End Wall	Interior Wall	
b) Minimum plywood thickness			in.
c) Required anchor bolt diameter			in.
d) Required anchor bolt spacing			in.

b. ***For short foundation walls completed with diagonal braces.*** (603-5)

Using Appendix C, Table C-5A, verify the diagonal anchorage capacity to the short foundation wall.

	End	Interior	
1) Record the required horizontal force (Ah × Wt) from 602-5.G.1.a and item #56.			lbs.
2) Table C-5A capacity for one 1/2" diameter bolt at 12" o.c.	1800	1800	lbs.
3) Number of bolts (Ah × Wt ÷ 1800; one minimum) at concrete or masonry top of short wall.			*
4) Size of anchor bolts			in.
5) Using Table C-3A:			
a) Rebar size			*
b) Lap splice			in.
c) Rebar hook length			in.

c. ***For vertical X-bracing planes in the transverse direction.*** (603-6)

Using Appendix C, Table C-5A, verify the diagonal anchorage to the pier footings and the tension capacity of the diagonals.

1) Record the required horizontal force (C) from item #59c.		lbs.
2) Table C-5A capacity for one 1/2" diameter bolt at 12" o.c.	1800	lbs.

3) Number of bolts (C ÷ 1800; one minimum) at top of a footing. _____ *

4) Record the required tension force (T_t) from item #59e. _____ lbs./d

5) Select tension strap capacity greater than or equal to T_t from owner's product supplier or manufacturer's supplied capacity (item #60). **N.A.** lbs./d

6) Record diagonal strap data _____

Horizontal Anchorage for Longitudinal Foundation Walls (603-4)

70. Using Appendix C, Table C-5A or C-5B, verify that the foundation horizontal anchorage will resist sliding at the long foundation walls. Use for types C, E and I.

a. ***For continuous exterior foundation walls.***

Using Table C-5A (concrete and masonry) or Table C-5B (wood), which capacity is greater than the required exterior Ah? (602-6.E) (item #62a) **300** lbs./f

1) Using Table C-5A, find:

a) Required anchor bolt diameter **1/2"** in.

b) Required anchor bolt spacing **72" o.c.** in.

c) Using Table C-3A:

(1) Rebar size **#4** *

(2) Lap splice **16"** in.

(3) Rebar hook length **6"** in.

2) Using Table C-5B, find:

a) Required nailing _____ *

b) Minimum plywood thickness _____ in.

c) Required anchor bolt diameter _____ in.

d) Required anchor bolt spacing _____ in.

b. ***For vertical X-bracing planes.***
(603-6.A.(2))

Using Appendix C, Table C-5A, verify the diagonal anchorage to the pier footings and the tension capacity of the diagonals.

1) Record the required horizontal force (B) from item #62b.2. _____ lbs.

2) Table C-5A capacity for one 1/2" diameter bolt at 12" o.c. 1800 lbs.

3) Number of bolts (B ÷ 1800; one minimum) _____ *

4) Record the required tension force (T_L) from item #62b.4. _____ lbs./diag.

5) Select tension strap capacity greater than or equal to T_L from owner's product supplier or manufacturer's supplied capacity (item #60). **N.A.** lbs./diag.

6) Record diagonal strap data _____

SUMMARY SHEET
(Accompanies Chapter 7)

71. Compare values from preceding questions. Select the largest value.

a. **Bearing area and vertical anchorage**

1. *Pier footings: types C, E & I.*

	Piers				
			Marriage Wall		
	Exterior	Interior	Cont.	At Post	
Required Effective Footing Area from questions #49, #50, & #51.		**2.0**	**5.7**	**9.1**	sq.ft.
Required footing area to resist withdrawal due to uplift from Question #67. (for single-section or 2 tie-down system, only the exterior piers resist uplift, for 4 tie-down only the interior piers and exterior walls resist uplift)					sq.ft.

	Piers				
	Exterior	Interior	Marriage Wall Cont.	Marriage Wall At Post	
Pier Footing Sizes (largest of above)		**2.0**	**5.7**	**9.1**	sq.ft.
"Dead-man" footing size.		sq.ft.			

Reinforcing for pier footings:
Bring forward answers from previous questions. (#68b)
(Types C , I, or E with interior pier anchorage.)

	Exterior	Interior	
Number of anchor bolts			
Anchor bolt diameter			
Rebar size			
Lap splice			
Rebar hook length			

	Exterior	Interior	Marriage Wall	
Footing depth: grade to bottom of footing			**30**	sq.ft.
Pier footing and "dead-man" footing reinforcing bars:			#4 at 10" o.c.	
"Dead-man" footing depth: grade to bottom of footing				in.

2. *Long Foundation wall footing: type E or I:*

Required Effective Footing Width		
Required Footing Width for soil bearing (#49)	**1.0**	ft.
Required Footing Width to resist uplift withdrawal (#67a.6)	**12"**	ft.
Wall Footing Size (largest of above)	**12"**	ft.
Footing Depth: Grade to bottom of footing (#67a.5)	**30"**	in.

Footing reinforcing bars. 2 #4 bars

Reinforcing for longitudinal foundation walls: Record answers from item #68a and record sizes and spacings.

From 68a.2: masonry and concrete:

Required anchor bolt diameter **1/2"** in.

Required washer size (Standard) Oversized

Required anchor bolt spacing **6'-0"** in.

Rebar size **#4**

Lap splice **16"** in.

Rebar hook length **6"** in.

From 68a.4: wood: Record answers from item #68a.4 and record sizes and spacings.

Required nailing _____

Minimum plywood thickness. _____ in.

Required anchor bolt diameter _____

Required anchor bolt spacing _____ in.

b. **Horizontal anchorage in the transverse direction - foundation walls**

1. *Continuous foundation walls* (#69a)

Number of transverse foundation walls (#55a) **2**

Required Footing Width (minimum) **12** in.

From #69a.1: concrete / masonry:

	End Wall	Interior Wall	
Anchor bolt diameter	**1/2"**	_____	in.

	End Wall	Interior Wall	
Anchor bolt spacing	**72" o.c.**		in
Rebar size	**#4**		
Lap splice	**16"**		in
Rebar hook length	**6"**		in
From #69a.2: wood:			
Required nailing			
Minimum plywood nailer			
Anchor bolt diameter			
Anchor bolt spacing			

2. *For transverse short foundation walls completed with diagonal braces* (#69b)

	End	Interior	
Number of pairs of diagonals (1 for single-section units, 2 for multi-section units) times number of short walls (end or interior) (#55a)			
Diagonal spacing (same as number of short walls)			
From #69b: concrete / masonry:			
Anchor bolt diameter			in
Number of bolts			
Rebar size			
Lap splice			in
Rebar hook length			in

3. *For vertical X-bracing planes in lieu of short walls.* (#69c)

Number of X-brace locations (#59) _____

Spacing of vertical X-brace planes (#59) _____ ft.

Items from #69c.3 and #69c.5

Required anchor bolt diameter _____ in.

Number of bolts at top of footing to connect diagonal _____

Diagonal strap size _____

Connection to top flange of chassis beam (describe) _____

c. **Horizontal anchorage in the longitudinal direction - exterior foundation walls**

1. *Continuous foundation walls*

Reinforcing for longitudinal foundation walls: record only if larger sizes or closer spacing than recorded for vertical anchorage (#71a.2).

From #70a.1: concrete / masonry:

Anchor bolt diameter **1/2"** in.

Anchor bolt spacing **72" o.c.** in.

Rebar size **#4**

Lap splice **16"** in.

Rebar hook length **6"** in.

From #70a.2: wood: record only if larger sizes or closer spacings than recorded for vertical anchorage (#71a.2)

Required nailing _____

Minimum plywood nailer _____

Anchor bolt diameter _____

Anchor bolt spacing _____ in.

2. *Vertical X-bracing planes under chassis beam lines* (#70b.)

Number of X-brace locations along one chassis beam line. _____

Spacing of X-brace locations along one chassis beam line. _____ ft.

Required anchor bolt diameter. _____ in.

Number of bolts at top of footing at connection to the diagonal. _____

Diagonal strap size. _____

Connection to bottom flange of chassis beam (describe). _____

72. Do foundation dimensions and details comply with Foundation Capacities Table, based on Foundation Design Table Values? (yes) no

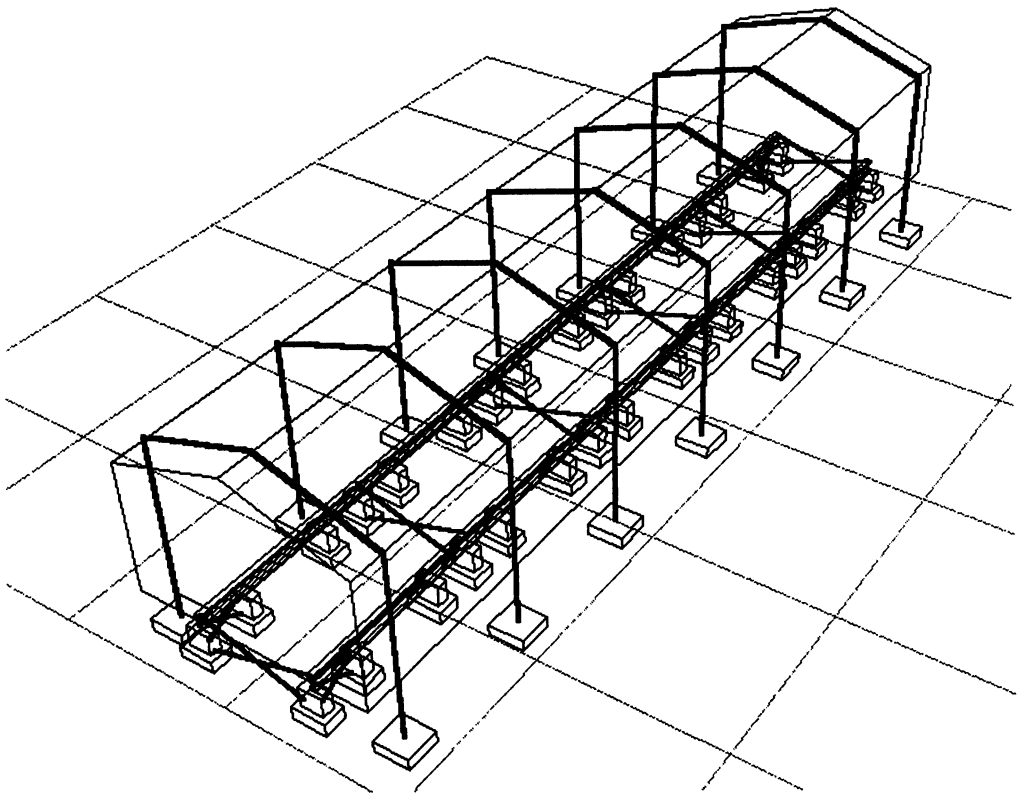
73. If #72 yes, approve. If no, return to applicant. **APPROVE**

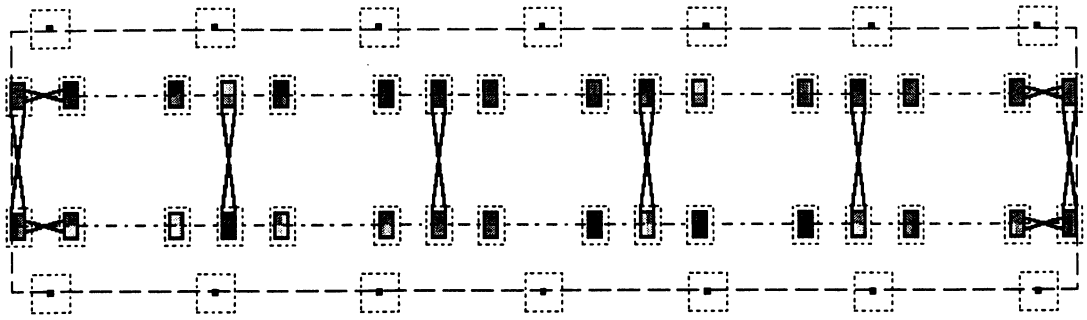
DISAPPROVE

Appendix B

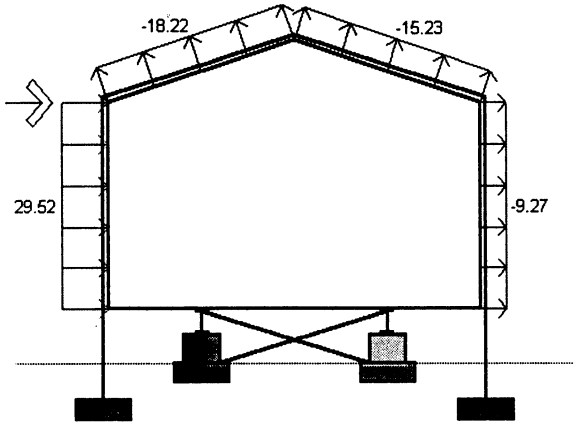
Example #2 - Foundation Concept Type C1

Single-Section Unit



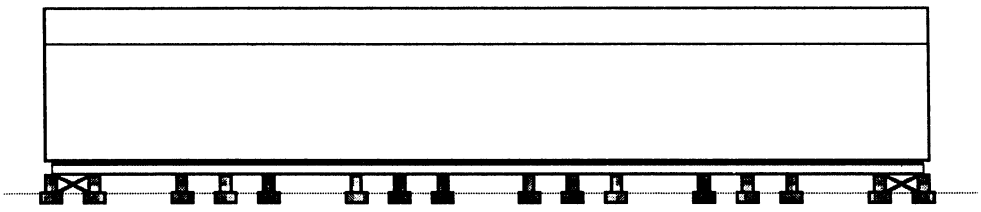


Foundation Plan



Wind Load GCpi -0.25 (psf)

Transverse Section



Longitudinal Section At Chassis Beam

APPENDIX E
OWNER'S SITE ACCEPTABILITY WORKSHEET

Owner's Name: **John Smith**

Address: **35 Brandywine**

Tampa, FL

Telephone: **xxx/234-9879**

Site Location: **Tampa, FL**

Legal Description: _____

Have you provided a copy of a map pinpointing the site? (yes) no

Have you submitted a foundation plan? (See #10 of Manufacturer's Worksheet) (yes) no

---

Preliminary Site Information

Before approval of the site can begin, the applicant must provide preliminary site information to the field office. Refer to Chapter 2, "Site Acceptability Criteria" for clarification.

1. Provide survey results showing existing grade elevation. (201-1) **28** ft.
2. Is the building in a flood-prone area? (201-2) yes (no)
   If the answer to 2 is Yes, answer 3, 4, & 5.
   If the answer to 2 is No, answer 6, below.

3. What is the Base Flood Elevation? _____ ft.

   What is the Flood Protection Elevation? _____ ft.

4. Has approval for drainage, grading and berming been approved for flood-prone sites? yes no

5. Have permits been provided? yes no
   (Permits must be obtained for any alteration of the building site in a flood protection area.)

6. Provide geotechnical report in areas of known high water table. (201-4) yes (no)

7. Provide geotechnical report if adverse site conditions are found or suspected. (203) yes (no)

8. Provide site-drainage plan complying with CABO R301.3 or local requirements. (301) (yes) no

9. Provide fill specifications if site is to be prepared with earth fill. (303-2) yes (no)

10. If a geotechnical report is required, what is the net allowable soil bearing pressure? (202) _____ psf

11. If no adverse soil conditions are known or suspected, and if the home is individually sited, assume a soil bearing pressure of 1,000 psf. and use this value when a determination of soil bearing pressure is called for. (1,000) psf

APPENDIX E
MANUFACTURER'S WORKSHEET

Manufacturer's Company Name: **New Homes, Inc.**

Address: **39 Peachtree Lane**

Atlanta, GA

Telephone: **219/333-1792**

Determination of Building Structure and Size

The manufacturer shall provide the following information:

1.	Type of unit	Single-Section ~~Multi-Section~~
2.	Method, location and types of support: Refer to Figures 6-7 and 6-8 and Section 601-4. Is the home a **C, E, or I**?	**C**
3.	Length of unit L	**56'-0"** ft.
4.	Actual width of unit Wt	**13'-8"** ft.
5.	Height of exterior wall **	**7'-6"** ft.
6.	Height of roof peak **	**2.28'** ft.
7.	Roof slope **	**4 in 12**
8.	Self weight of total unit (W) including mechanical equipment **	**16,452** lbs.
9.	Distance between chassis members	**82.0"** ft.
10.	One foundation design concept (See Appendix A) **(C1-C4; E1-E8; or I)**	**C1**

11. Recommended pier spacing **

    a. Exterior — 7'-0" ft.

    b. Interior — 7'-0" ft.

    c. Continuous Marriage Wall — _____ ft.

    Length of largest isolated marriage wall opening or average of largest two adjacent openings — _____ ft.

    d. Tie-down Strap (C1 concept only) — 7 (Number) — 8'-8" (Spacing) ft.

12. One installation method recommendations (include documentation showing connection details pertinent to geographic area for seismic or wind). ** — (yes) no

13. Interior shear wall locations (include documentation showing locations). ** — (yes) no

14. Design wind speed used in designing connection details for horizontal anchorage (Ah) and vertical anchorage (Av) in the transverse direction. ** — 120 mph.

15. Seismic acceleration values used in designing connection details for horizontal anchorage (Ah) in the transverse and longitudinal directions. ** — Av 0.05; Aa 0.05

16. Shear wall connection details with rated capacity for wind and seismic are provided. ** † — (yes) no

    a. Connection locations at foundation end and interior walls shown? ** — (yes) no

    b. Rated connection capacity for uplift and overturning ** — 3,150 lbs./ft (or lbs./tie-down)

    c. Rated connection capacity for sliding in transverse direction ** — 4,800 lbs./ft (or lbs./diag. strap)

    d. Rated connection capacity for sliding in longitudinal direction ** — 4,800 lbs./ft

    e. Vertical X-bracing tension strap capacity ** — 5,600 lbs./diag. strap

f. Engineering calculation by licensed structural engineer? ** (yes) no

** **Optional values:** It is optional for the manufacturer to provide these values. If the manufacturer does not provide the values, it is the responsibility of the owner to supply values, based on engineering analysis by a licensed structural engineer.

† Item 16 is provided in California.

APPENDIX F
DESIGN WORKSHEET

Owner's Name: **John Smith**

Address: **35 Brandywine, Tampa, FL**

Builder's Name: _____

Site Location: **Tampa, FL**

PART 1: SITE CONDITIONS
(Accompanies Chapter 2)

1. Has the Manufacturer's Worksheet been provided? — (yes) no

Existing Grade Elevation (201-1)

2. Does the site require a survey?
(Answer yes if: 1) elev. to be altered by grade or fill; 2) site near flood zone; 3) subdivision. Answer no if individually-sited with no alteration of building site.) — (yes) no

3. If yes to above, what is the surveyed existing elevation? — **28** ft.

Flood Protection Elevation (201-2)

4. Is the building site in a flood zone?
(If yes to 4, then answer 5, 6, & 7. If no, skip to 9.) — yes (no)

5. What is the Base Flood Elevation or the Flood Protection Elevation (use highest value)? — _____ ft.

6. Is the site to be graded, filled, or bermed?
(If no, skip to 9.) — yes no

7. If yes to 6, have all permits been provided? — yes no

8. If no to 6, then are the buildings to be built on elevated foundations?
(If yes, this handbook cannot be used. Refer to FEMA Manual.) — yes no

Frost Penetration Depth (201-3)

9. What is the maximum frost penetration depth? (see Appendix H, page H-4) — **0** in.

10a. Does foundation plan show base of footing extending below frost penetration depth? (If yes proceed; if no, applicant should revise plans.) — (yes) no

10b. Does foundation plan show base of footing extending below top-soil layer (min. 12") to undisturbed soil? — (yes) no

Ground Water Table Elevation (201-4)

11. For subdivisions, does a Geotechnical Engineer recommend drainage of subsurface water? (If no, skip to 13.) — yes (no)

12. Has groundwater drainage plan been provided? — yes no

Soil Conditions (202, 203)

13. If any of the following adverse site conditions are discovered, specific recommendations by a Geotechnical Engineer will be required (applies to subdivisions and individually-sited homes.)

Organic soil (8" topsoil layer) — (yes) no

Expansive (shrink-swell) soil — yes (no)

Sloping site — yes (no)

Subsidence — yes (no)

(Applicant may be referred to Geotechnical Engineer if any of the above are yes. If no, to all of above, move to next step.)

14. Is area in a known termite infestation area? — (yes) no

Region classification? (See Appendix H, Termite Infestation Map, page H-10) (If no, skip to 16.) — **very heavy**

15. Has applicant complied with CABO R-308 or local ordinance for construction procedures and treatment? (If yes, continue; if no, refer applicant to CABO requirements.) — (yes) no

PART 2: SITE PREPARATION
(Accompanies Chapter 3)

16. Acceptable surface drainage plan provided? (301)
(If no, one must be provided for subdivision) — (yes) no

17. Grading plan provided? (302) — (yes) no

18. Fill specifications conforming to those cited in HUD Land Planning Data Sheet (79g)? (303)
(If fill is used, below the home's foundation, a report by Geotech. Eng. should be submitted to provide fill specifications.) — yes (no)

19. Finish grade elevation? (304)
(Check answers to Part 1: #4 & #5. The finish grade elevation must be higher than #5 if in flood zone.) — **28'-0"** *

PART 3: DESIGN LOADS
(Accompanies Chapter 4)

Information from Manufacturer's Worksheet

20. Has all the information been provided on the Manufacturer's Worksheet? (Appendix E) — (yes) no

21. What is the building self weight (W)?
(Mfg. Wksht. #8) — **16,452** lbs.

22. What is the building length (L)?
(Mfg. Wksht. #3) — **56'-0"** ft.

23. What is the distributed weight per foot of unit length? (w=W/L)
(402-B, C) — **294** lbs./ft.

24. What is the building type?
(Mfg. WkSht. #2) — (Single-Section) ~~Multi-Section~~

(C), E, or I

Foundation design concept?
(C1, C2, C3, C4, E1, E3, E4, E5, E6, E7, E8, I) — **C1** *

Dead Load (402-1)

25. What is the light dead load value from Table 4-1? (402-1.A.1) _____ (lbs./ft.) *

26. What is the heavy dead load value from Table 4-1? (402-1.A.2) _____ (lbs./ft.) *

27. Does the answer from Question #23 fall within the values in #25 and #26? (402-1.D) yes no
(If the answer is yes, continue. If no, the foundation is not within the limits of this document and must be redesigned by a structural engineer.)

Snow Load (402-2) / Minimum Roof Live Load (402-2.C)

28a. What is average annual ground snowfall (Pg)? **0** (lbs./sq.ft.) *
(See Ground Snow Load map, pages H-11, H-12 and H-13.)

28b. What is 0.7 multiplied by Pg? (Cs=0.74) **0.0** psf.

29a. What is the roof slope? (Mfg. Wksht. #7) **4 in 12**

29b. What is the minimum roof live load for the roof slope? (D-200.2.B) **15.0** psf.

30. Record the larger magnitude of item 28b or item 29b. Use this magnitude for roof load where required. **15.0** psf.

Wind Load (402-3)

31a. What is the basic wind speed (V)? **100** mph.
(See Wind Speed map, page H-14.)

31b. If V is less than 80 mph, record MPS min. 80 mph for wind design. (402-3.A) **100** mph.

32. Is the site inland or coastal? (402-3.B) Inland / (Coastal)
(If inland, skip to question #38.)

33. If a coastal area, has the manufacturer provided connection details? (402-3.D) (Mfg. Wksht. #12) (yes) no

34. If yes to #33, what design wind speed has the manufacturer used in designing connection details? (Mfg. Wksht. #14) — **120** mph.

35. Are the connection locations shown? (Mfg. Wksht. #16a) — (yes) no

36. Are connection details provided for foundation shear walls? (For an answer of yes, all questions under Mfg. Wksht #16 must be answered satisfactorily.) — (yes) no

37. Is the value for Question 34 equal to or greater than the number given in Question 31? (If yes, proceed. If no, return design to manufacturer for clarification.) — (yes) no

Seismic Load

38a. What are the seismic acceleration values? (See Seismic maps, pages H-15 and H-16) — Aa **0.05** * ; Av **0.05** *

38b. Is Av < 0.15? (If no, proceed. If yes, seismic need not be considered, skip questions 39 to 41.) — (yes) no

39. Seismic performance category. (See H-300 for Special Requirements of Foundation Design.) — **B**

40. What is the applicant's proposed design concept? (Design Wksht. #24) — **C1** *

41. Do the Foundation Design Concept Tables approve the foundation system for use in seismic areas of Question #38 above? (See Appendix A) (If yes, proceed. If no, return to applicant for foundation design choice more suited to high seismic areas.) — (yes) no

PART 4: FINAL DESIGN PROCEDURE
(Accompanies Chapter 6)

42. What is the actual building width? (Mfg. Wksht. #4) — **13'-8"** ft.

43. The nominal building width to be used in the Foundation Design Tables, (Aftg, Av & Ah) is Wt: (600-2.A and Figure 6-1) — **14'-0"** ft.

44. Where are the foundation supports located? Check drawings submitted by the owner and Foundation Design Concepts in Appendix A. Circle the support locations shown on the Manufacturer's foundation concept plan. — (Chassis Beams) ~~Exterior Walls~~ Marriage Wall

45. Do these locations match the Foundation Concept shown in Appendix A? Do the locations match Question #24 on the Design Worksheet? (If yes, proceed. If no, return to Owner for clarification.) — (yes) no

46. Is Vertical Anchorage present? (601-2.B, 601-3.B & 601-4.B (Figures 6-7 & 6-8); Mfg. Wksht. #12 & #16) — (yes) no

APPENDIX A

47. What is the basic system type? (From Part 3: #24; Mfg. Wksht. #2) — **C1** *

48. What is the spacing between piers? (Mfg. Wksht. #11) (602-2)

Exterior: **5.53'**

Interior: **5.53'**

Continuous Marriage Wall: _____

Largest or Average Marriage Wall Opening: _____ ft.

Tie Down (C1) **8'-8"** ft.

APPENDIX B

Required Footing Size

49. The required Exterior Wall Footing, for the foundation type, is found in the Required Effective Footing Area table in App. B, Part 1. (Use maximum value from item #30.) — **C1** *

The Required Exterior Square Footing size is:

Type C **3.6** sq.ft.

Type E or I _____ ft. (width)

50. The Required Interior Footing area is: (Also exterior piers for foundation type E) _____ sq.ft.

51a. The Required Continuous Marriage Wall Footing area is: _____ sq.ft.

51b. The Required Footing area under posts at the ends of marriage wall opening(s) is: _____ sq.ft.

Vertical Anchorage Requirements in the Transverse Direction (602-4)

52a. Using the Foundation Design Load Tables (Appendix B, Part 2), determine the Required Vertical Anchorage. Exterior Av **2,565** * (lbs./pier spacing; lbs./ft. for E type; lbs./tie-down spacing)

52b. Number of vertical tie-down locations for multi-section units: 2 or 4 or 6

52c. For units with additional vertical anchorage at the interior piers, determine the Required Vertical Anchorage. Interior Av _____ * (lbs./int. pier spacing)

53. What is the manufacturer-supplied value? (#16b, Mfg. WkSht.) Exterior **3,150** *

Interior _____ *

54. Is this value (#53) greater than the value given in #52a? (If yes, continue. If no, return to owner for clarification.) (yes) no

Horizontal Anchorage Requirements In The Transverse Direction (602-5)

trial 1	trial 2	trial 3
2		
yes no	yes no	yes no
10"		

55a. What number of transverse foundation walls was selected? (602-5.E) (If vertical X-bracing planes are used, complete items #55a, #56 and #57 for 2 transverse walls, and then skip to item #59.)

55b. Are diagonal ties used to complete the top of the transverse short wall for horizontal anchorage? (602-5.G.1)

Estimate height (h) for appropriate illustration in Figure 6-10. ft.

		trial 1	trial 2	trial 3	
56. Using the tables, find the Required Horizontal Anchorage (Ah). (Appendix B; Part 3)	End Wall Ah	**858**			lbs./ft
	Int Wall Ah				lbs./ft
57a. What is the manufacturer's-supplied rated capacity for sliding? (#16c, Mfg. WkSht.)		**4,800**			lbs./ft
57b. If answer to item #55b is yes, record manufacturer or product supplier rated strap tension capacity.		**5,600**			lbs./st
58a. Is value #57a greater than item #56? If yes, continue. If no, return to section 602-4.C and to question #55a and select a larger number of transverse foundation walls. If the maximum number selected (6) does not work, return to owner (who may wish to contact the manufacturer for clarification).		(yes) no	yes no	yes no	
58b. If answer to #55b is yes, required tension in diagonal (T_t). (Complete procedure in Section 602-5.G.1.)					lbs.
58c. Is value #57b greater than #58b? If yes, continue to item #62. If no, return to owner for product with greater capacity.		yes no	yes no	yes no	

59. If using vertical X-bracing planes in lieu of transverse short walls (and the formulas in section 602-5.G.2), determine anchorage values and sizes for diagonal members. (If shear walls are selected in item #55, skip to item #62.)

	trial 1	trial 2	trial 3	
a. Vertical X-bracing spacing proposed.	**11.07'**			ft. *
b. Number of vertical X-bracing locations proposed. (Item #13, Mfg. WkSht. for trial 1.)	**6**			*

	trial 1	trial 2	trial 3	
c. Required horizontal anchorage (C) value, based on formula. (602-5.G.2.c)	**4,637**			lbs./ x-brace set
d. Estimated height (h) in Figure 6-10.	**4.0**			ft.
e. Tension (T_t) required. (602-5.G.2.d)	**5,373**			lbs./diag.
60. What is the manufacturer-supplied rated strap tension capacity? (#16, Mfg. WkSht.) (or capacity defined by literature supplied by product supplier)	**5,600**			lbs. *
61a. Is value #57 greater than value #59c? If yes, continue. If no, return to Section 602-5.G and to question #59 and select a greater number of X-brace locations as a next trial. Repeat until answer is yes, then continue.	(yes) no	yes no	yes no	
61b. Is value #60 greater than value #59e? If yes, continue. If no, return to section 602-5.G and to question #59 and select a greater number of X-bracing locations. If the maximum number selected does not work, return to owner (who may wish to contact the manufacturer for clarification or product supplier for clarification).	(yes) no	yes no	yes no	

Horizontal Anchorage Requirements In The Longitudinal Direction (602-6)

62a. Using the tables, find the required horizontal anchorage (Ah) in the longitudinal direction. (Appendix B, Part 4) (602-6.E)

Exterior Wall Ah **46** lbs./ft.

62b. If using vertical X-bracing planes (and the formulas in section 602-6.F) determine anchorage value for X-bracing planes. (If using exterior long walls, skip to item #63.)

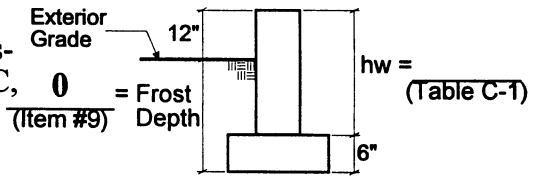
	trial 1	trial 2	trial 3
1. Number of chassis beam lines used for vertical X-bracing planes.	(2 or 4)	2 or 4	2 or 4

	trial 1	trial 2	trial 3	
Number of X-bracing planes proposed under each chassis beam along the length of the unit.	**2**			
2. Horizontal anchorage (B) required force, based on formula.	**1,293**			lbs.
3. Assumed height (h-b) based on Figure 6-11.	**3**			ft.
4. Tension (T_L) based on formula. (602-6.F.(3))	**1,471**			ft.
63. What is the manufacturer-supplied value for horizontal anchorage? (#16d, Mfg. WkSht.)	**4,800**			lbs./ft.
64a. For shear walls: is value #63 greater than #62a? If yes, skip to item #67. If no, contact owner for clarification.	yes no	yes no	yes no	
64b. For X-bracing: is value #63 greater than value #62b.2? If yes, return to item #62b.3. If no, increase number of vertical X-bracing planes and repeat items 62b.1 and 62b.2 until answer is yes. For multi-section units consider 4 lines of vertical X-bracing under all chassis beams.	(yes) no	yes no	yes no	
65. What is the manufacturer-supplied rated strap tension? (#16e, Mfg. WkSht. or product supplier)	**5,600**			lbs.
66. Is value #65 greater than #62b.4? If yes, continue. If no, contact owner to obtain straps with greater capacity, or return to item #62b.1 and increase the number of vertical X-bracing planes until answer is yes.	(yes) no	yes no	yes no	

APPENDIX C

Withdrawal Resistance Verification (603-2.2)

67. Using Appendix C, Table C-1 or C-2, verify that the foundation system will resist withdrawal. Answer question #67a for type E. Answer question #67b for types C, I, or type E with interior pier anchorage.



a. ***Withdrawal Resistance for long foundation wall.*** (Type E)
Circle the type of material that is to be used.

Reinforced Concrete
Masonry-Fully Grouted
Masonry-Grouted @ 48" o.c.
All-Weather Wood / Footing

1) Using Table C-1, which capacity is greater than required Av? (603-2.B.(1)) (#52a) _____ lbs./ft.

2) Using Table C-1, what is the height of the wall + footing for required withdrawal resistance? (hw + 6") _____ in.

3) What is the height of the wall + footing for frost protection? (frost depth (#9) + 12") _____ in.

4) What is the greatest height #67a.2 or #67a.3? _____ in.

Circle the height which controls. Withdrawal / Frost Depth

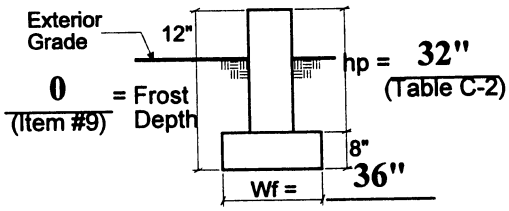
5) Record the bottom of footing depth from grade. (Item #67a.4 - 12") _____ in.

6) Using Table C-1, what is the required width of the wall footing for withdrawal? _____ in.

7) Is item #67a.6 greater than or equal to item #49? yes no
If yes, continue. If no, change footing width to item #49.

8) Record design exterior wall footing width. _____ in.

b. ***Withdrawal Resistance for Piers.*** (Types C, C1 (concrete dead-man), I or type E with interior pier anchorage - multi-section units.)



Circle pier type:

Reinforced Concrete
Reinforced Masonry - fully grouted
Reinforced Concrete Dead-man

	Exterior	Interior (when used)	
1) Using Table C-2, which capacity is greater than required Av? (#52a and #52c) (603-2.B.(2))	**2,824**		lbs./pi
2) Using Table C-2, what is the height of the pier + footing for required withdrawal resistance? (hp + 8")	**40"**		in. *
3) What is the required height of pier + footing for frost protection? (frost depth (#9) + 12")			in.
4) What is the greatest height #67b.2 or #67b.3?	**40"**		in.
Circle the height which controls.	(Withdrawal) ~~Frost Depth~~	Withdrawal Frost Depth	
5) Record the bottom of footing depth from grade. (Item #67b.4 - 12")			in.
6) Using Table C-2, what is the required width of the square footing if withdrawal resistance controls or if frost depth controls?	**36"**		in. *

c. ***Frost depth for marriage walls.*** What is the required depth of footing below grade for frost protection? (frost depth (#9)) (no withdrawal resistance) **0** in.

Vertical Anchorage and Reinforcement for Longitudinal Foundation Walls and Piers (603-2.D)

68. Using Appendix C, Table C-3, C-4A or C-4B, verify that the foundation anchors will resist uplift. Answer question #68a for type E. Answer question #68b for types C, I, or type E with interior pier anchorage.

a. ***Vertical Anchor Capacity for longitudinal foundation wall*** (type E). (603-2.D.2)

1) Using Table C-4A (concrete & masonry), which capacity is greater than the required Av? (#52a, Design Wksht.) If treated wood wall, skip to item #68a.3. _____ lbs./lineal ft. of wall

Circle correct washer choice for the capacity selected — Standard Washer / Oversized Washer

2) Using Table C-4A (masonry and concrete):

a) Required anchor bolt diameter _____ in.

b) Required anchor bolt spacing _____ in.

c) Using Table C-3A:

(1) Rebar size _____ *

(2) Lap splice _____ in.

(3) Rebar hook length _____ in.

3) Using Table C-4B (wood), which capacity is greater than the required Av? (#52a, Design Wksht.)
If using concrete or masonry wall, skip to item #68b. _____ lbs./lineal ft. of wall

4) Using Table C-4B (wood):

a) Required nailing _____ *

b) Minimum plywood thickness _____ in.

c) Required anchor bolt diameter _____ in.

d) Required anchor bolt spacing _____ in.

b. ***Vertical Anchor Capacity for Piers***
(Types C, I, or type E with interior pier anchorage)
(603-2.D.1)

	Exterior	Interior (when used for anchorage in multi-section units)	
1) Using Table C-3, which capacity in the table is greater than the required Av? (From #52a, Design Wksht.)	_____	_____	lbs./pie

	Exterior	Interior	
2) Using Table C-3:			
a) Number of anchor bolts	1 or 2	1 or 2	
b) Anchor diameter	1/2" or 5/8"	1/2" or 5/8"	
3) Using Table C-3A:			
a) Rebar size	#4 or #5	#4 or #5	
b) Lap splice	_____	_____	in.
c) Rebar hook length	_____	_____	in.

Horizontal Anchorage and Reinforcement for Transverse Foundation Walls (603-3)

69. Using Appendix C, Table C-5A or C-5B, verify that the foundation anchorage will resist sliding at the transverse end foundation walls. Use for types C, E, or I.

	End Wall	Interior Wall	
a. ***For continuous foundations.***			
Using Table C-5A (concrete & masonry) or C-5B (wood), which capacity is greater than the required (Ah) (603-3) (item #56)?	_____	_____	lbs./f
1) Using Table C-5A, find:			
a) Required anchor bolt diameter	_____	_____	in.
b) Required anchor bolt spacing	_____	_____	in.
c) Using Table C-3A:			
(1) Rebar size	_____	_____	*
(2) Lap splice	_____	_____	in.
(3) Rebar hook length	_____	_____	in.
2) Using Table C-5B, find:			
a) Required nailing	_____	_____	*

	End Wall	Interior Wall	
b) Minimum plywood thickness			in.
c) Required anchor bolt diameter			in.
d) Required anchor bolt spacing			in.

b. ***For short foundation walls completed with diagonal braces.*** (603-5)

Using Appendix C, Table C-5A, verify the diagonal anchorage capacity to the short foundation wall.

	End	Interior	
1) Record the required horizontal force (Ah × Wt) from 602-5.G.1.a and item #56.			lbs.
2) Table C-5A capacity for one 1/2" diameter bolt at 12" o.c.	1800	1800	lbs.
3) Number of bolts (Ah × Wt ÷ 1800; one minimum) at concrete or masonry top of short wall.			*
4) Size of anchor bolts			in.
5) Using Table C-3A:			
a) Rebar size			*
b) Lap splice			in.
c) Rebar hook length			in.

c. ***For vertical X-bracing planes in the transverse direction.*** (603-6)

Using Appendix C, Table C-5A, verify the diagonal anchorage to the pier footings and the tension capacity of the diagonals.

1) Record the required horizontal force (C) from item #59c.	**4,637**	lbs.
2) Table C-5A capacity for one 1/2" diameter bolt at 12" o.c.	1800	lbs.

3) Number of bolts (C ÷ 1800; one minimum) at top of a footing. **3** *

4) Record the required tension force (T_t) from item #59e. **5,373** lbs./dia

5) Select tension strap capacity greater than or equal to T_t from owner's product supplier or manufacturer's supplied capacity (item #60). **5,600** lbs./dia

6) Record diagonal strap data **A36 galv. steel plate:1/4" x**

Horizontal Anchorage for Longitudinal Foundation Walls (603-4)

70. Using Appendix C, Table C-5A or C-5B, verify that the foundation horizontal anchorage will resist sliding at the long foundation walls. Use for types C, E and I.

a. ***For continuous exterior foundation walls.***

Using Table C-5A (concrete and masonry) or Table C-5B (wood), which capacity is greater than the required exterior Ah? (602-6.E) (item #62a) _____ lbs./ft.

1) Using Table C-5A, find:

a) Required anchor bolt diameter _____ in.

b) Required anchor bolt spacing _____ in.

c) Using Table C-3A:

(1) Rebar size _____ *

(2) Lap splice _____ in.

(3) Rebar hook length _____ in.

2) Using Table C-5B, find:

a) Required nailing _____ *

b) Minimum plywood thickness _____ in.

c) Required anchor bolt diameter _____ in.

d) Required anchor bolt spacing _____ in.

b. ***For vertical X-bracing planes.***
(603-6.A.(2))

Using Appendix C, Table C-5A, verify the diagonal anchorage to the pier footings and the tension capacity of the diagonals.

1)	Record the required horizontal force (B) from item #62b.2.	**1,293** lbs.
2)	Table C-5A capacity for one 1/2" diameter bolt at 12" o.c.	1800 lbs.
3)	Number of bolts (B ÷ 1800; one minimum)	**1** *
4)	Record the required tension force (T_L) from item #62b.4.	**1,471** lbs./diag.
5)	Select tension strap capacity greater than or equal to T_L from owner's product supplier or manufacturer's supplied capacity (item #60).	**5,600** lbs./diag.
6)	Record diagonal strap data	**A36 Galv. Steel Plate: 1/4" x 1**

SUMMARY SHEET
(Accompanies Chapter 7)

71. Compare values from preceding questions. Select the largest value.

a. **Bearing area and vertical anchorage**

1. *Pier footings: types C, E & I.*

	Piers				
			Marriage Wall		
	Exterior	Interior	Cont.	At Post	
Required Effective Footing Area from questions #49, #50, & #51.	**3.6**				sq.ft.
Required footing area to resist withdrawal due to uplift from Question #67. (for single-section or 2 tie-down system, only the exterior piers resist uplift, for 4 tie-down only the interior piers and exterior walls resist uplift)	**9.0**		sq.ft.		

	Piers				
	Exterior	Interior	Marriage Wall Cont.	Marriage Wall At Post	
Pier Footing Sizes (largest of above)	**3.6**				sq.f
"Dead-man" footing size.	**9.0** sq.ft.				

Reinforcing for pier footings:
Bring forward answers from previous questions. (#68b)
(Types C , I, or E with interior pier anchorage.)

	Exterior	Interior
Number of anchor bolts		
Anchor bolt diameter		
Rebar size		
Lap splice		
Rebar hook length		

	Exterior	Interior	Marriage Wall	
Footing depth: grade to bottom of footing				sq.

Pier footing and "dead-man" footing reinforcing bars: #4 at 10" o.c.

"Dead-man" footing depth: grade to bottom of footing _____ in.

2. *Long Foundation wall footing: type E or I:*

Required Effective Footing Width

Required Footing Width for soil bearing (#49) _____ ft.

Required Footing Width to resist uplift withdrawal (#67a.6) _____ ft.

Wall Footing Size (largest of above) _____ ft.

Footing Depth: Grade to bottom of footing (#67a.5) _____ in.

Footing reinforcing bars. 2 #4 bars

Reinforcing for longitudinal foundation walls: Record answers from item #68a and record sizes and spacings.

From 68a.2: masonry and concrete:

Required anchor bolt diameter _____ in.

Required washer size Standard Oversized

Required anchor bolt spacing _____ in.

Rebar size _____

Lap splice _____ in.

Rebar hook length _____ in.

From 68a.4: wood: Record answers from item #68a.4 and record sizes and spacings.

Required nailing _____

Minimum plywood thickness. _____ in.

Required anchor bolt diameter _____

Required anchor bolt spacing _____ in.

b. **Horizontal anchorage in the transverse direction - foundation walls**

1. *Continuous foundation walls* (#69a)

Number of transverse foundation walls (#55a) **2**

Required Footing Width (minimum) **12** in.

From #69a.1: concrete / masonry:

	End Wall	Interior Wall	
Anchor bolt diameter	_____	_____	in.

	End Wall	Interior Wall	
Anchor bolt spacing	_____	_____	in
Rebar size	_____	_____	
Lap splice	_____	_____	in
Rebar hook length	_____	_____	in
From #69a.2: wood:			
Required nailing	_____	_____	
Minimum plywood nailer	_____	_____	
Anchor bolt diameter	_____	_____	
Anchor bolt spacing	_____	_____	

2. *For transverse short foundation walls completed with diagonal braces* (#69b)

	End	Interior	
Number of pairs of diagonals (1 for single-section units, 2 for multi-section units) times number of short walls (end or interior) (#55a)	_____	_____	
Diagonal spacing (same as number of short walls)	_____	_____	
From #69b: concrete / masonry:			
Anchor bolt diameter	_____	_____	i
Number of bolts	_____	_____	
Rebar size	_____	_____	
Lap splice	_____	_____	i
Rebar hook length	_____	_____	i

3. *For vertical X-bracing planes in lieu of short walls.* (#69c)

Number of X-brace locations (#59) **6**

Spacing of vertical X-brace planes (#59) **11.07'** ft.

Items from #69c.3 and #69c.5

Required anchor bolt diameter **1/2"** in.

Number of bolts at top of footing to connect diagonal **3**

Diagonal strap size **A36 galv. steel plate:1/4" x 1**

Connection to top flange of chassis beam (describe) _____

c. **Horizontal anchorage in the longitudinal direction - exterior foundation walls**

1. *Continuous foundation walls*

Reinforcing for longitudinal foundation walls: record only if larger sizes or closer spacing than recorded for vertical anchorage (#71a.2).

From #70a.1: concrete / masonry:

Anchor bolt diameter _____ in.

Anchor bolt spacing _____ in.

Rebar size _____

Lap splice _____ in.

Rebar hook length _____ in.

From #70a.2: wood: record only if larger sizes or closer spacings than recorded for vertical anchorage (#71a.2)

Required nailing _____

Minimum plywood nailer _____

Anchor bolt diameter _____

Anchor bolt spacing _____ in.

2. *Vertical X-bracing planes under chassis beam lines* (#70b.)

Number of X-brace locations along one chassis beam line. **2**

Spacing of X-brace locations along one chassis beam line. _____ ft.

Required anchor bolt diameter. **1/2"** in.

Number of bolts at top of footing at connection to the diagonal. **1**

Diagonal strap size. **A36 Galv. Steel Plate: 1/4"**

Connection to bottom flange of chassis beam (describe). _____

72. Do foundation dimensions and details comply with Foundation Capacities Table, based on Foundation Design Table Values? (yes) no

73. If #72 yes, approve. If no, return to applicant. **APPROVE**

DISAPPROVE

U.S. Department of Housing and Urban Development
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