

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 $\approx$ 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.

Superstructure Dimensions

Type of Unit: ☒ Single-Section ☐ Multi-Section

Roof Height: 2.28' Roof Slope: 12/4

Exterior Wall Height (in): 7'-6"

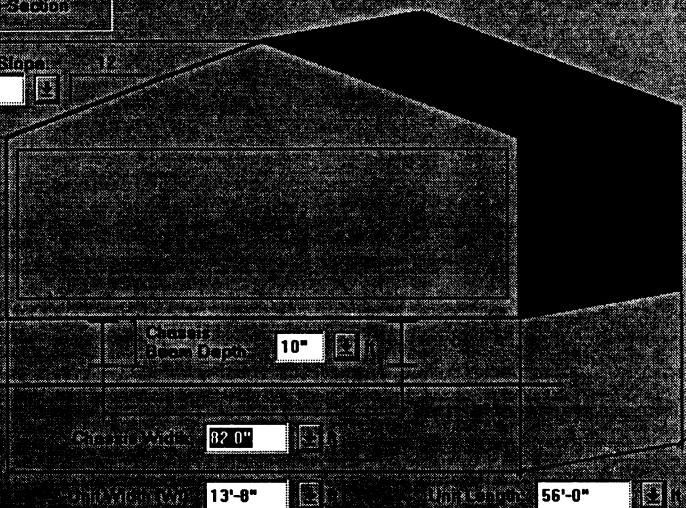
Height Above Grade: 2'-0"

Chassis Beam Depth: 10"

Grade: Ground Width: 82'-0"

Foundation Width: 13'-8" Unit Length: 56'-0"

OK Cancel Help



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.

Foundation Design Concept

Foundation	Engineering Decision	Cost	High Wind Zone	Detached	Support	Accessory
C1 Reinforced masonry piers with tie-downs & diagonal tie	Maybe		Some	Some		
C2 Reinforced masonry or concrete piers	No					
C3 Isolated deep piers	Yes					
C4 Mat slab w/isolated piers	Yes					
E1 Reinforced piers	No		Some			

OK Cancel Help Appendix A

- 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:

Dead Loads

Floor **Roof** **Exterior Wall** **Marriage Wall**

Material

Finish	Carpet and Pad	1.0
Decking	1/2" Oriented Strand Board	1.7
Joists	Wood 2 x 6 @ 16" o.c.	1.7
Insulation	5 1/2" Batt	1.1
Mechanical	Mechanical	0.6
Partitions	Miscellaneous Partitions	2.2
Total		
Chassis Beam Weight	9.0	

Floor **Roof** **Exterior Wall** **Marriage Wall**

Material

Roofing	Standing Seam Aluminum	0.3
Decking	1/2" Oriented Strand Board	1.7
Joists/Trusses	Wood 2 x 6 @ 16" o.c.	1.7
Insulation	5 1/2" Batt	1.1
Ceiling	5/16" Gypsum Board	1.4
Total		6.2

Floor **Roof** **Exterior Wall** **Marriage Wall**

Material

Exterior Finish	M19 Aluminum Siding	0.2
Studs	Wood 2 x 4 @ 16" o.c.	1.5
Insulation	3 1/2" Batt	0.7
Interior Finish	5/16" Gypsum Board	1.4
Total		3.8

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:

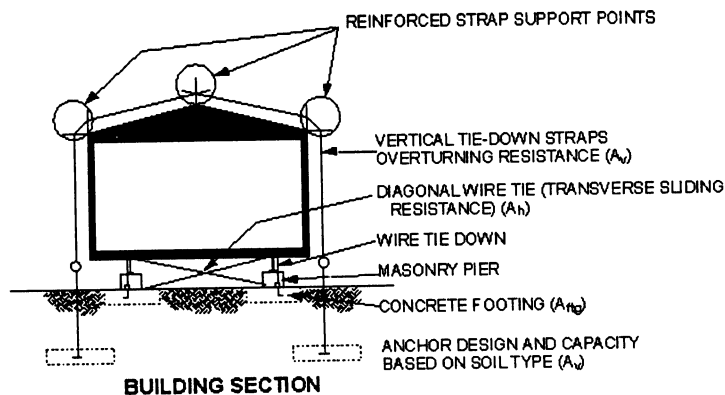
A-100.5. Selection Table

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

<u>Foundation Type</u>	<u>High Wind Zone</u>			<u>Engineering Design Required</u>			<u>Seismic Zone</u>		
	<u>All</u>	<u>Some</u>	<u>None</u>	<u>Yes</u>	<u>No</u>	<u>Maybe</u>	<u>All</u>	<u>Some</u>	<u>None</u>
<u>C1</u> 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:



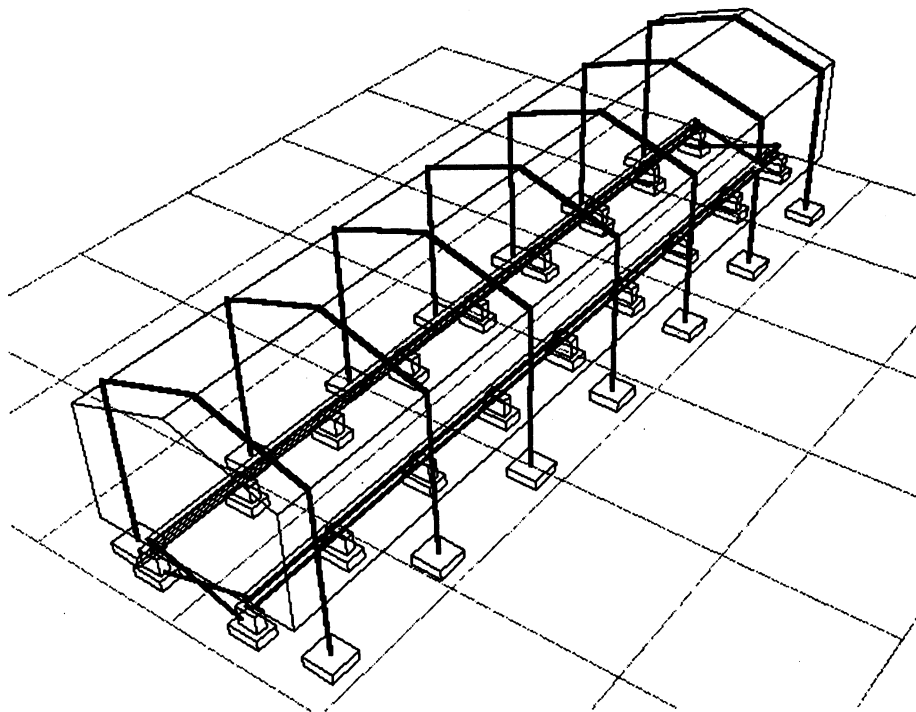
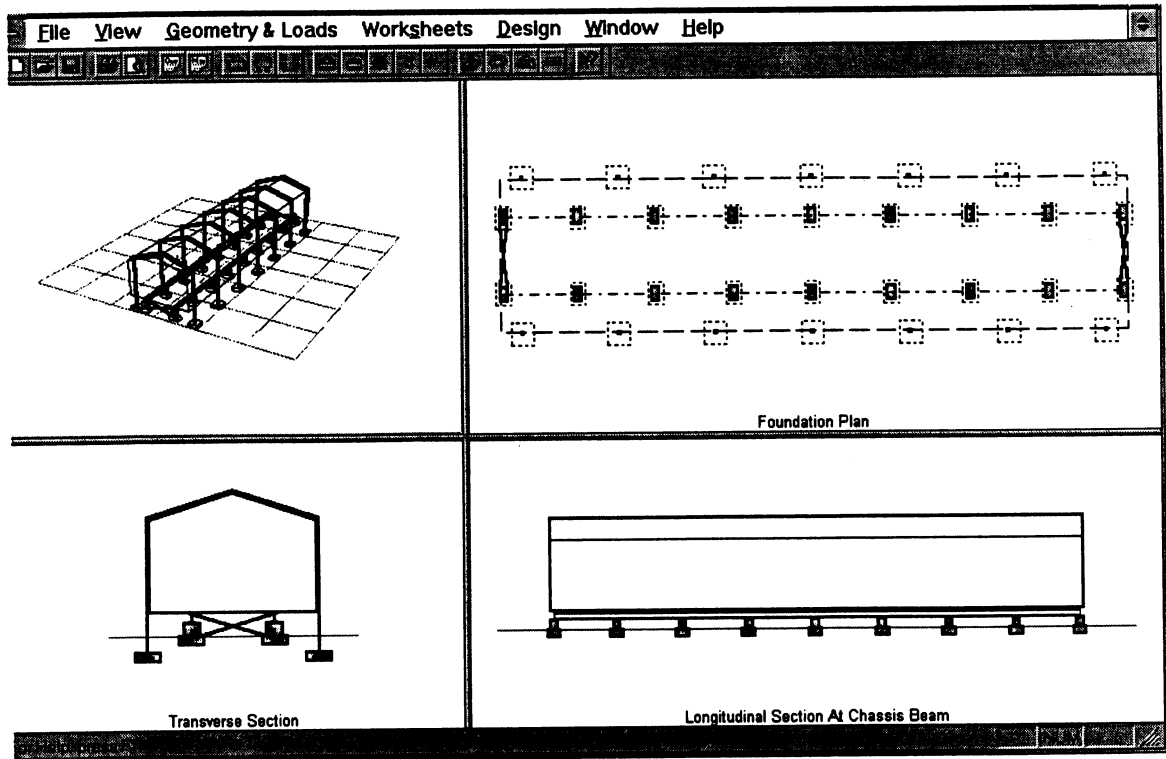
NOTE: TYPICAL STEEL TIE-DOWN STRAP: 1/32" X 1-1/4"
MINIMUM BREAKING TENSION STRENGTH = 4750 LB (ULTIMATE LOAD)
(ASTM D3953-83) OR
FEDERAL QQ-S-781G

FOUNDATION TYPE Reinforced masonry piers w/ wire tie downs and diagonal tie	SYSTEM NUMBER 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.

The screenshot shows a dialog box titled "Recommended Pier Spacing". It contains several input fields and buttons. At the top, there are two rows of input fields for "Pier Spacing" and "Tie-down Strap (C1 only) Number". Below these, there is a large diagram showing a perspective view of a structure with tie-downs. At the bottom, there are three buttons: "OK", "Cancel", and "Help".

- 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:



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.

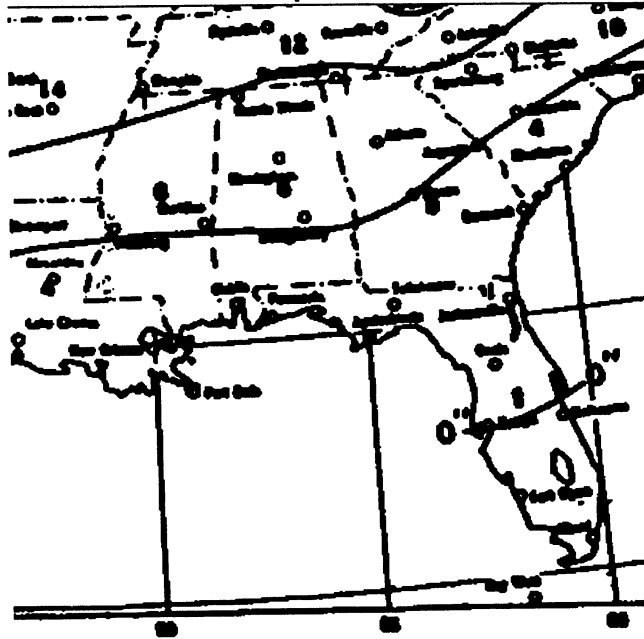
Part 1 - Site Conditions

- 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.

The screenshot shows a form titled "DESIGN WORKSHEET - PART 1 - SITE CONDITIONS". The form is divided into several sections, each with a question and a corresponding input field or checkbox. The questions are numbered 1 through 7. The input fields are on the right side of the form. The first input field contains the number "28". The second input field contains the number "0". The third input field contains the number "0". The fourth input field contains the number "0". The fifth input field contains the number "0". The sixth input field contains the number "0". The seventh input field contains the number "0".

- 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.

Frost Penetration Depth



13. Is there a significant chance of finding a 20-year-old home?

14. Frost penetration depth (2013)

15. What is the maximum frost penetration depth?

16. Frost penetration depth (2013)

17. Frost penetration depth (2013)

18. Frost penetration depth (2013)

19. Frost penetration depth (2013)

20. Frost penetration depth (2013)

21. Frost penetration depth (2013)

22. Frost penetration depth (2013)

23. Frost penetration depth (2013)

24. Frost penetration depth (2013)

25. Frost penetration depth (2013)

26. Frost penetration depth (2013)

27. Frost penetration depth (2013)

28. Frost penetration depth (2013)

29. Frost penetration depth (2013)

30. Frost penetration depth (2013)

31. Frost penetration depth (2013)

32. Frost penetration depth (2013)

33. Frost penetration depth (2013)

34. Frost penetration depth (2013)

35. Frost penetration depth (2013)

36. Frost penetration depth (2013)

37. Frost penetration depth (2013)

38. Frost penetration depth (2013)

39. Frost penetration depth (2013)

40. Frost penetration depth (2013)

41. Frost penetration depth (2013)

42. Frost penetration depth (2013)

43. Frost penetration depth (2013)

44. Frost penetration depth (2013)

45. Frost penetration depth (2013)

46. Frost penetration depth (2013)

47. Frost penetration depth (2013)

48. Frost penetration depth (2013)

49. Frost penetration depth (2013)

50. Frost penetration depth (2013)

51. Frost penetration depth (2013)

52. Frost penetration depth (2013)

53. Frost penetration depth (2013)

54. Frost penetration depth (2013)

55. Frost penetration depth (2013)

56. Frost penetration depth (2013)

57. Frost penetration depth (2013)

58. Frost penetration depth (2013)

59. Frost penetration depth (2013)

60. Frost penetration depth (2013)

61. Frost penetration depth (2013)

62. Frost penetration depth (2013)

63. Frost penetration depth (2013)

64. Frost penetration depth (2013)

65. Frost penetration depth (2013)

66. Frost penetration depth (2013)

67. Frost penetration depth (2013)

68. Frost penetration depth (2013)

69. Frost penetration depth (2013)

70. Frost penetration depth (2013)

71. Frost penetration depth (2013)

72. Frost penetration depth (2013)

73. Frost penetration depth (2013)

74. Frost penetration depth (2013)

75. Frost penetration depth (2013)

76. Frost penetration depth (2013)

77. Frost penetration depth (2013)

78. Frost penetration depth (2013)

79. Frost penetration depth (2013)

80. Frost penetration depth (2013)

81. Frost penetration depth (2013)

82. Frost penetration depth (2013)

83. Frost penetration depth (2013)

84. Frost penetration depth (2013)

85. Frost penetration depth (2013)

86. Frost penetration depth (2013)

87. Frost penetration depth (2013)

88. Frost penetration depth (2013)

89. Frost penetration depth (2013)

90. Frost penetration depth (2013)

91. Frost penetration depth (2013)

92. Frost penetration depth (2013)

93. Frost penetration depth (2013)

94. Frost penetration depth (2013)

95. Frost penetration depth (2013)

96. Frost penetration depth (2013)

97. Frost penetration depth (2013)

98. Frost penetration depth (2013)

99. Frost penetration depth (2013)

100. Frost penetration depth (2013)

- 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".

Expansive (shrink-swell) soil?

Sloping site?

Subsidence?

(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?

Region classification:
(See Appendix B, Termite Infestation Map, page B-10). (If no, skip to 15.)

15. Has applicant complied with CARBOR 308 or local ordinance for construction procedures and materials?
(If yes, continue. If no, refer applicant to CARBOR requirements.)

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 2 - SITE PREPARATION
(Accompanies Chapter 3)

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

17. Grading plan provided? (302)

18. Fill specifications conforming to those cited in HIVE II and Planning Data Sheet (DS) (303)
(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 #44-45. The finish grade elevation must be higher than #5 if in flood zone.)

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**.

The screenshot shows a software window titled "DESIGN WORKSHEET". Below the title bar, there is a section labeled "Information from Manufacturer's Worksheet". This section contains several input fields with the following values:

- 16,452
- 56'-0"
- 294
- C
- C1

Each input field has a small icon to its right, likely for unit selection or format toggling. The background of the window is dark, and the text is light-colored.

- 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.

Roof Live Load

Snow Load

Ground Snow Load (P_g)	0	psf	Maps
Importance Factor	I		I = 1.0
Exposure Factor	C		C _e = 1.0
Thermal Factor	Heated		C _t = 1.0
Roof Slope	4 in 12		
☒ Unobstructed Slippery Surface			C _s = 0.74
☐ Located in Alaska			
Computed Snow Load	$P_s = 0.74 \cdot C_e \cdot C_t \cdot I \cdot P_g$	0.0	psf
	$P_s = C_s \cdot P_g$	0.0	psf

Minimum Roof Live Load

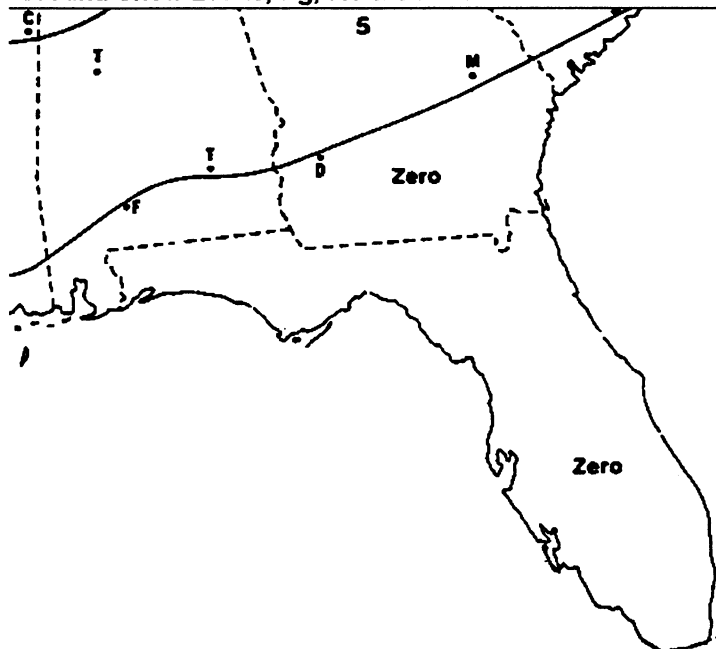
15.0 psf

Roof Live Load (larger of snow load and min. roof ll)

15.0 psf

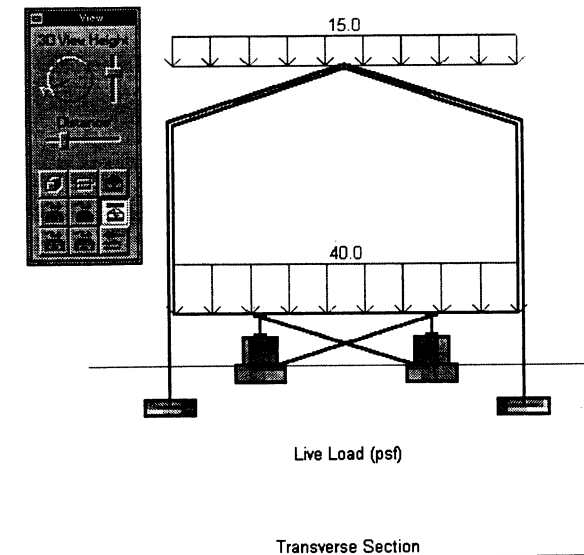
OK Cancel Help

Ground Snow Loads, P_g , for the Eastern United States



- 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.

Wind Load

Basic Wind Speed from Map: 100 mph

Design Wind Speed (V): 100 mph

☒ Coastal Distance to Ocean (mi): 0 miles

Importance Factor: 1

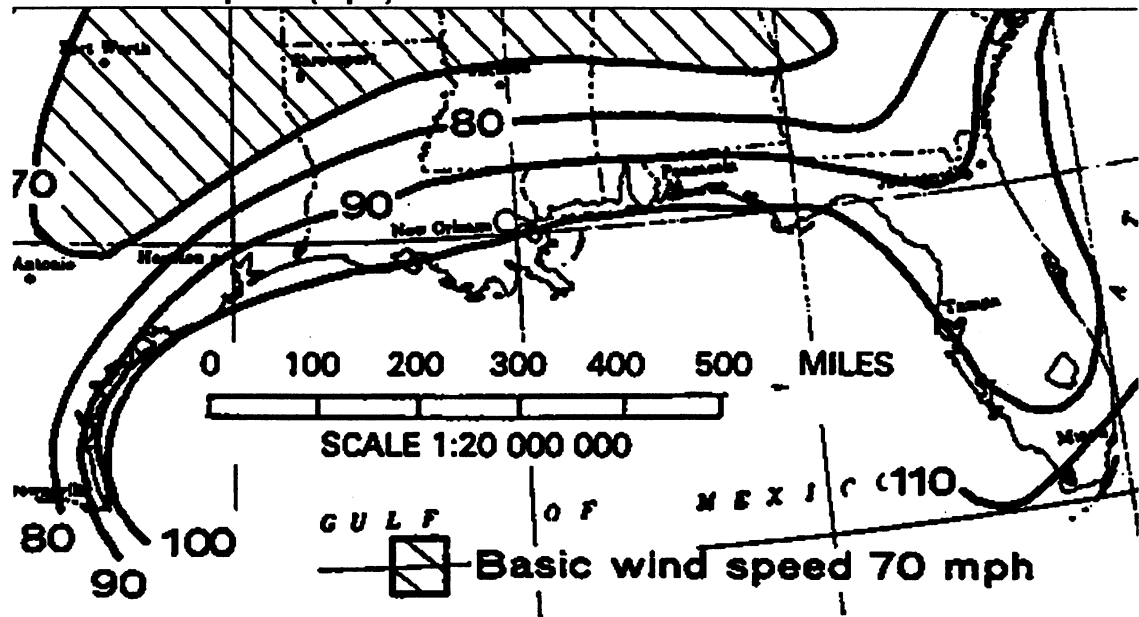
Exposure Category: C

Opening Coefficient: 0.25 and +0.25

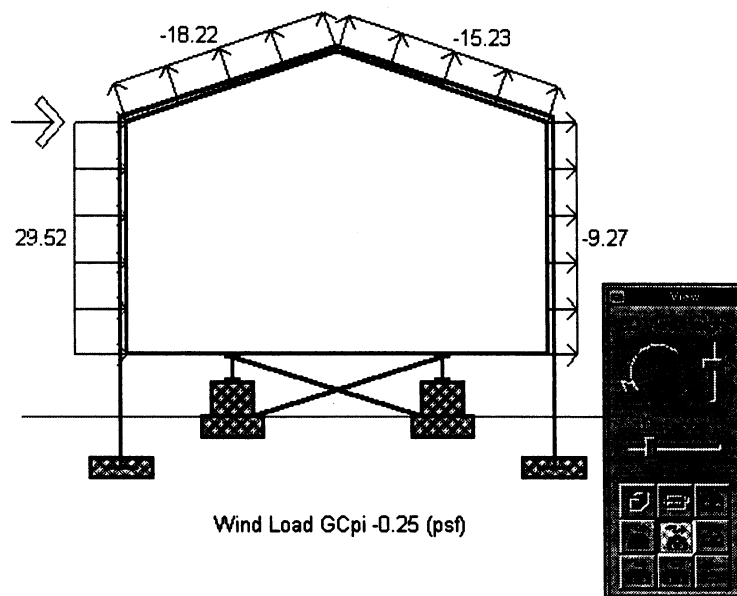
$q = 0.00256 V^2 K_z K_{zt} K_d K_{e1} K_{e2} K_{e3} K_{e4} K_{e5} K_{e6} K_{e7} K_{e8} K_{e9} K_{e10} K_{e11} K_{e12} K_{e13} K_{e14} K_{e15} K_{e16} K_{e17} K_{e18} K_{e19} K_{e20} K_{e21} K_{e22} K_{e23} K_{e24} K_{e25} K_{e26} K_{e27} K_{e28} K_{e29} K_{e30} K_{e31} K_{e32} K_{e33} K_{e34} K_{e35} K_{e36} K_{e37} K_{e38} K_{e39} K_{e40} K_{e41} K_{e42} K_{e43} K_{e44} K_{e45} K_{e46} K_{e47} K_{e48} K_{e49} K_{e50} K_{e51} K_{e52} K_{e53} K_{e54} K_{e55} K_{e56} K_{e57} K_{e58} K_{e59} K_{e60} K_{e61} K_{e62} K_{e63} K_{e64} K_{e65} K_{e66} K_{e67} K_{e68} K_{e69} K_{e70} K_{e71} K_{e72} K_{e73} K_{e74} K_{e75} K_{e76} K_{e77} K_{e78} K_{e79} K_{e80} K_{e81} K_{e82} K_{e83} K_{e84} K_{e85} K_{e86} K_{e87} K_{e88} K_{e89} K_{e90} K_{e91} K_{e92} K_{e93} K_{e94} K_{e95} K_{e96} K_{e97} K_{e98} K_{e99} K_{e100}$

Transverse Direction	z (ft)	G _z	K _z	q _z (psf)	C _p	Pressure (psf)	0.25	+0.25
Windward Wall	3.5	1.32	0.80	22.6	-0.80	-23.5	-18.2	
Leeward Wall	10.5	1.32	0.80	22.6	-0.50	-9.3	-20.6	
Windward Roof	10.5	1.32	0.80	22.6	-0.80	-18.2	-29.5	
Leeward Roof	10.5	1.32	0.80	22.6	-0.70	-15.2	-26.5	

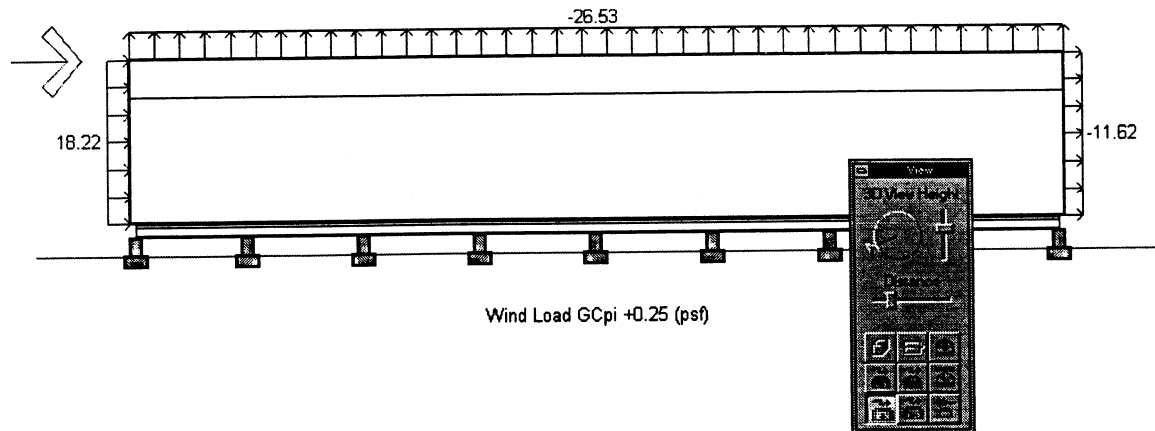
Longitudinal Direction	z (ft)	G _z	K _z	q _z (psf)	C _p	Pressure (psf)	0.25	+0.25
Windward Wall	11.0	1.32	0.80	22.6	0.80	23.5	-18.2	
Leeward Wall	10.5	1.32	0.80	22.6	-0.20	-6.3	-11.6	
Roof	10.5	1.32	0.80	22.6	-0.70	-15.2	-26.5	

Basic Wind Speed (mph)

- 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 $\pm$ 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.

Seismic Load

Load Summary (psf)

	Dead		Snow (Psf)	Percentage of P _f to include in roof weight
Floor	8.3	☐		
Roof	6.2	☐	0.0	0
Exterior Wall	3.8	☐		
Masonry Wall	4.3	☐		

Seismic Acceleration Values

A_s 0.05

A_v 0.05

Site Coefficient: S₄ S₁ 2.0

Hazard Exposure Group: I **Performance Category:** B

Basic Structural System: Bearing wall system

Seismic Force Resisting System: Light frame walls with shear walls

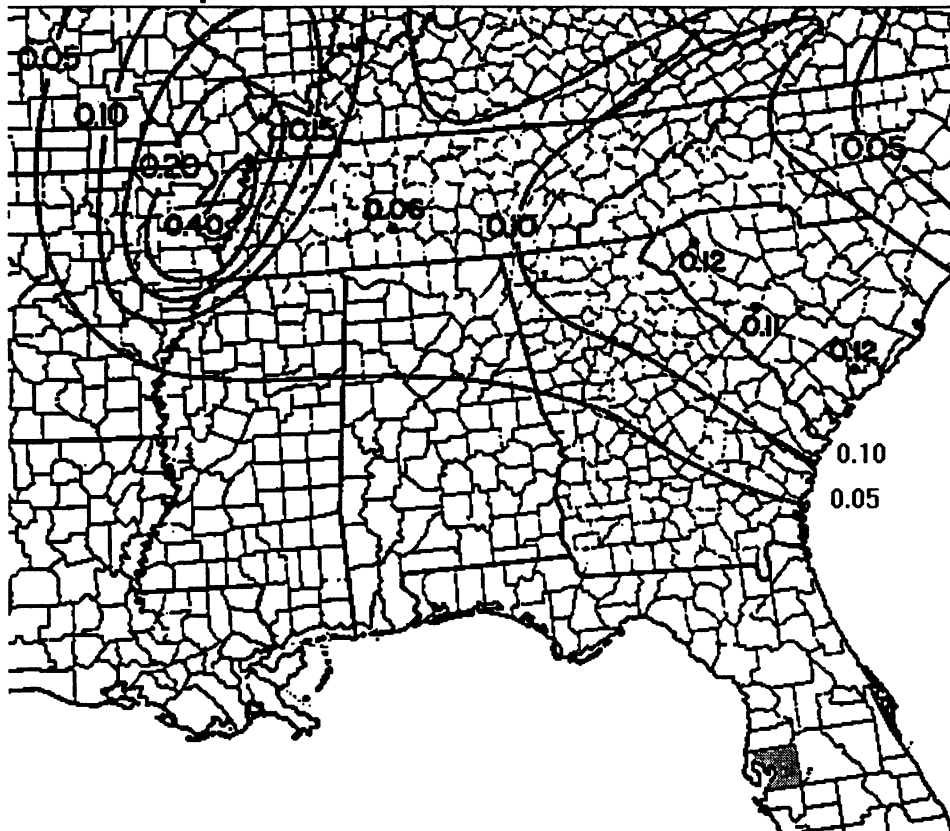
Response Modification Coeff. (R): 6.5

Building Period Coefficient (C_p): 0.020 **Fundamental Period (T):** 0.32

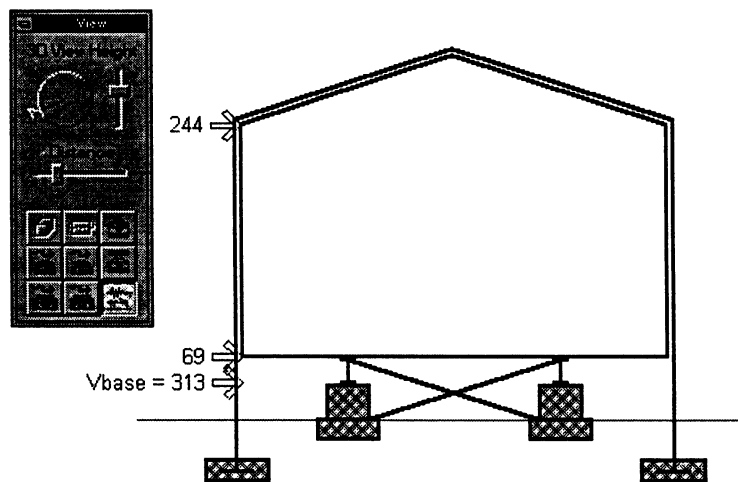
Seismic Design Coefficient (C_s): 0.019 **Base Shear (V):** 313

Level	w (lbs)	h (ft)	V _x	C _v	F _x (lbs)
Roof	7,047	8.50	66,846	0.781	244
Floor	9,405	2.00	18,010	0.219	69
Sum	16,452		84,756		313

Contour Map for Seismic Coefficient A_a



- 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:

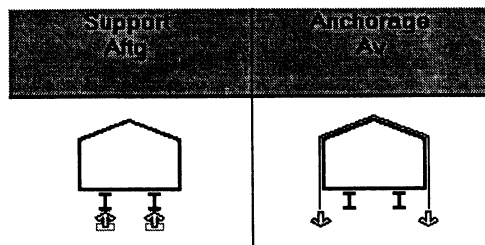


Seismic Load (lbs)

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.



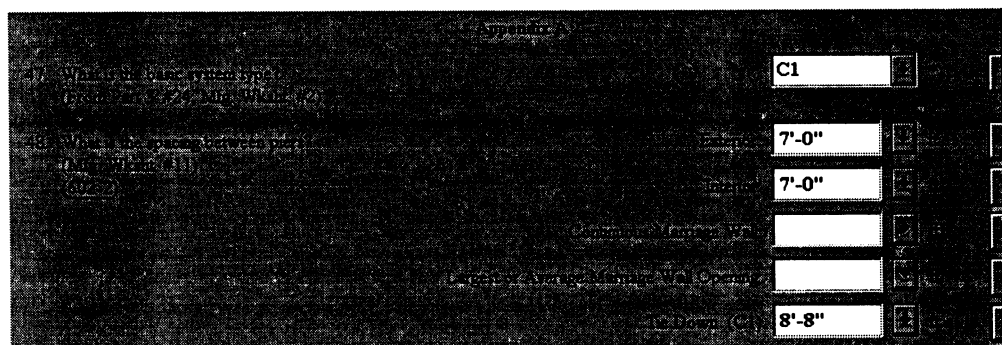
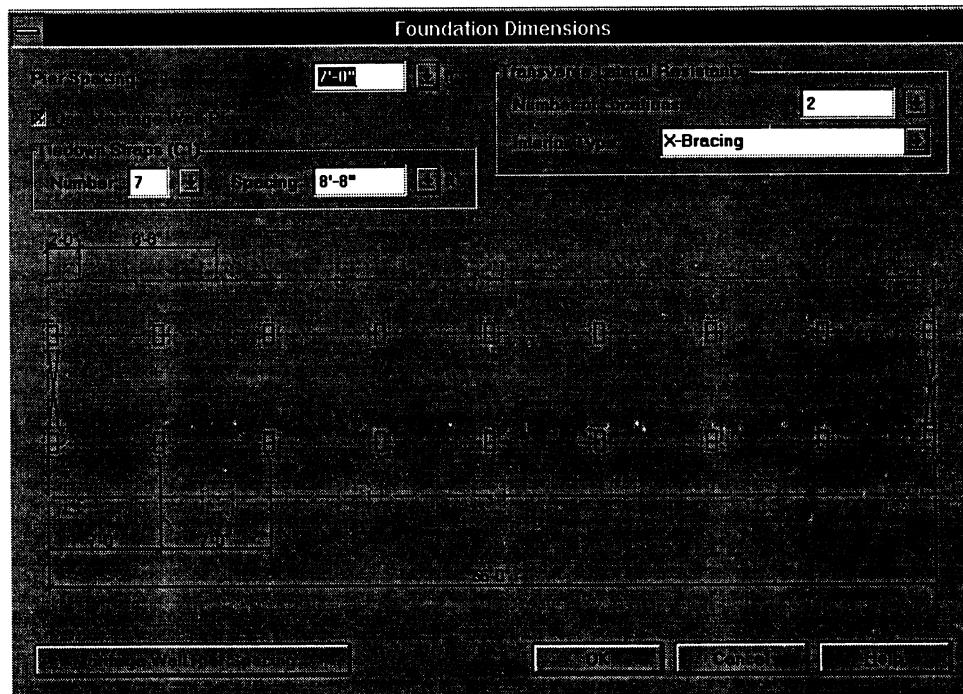
- From the graphic above it is apparent that the **Support** is under the chassis beams and the **Anchorage** comes from tie-down straps that either wrap around the roof of the unit or attach to the side wall of the unit, and then attach to concrete deadmen below grade for ballast.
- Question #45 and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

PART 3 - FINAL DESIGN PROCEDURE (Assembling, Chapter 6)	
42. What is the final bearing width? (Misc. Width 13)	13'-8" ☐
43. The bearing width is used in the foundation design tables. (Misc. 13 & 14) (Misc. 13 and 14)	14'-0" ☐
44. Where is the foundation incorporated into the design? Submitted by the owner and Foundation Design Consultant Approved by the contractor (foundation) shown on the Foundation Design Consultant's plan.	☐ Chain Bearing ☐ Foundation Wall ☐ Bridge Wall
45. Do these foundation walls have foundation contract design? Approved by the owner and foundation consultant (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15) (16) (17) (18) (19) (20) (21) (22) (23) (24) (25) (26) (27) (28) (29) (30) (31) (32) (33) (34) (35) (36) (37) (38) (39) (40) (41) (42) (43) (44) (45) (46) (47) (48) (49) (50) (51) (52) (53) (54) (55) (56) (57) (58) (59) (60) (61) (62) (63) (64) (65) (66) (67) (68) (69) (70) (71) (72) (73) (74) (75) (76) (77) (78) (79) (80) (81) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (98) (99) (100) (101) (102) (103) (104) (105) (106) (107) (108) (109) (110) (111) (112) (113) (114) (115) (116) (117) (118) (119) (120) (121) (122) (123) (124) (125) (126) (127) (128) (129) (130) (131) (132) (133) (134) (135) (136) (137) (138) (139) (140) (141) (142) (143) (144) (145) (146) (147) (148) (149) (150) (151) (152) (153) (154) (155) (156) (157) (158) (159) (160) (161) (162) (163) (164) (165) (166) (167) (168) (169) (170) (171) (172) (173) (174) (175) (176) (177) (178) (179) (180) (181) (182) (183) (184) (185) (186) (187) (188) (189) (190) (191) (192) (193) (194) (195) (196) (197) (198) (199) (200) (201) (202) (203) (204) (205) (206) (207) (208) (209) (210) (211) (212) (213) (214) (215) (216) (217) (218) (219) (220) (221) (222) (223) (224) (225) (226) (227) (228) (229) (230) (231) (232) (233) (234) (235) (236) (237) (238) (239) (240) (241) (242) (243) (244) (245) (246) (247) (248) (249) (250) (251) (252) (253) (254) (255) (256) (257) (258) (259) (260) (261) (262) (263) (264) (265) (266) (267) (268) (269) (270) (271) (272) (273) (274) (275) (276) (277) (278) (279) (280) (281) (282) (283) (284) (285) (286) (287) (288) (289) (290) (291) (292) (293) (294) (295) (296) (297) (298) (299) (300) (301) (302) (303) (304) (305) (306) (307) (308) (309) (310) (311) (312) (313) (314) (315) (316) (317) (318) (319) (320) (321) (322) (323) (324) (325) (326) (327) (328) (329) (330) (331) (332) (333) (334) (335) (336) (337) (338) (339) (340) (341) (342) (343) (344) (345) (346) (347) (348) (349) (350) (351) (352) (353) (354) (355) (356) (357) (358) (359) (360) (361) (362) (363) (364) (365) (366) (367) (368) (369) (370) (371) (372) (373) (374) (375) (376) (377) (378) (379) (380) (381) (382) (383) (384) (385) (386) (387) (388) (389) (390) (391) (392) (393) (394) (395) (396) (397) (398) (399) (400) (401) (402) (403) (404) (405) (406) (407) (408) (409) (410) (411) (412) (413) (414) (415) (416) (417) (418) (419) (420) (421) (422) (423) (424) (425) (426) (427) (428) (429) (430) (431) (432) (433) (434) (435) (436) (437) (438) (439) (440) (441) (442) (443) (444) (445) (446) (447) (448) (449) (450) (451) (452) (453) (454) (455) (456) (457) (458) (459) (460) (461) (462) (463) (464) (465) (466) (467) (468) (469) (470) (471) (472) (473) (474) (475) (476) (477) (478) (479) (480) (481) (482) (483) (484) (485) (486) (487) (488) (489) (490) (491) (492) (493) (494) (495) (496) (497) (498) (499) (500) (501) (502) (503) (504) (505) (506) (507) (508) (509) (510) (511) (512) (513) (514) (515) (516) (517) (518) (519) (520) (521) (522) (523) (524) (525) (526) (527) (528) (529) (530) (531) (532) (533) (534) (535) (536) (537) (538) (539) (540) (541) (542) (543) (544) (545) (546) (547) (548) (549) (550) (551) (552) (553) (554) (555) (556) (557) (558) (559) (560) (561) (562) (563) (564) (565) (566) (567) (568) (569) (570) (571) (572) (573) (574) (575) (576) (577) (578) (579) (580) (581) (582) (583) (584) (585) (586) (587) (588) (589) (590) (591) (592) (593) (594) (595) (596) (597) (598) (599) (600) (601) (602) (603) (604) (605) (606) (607) (608) (609) (610) (611) (612) (613) (614) (615) (616) (617) (618) (619) (620) (621) (622) (623) (624) (625) (626) (627) (628) (629) (630) (631) (632) (633) (634) (635) (636) (637) (638) (639) (640) (641) (642) (643) (644) (645) (646) (647) (648) (649) (650) (651) (652) (653) (654) (655) (656) (657) (658) (659) (660) (661) (662) (663) (664) (665) (666) (667) (668) (669) (670) (671) (672) (673) (674) (675) (676) (677) (678) (679) (680) (681) (682) (683) (684) (685) (686) (687) (688) (689) (690) (691) (692) (693) (694) (695) (696) (697) (698) (699) (700) (701) (702) (703) (704) (705) (706) (707) (708) (709) (710) (711) (712) (713) (714) (715) (716) (717) (718) (719) (720) (721) (722) (723) (724) (725) (726) (727) (728) (729) (730) (731) (732) (733) (734) (735) (736) (737) (738) (739) (740) (741) (742) (743) (744) (745) (746) (747) (748) (749) (750) (751) (752) (753) (754) (755) (756) (757) (758) (759) (760) (761) (762) (763) (764) (765) (766) (767) (768) (769) (770) (771) (772) (773) (774) (775) (776) (777) (778) (779) (780) (781) (782) (783) (784) (785)	

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.

Gravity Load Footing Size

Dead Load Summary (psf)				Live Load Summary (psf)			
Floor:	8.3	☐	Floor:	40	☐		
Roof:	6.2	☐	Roof:	15.0	☐		
Exterior Wall:	3.8	☐	Auto:	0	☐		
Interior:		☐					

Soil Condition:
 Net Allowable Soil Bearing Pressure: **1.000** ☐ ☐

	Net Soil/Wall (lb)	(ft)	Spacing (ft)	Spacing (ft)	Footing Width (ft)
Pier:	700.0	☐	7	☐	4.3
Exterior Wall:	425.0	☐			0"
Interior Wall:	588.0	☐			0"
Manhole/Utility Pier:	588.0	☐			0"

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

Appendix B

Required Footing Size

49. The required footing area for the foundation is found in the Required Footing Size table. 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.

The Required Footing Square Footing area is: **4.3** sq ft

Type B: sq ft

(width)

50. The Required Interior Footing area is: sq ft

(Also enter area for foundation type B)

51a. The Required Common Manhole Wall Footing area is: sq ft

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

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 (A_v) is less than the manufacturer's rated connection capacity for uplift and overturning. If the Required (A_v) 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 - A_h - 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 (A_h) = **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.

Transverse Sliding

Dead Load Summary (psf)

Floor	8.3	☐
Roof	6.2	☐
Exterior Wall	3.8	☐
Window		☐

Wind Load Summary (psf)

Transverse Direction	Pressure		☐
	+1.25	-1.25	
Windward Wall	23.6	18.2	☐
Leeward Wall	9.3	20.6	
Windward Roof	18.2	29.5	
Leeward Roof	15.2	25.5	

Seismic Load Summary (lbs)

Level	0	☐
Roof	244	☐
Floor	339	☐

Number of Transverse Lateral Resistance Locations:

Ah Required:

	Wind	Seismic	lbs/ft
End Wall	858	0	
Interior Wall	0	0	

- 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.

Horizontal Anchorage Requirements In The Transverse Direction 602.5

55a. What number of transverse foundation walls will be used? (602.5.6) If vertical X-bracing planes will be used, complete items 55a, 55b, and 55c first. Transverse walls and their spacing: ft

55b. Are diagonal ties used to complete the top of the transverse short wall for horizontal anchorage? (602.5.7)

55c. What is the tie rod or anchor diameter? in

56. What is the design strength, R_n, of the anchor? (602.5.8) lbs

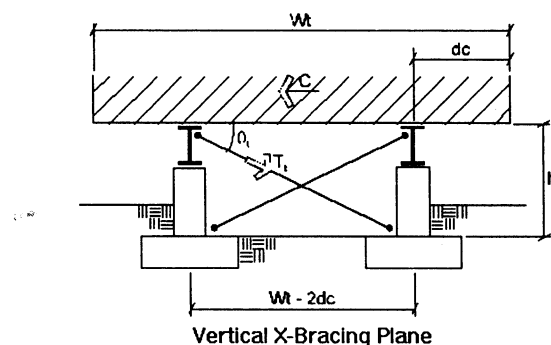
57. What is the manufacturer's specified rated allowable tensile capacity, T_a, of the anchor? lbs

58. What is the required anchorage, A_h, in lbs/ft? lbs/ft

59. Is the anchor OK for anchorage? (602.5.9)

- 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_i).

Figure 6-10



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

59. If using vertical X-bracing planes as lateral bracing for walls (and section 602.5.1.2.2), determine number of bracing planes for diagonal (If shear walls are subjected to lateral loads, use 1.5 times the value).

Longitudinal Sliding

a. Vertical X-bracing spacing proposed	55'-4"	ft
b. Number of vertical X-bracing planes proposed (Item 4) <i>See Note 10</i>	2	
c. Required horizontal anchorage (C) value based on formula (602.5.1.2.2)	23,177	lbs / brace set
d. Estimated height (h) in ft (602.5.1.2.2)	4.0	ft
e. Tension (T) in lbs (602.5.1.2.2)	26,856	lbs / brace
60. Wintered on wall (if wall is subjected to lateral loads, use 1.5 times the value) (602.5.1.2.2) <i>See Note 10</i>	5,600	lbs / brace
61. If value "c" is greater than 20,000 lbs	Yes No	
If yes, continue. If no, return to section 602.5.1.2.2		

Foundation Dimensions

Pier Spacing	5.53' ft	Transverse Lateral Resistance
☒ Use Marriage Wall Piers		Number of Locations
Tiedown Steps (C1)		Interior Type
Number	7	Spacing
Spacing	8'-8" ft	

Diagram showing foundation layout with dimensions:

- Overall width: 56'-0"
- Overall height: 11'-40"
- Left side dimensions: 2'-0" (top), 9'-10" (bottom), 5.53' (width)
- Right side dimensions: 8'-8" (width)

Buttons: Marriage Wall Pier Spacing, OK, Cancel, Help

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.

59. If using vertical X-bracing planes in lieu of transverse bracing walls (and the formulas in Section 507.5.2.1), determine the strap tensile force (B) in pounds (B).

Vertical X-bracing plane proposed:

60. Number of vertical X-bracing planes proposed (Item #12 Min. 4):

61. Strap tensile force (B) in pounds (B):

62. Strap tensile force (B) in pounds (B):

63. Strap tensile force (B) in pounds (B):

64. Strap tensile force (B) in pounds (B):

61a. Is value < 5600 lbs. (B)?

If yes, continue. If no, return to Section 507.5.2.1.

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.

Longitudinal Sliding

Dead Load Summary (psf)		Wind Load Summary (psf)	
Floor	8.3	Longitudinal Direction	0.25
Roof	6.2	Pressure	11.25
Exterior Wall	3.8	Windward Wall	29.5
Interior Wall		Leeward Wall	0.3
		Roof	15.2

Seismic Load Summary (lb)	
Level	1
Roof	21
Floor	59

All Required	
Exterior Wall	46
Wind	4
Seismic	10.0

OK Cancel Help

- 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:

Horizontal Anchorage Requirements in the Longitudinal Direction (602-6)

62a. What is the required horizontal anchorage force (lb) in the longitudinal direction (Appendix Part 6 (602-6.F))

Exterior Wall Ah: 46 lbs/ft

62b. From vertical X-bracing planes (and the formula given in 602-6.F) determine anchorage value for X-bracing planes (filling exterior long walls, skip to item 62c)

Number of chassis beam lines used for vertical X-bracing planes: 2

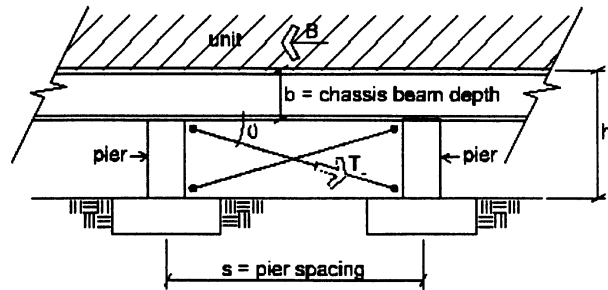
Number of X-bracing planes proposed under each chassis beam along the length of the unit: 2

2. Horizontal anchorage (B) required force, based on formula: 1,293 lbs

3. Limited load (1-5), based on Figure 6-11: 3

4. Section (1), based on formula (602-6.2)(5): 1,471 lbs

63. What is the manufacturer supplied value for horizontal anchorage? (#164 Mfg. Weibull): 4,800 lbs/ft



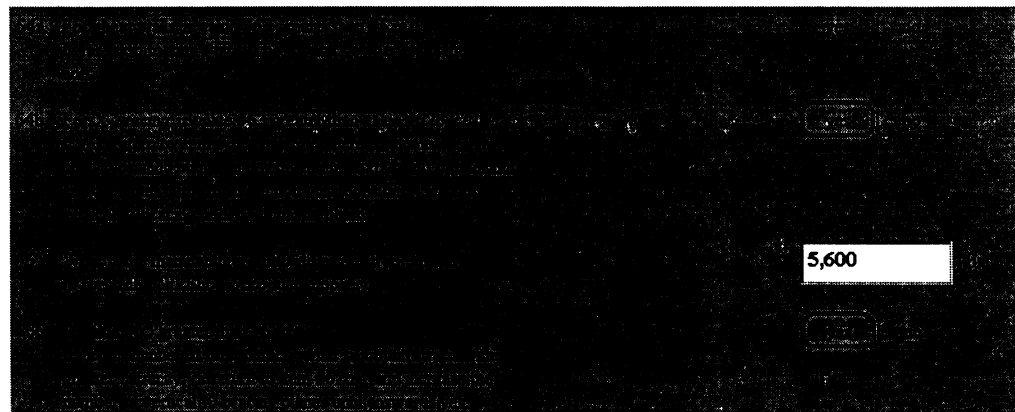
Longitudinal Direction

$$\cos \theta_1 = \frac{s}{\sqrt{(h-b)^2 + s^2}}$$

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_p) = **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 (A_v) = **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.

Withdrawal Resistance for Piers (Type C1 Concrete Deadman)

Exterior Grade: (ft)

Foundation Depth: (ft)

Deadman Side: (in)

Circle pier type:

1) Using Table C-2, which requires penetration required A_v (#52a and #52b) (0.13 x 2570)

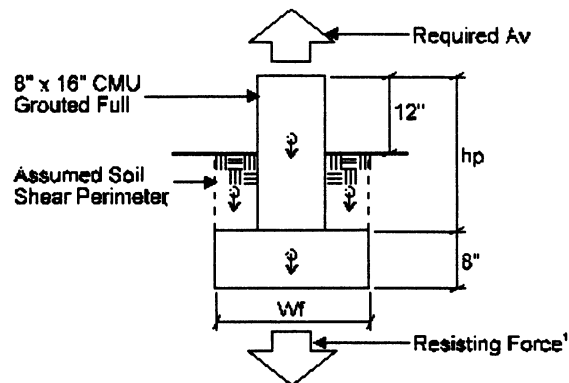
2) Using Table C-2, which requires the height of the pier footing for required withdrawal resistance (h_p + 8")

3) What is the required height of pier footing for frost protection? (frost depth (#9) + 12")

4) What is the greater height #57b, 2 or #57b, 3?

2,824	
40"	
40"	

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



<u>Hp</u>	<u>Width of Square Footing: Wf</u>			
<u>Depth</u>	<u>1'-0" (4)</u>	<u>2'-0"</u>	<u>3'-0"</u>	<u>4'-0" (4)</u>
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.

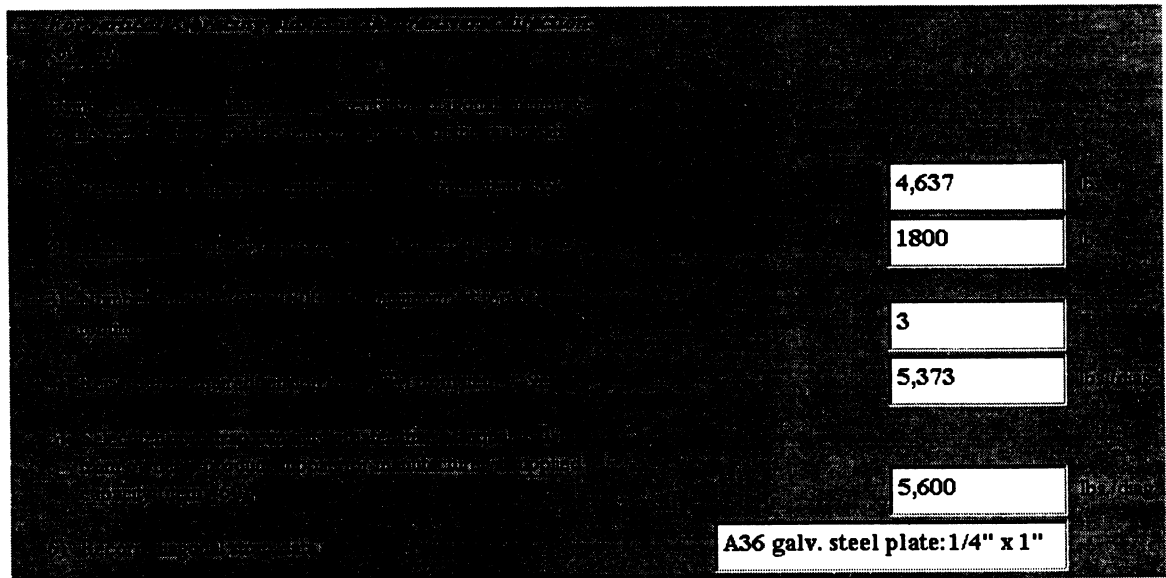
Vertical Anchorage and Reinforcement for Longitudinal Foundation Walls and Piers

- 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:



4,637
1800
3
5,373
5,600
A36 galv. steel plate: 1/4" x 1"

- 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.

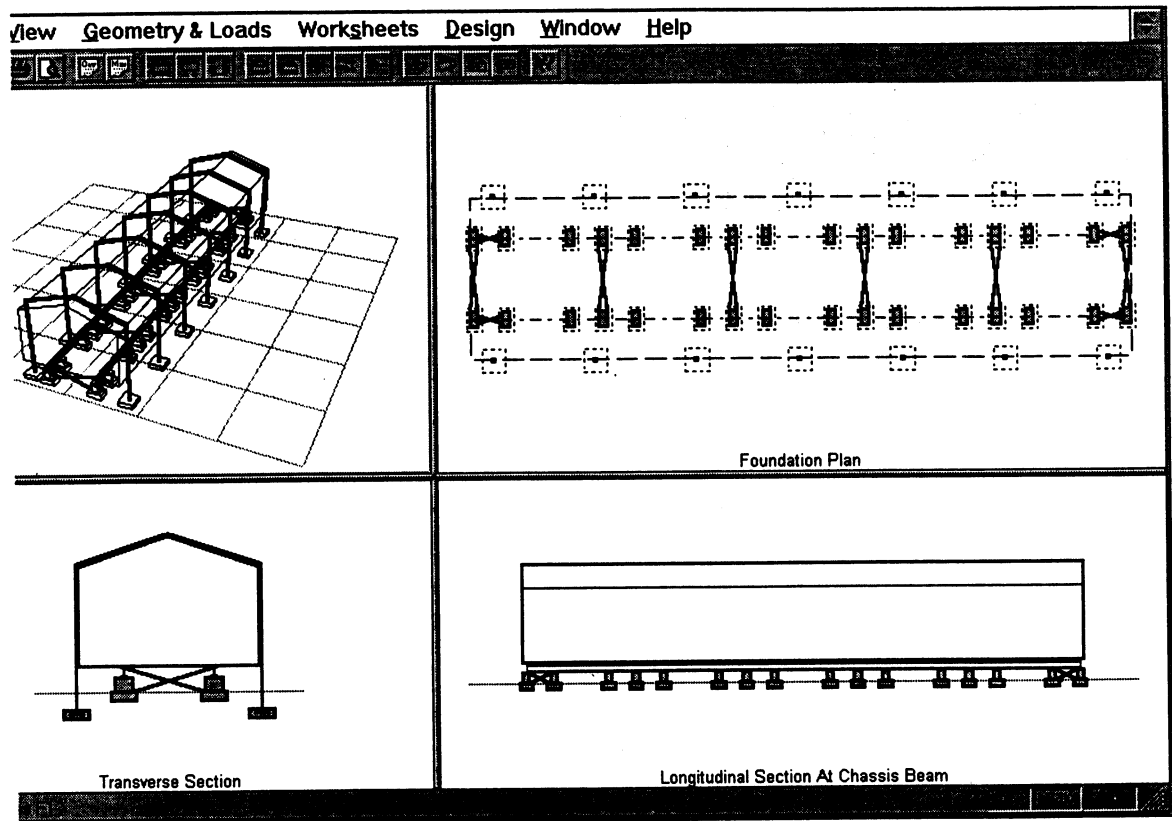
The screenshot shows a design worksheet with several input fields on the right side. The values entered are:

1,293
1800
1
1,471
5,600

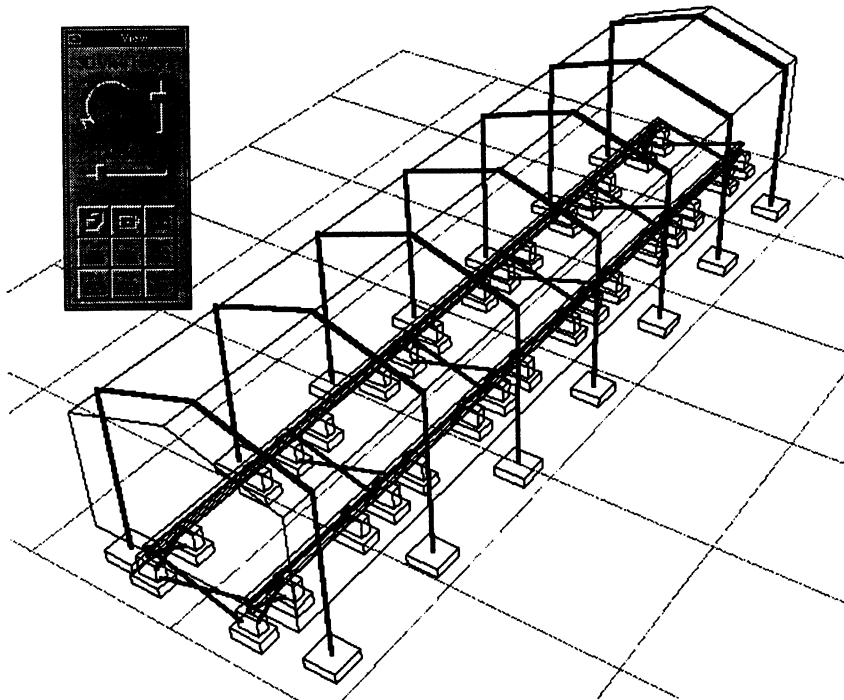
At the bottom right, there is a label: **36 Galv. Steel Plate: 1/4" x 1"**

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.



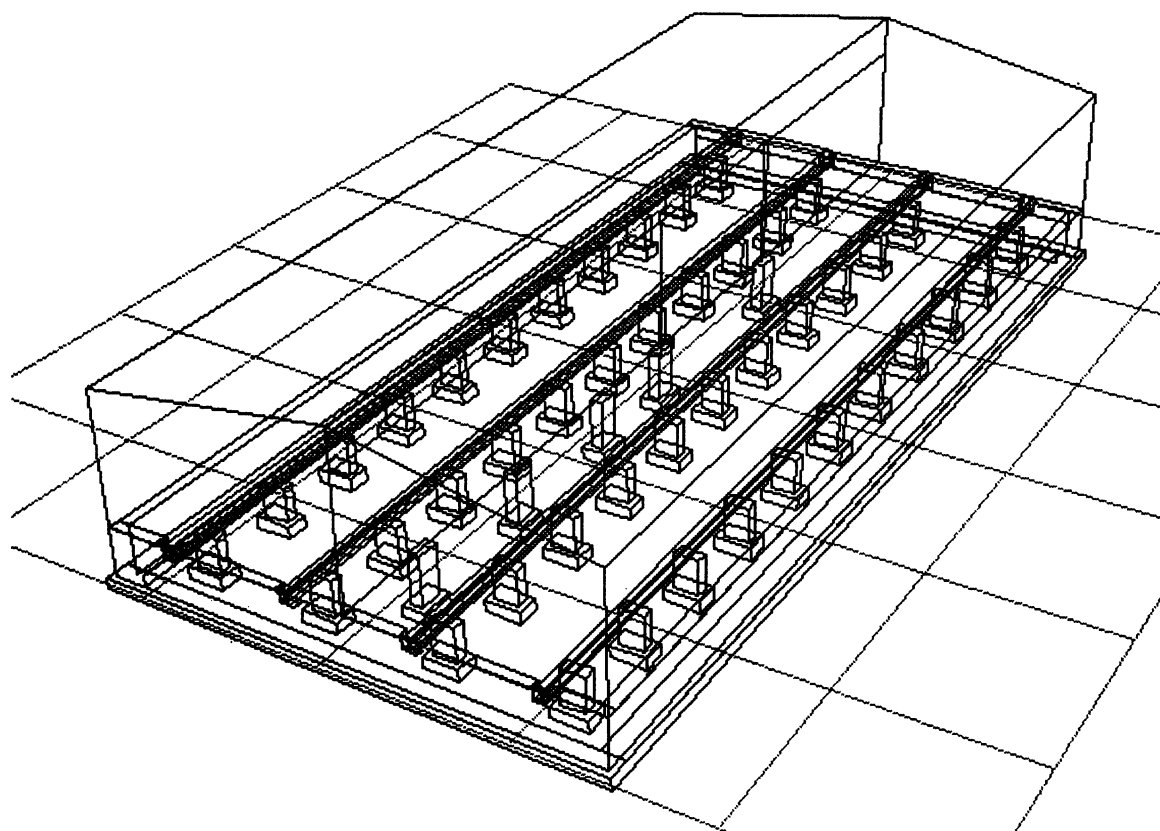
- Use the View Toolbar to manipulate the perspective view.

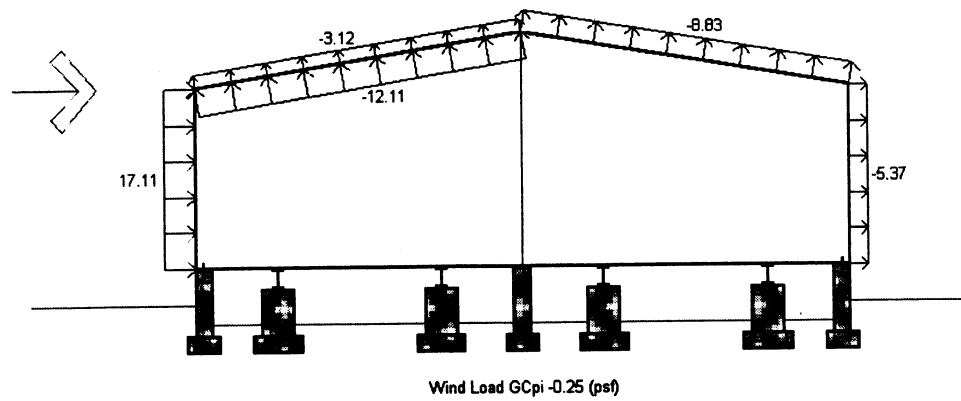


Appendix A

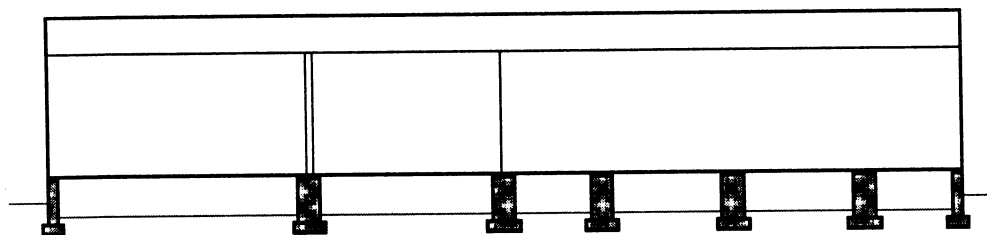
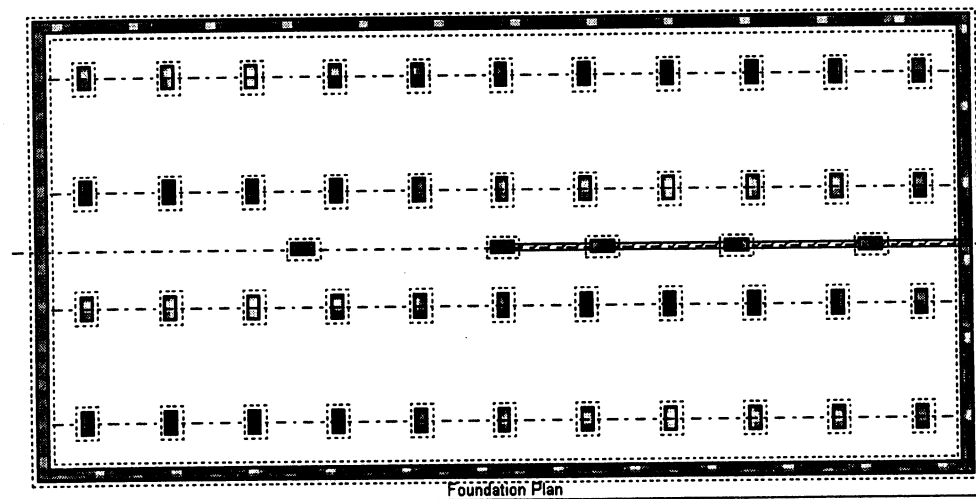
Example #1 - Foundation Concept Type E1

Multi-Section Unit





Transverse Section



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: Champaign, IL

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) N.A. ft.

2. Is the building in a flood-prone area? (201-2)

If the answer to 2 is Yes, answer 3, 4, & 5.

If the answer to 2 is No, answer 6, below.

yes no

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?
(Permits must be obtained for any alteration of the building site in a flood protection area.)

yes no

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:

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

11. Recommended pier spacing **

a. Exterior	<u>5'-0"</u>	ft.
b. Interior	<u>5'-0"</u>	ft.
c. Continuous Marriage Wall	<u>8'-0"</u>	ft.
Length of largest isolated marriage wall opening or average of largest two adjacent openings	<u>14'-0"</u>	ft.
d. Tie-down Strap (C1 concept only)	<u>(Number)</u>	<u>(Spacing)</u> 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?
(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?

N.A. 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.)
5. What is the Base Flood Elevation or the Flood Protection Elevation (use highest value)?
6. Is the site to be graded, filled, or bermed?
(If no, skip to 9.)
7. If yes to 6, have all permits been provided?
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

_____ ft.

yes ☐ no

yes ☐ no

yes ☐ no

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)
(If no, one must be provided for subdivision)
17. Grading plan provided? (302)
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.)
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.)

☒ yes ☐ no

☒ yes ☐ no

☐ yes ☒ no

_____ *

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)
21. What is the building self weight (W)?
(Mfg. Wksht. #8)
22. What is the building length (L)?
(Mfg. Wksht. #3)
23. What is the distributed weight per foot of unit length? ($w=W/L$)
(402-B, C)
24. What is the building type?
(Mfg. Wksht. #2)

☒ yes ☐ no

38,525 lbs.

56'-0" ft.

688 lbs./ft.

☐ 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)
26. What is the heavy dead load value from Table 4-1?
(402-1.A.2)
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.)

560 *
(lbs./ft.)

805 *
(lbs./ft.)

☒ 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.)
- 28b. What is 0.7 multiplied by Pg?
- 29a. What is the roof slope? (Mfg. Wksht. #7)
- 29b. What is the minimum roof live load for the roof slope?
(D-200.2.B)
30. Record the larger magnitude of item 28b or item 29b. Use this magnitude for roof load where required.

20 *
(lbs./sq.ft.)

14.0 psf.

2 in 12

20.0 psf.

20.0 psf.

Wind Load (402-3)

- 31a. What is the basic wind speed (V)?
(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)
32. Is the site inland or coastal? (402-3.B)
(If inland, skip to question #38.)
33. If a coastal area, has the manufacturer provided connection details? (402-3.D) (Mfg. Wksht. #12)

70 mph

80 mph

☒ Inland
☐ Coastal

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: 14'-0" ft.
(600-2.A and Figure 6-1)

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: 2.0 sq.ft.
(Also exterior piers for foundation type E)

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? Exterior 200 *
(#16b, Mfg. WkSht.) 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)

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.

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

ft.

	trial 1	trial 2	trial 3	
56. Using the tables, find the Required Horizontal Anchorage (Ah). (Appendix B; Part 3)	267			lbs./ft.
End Wall Ah				
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./str
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 _i). (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.)

1. Number of chassis beam lines used for vertical X-bracing planes.

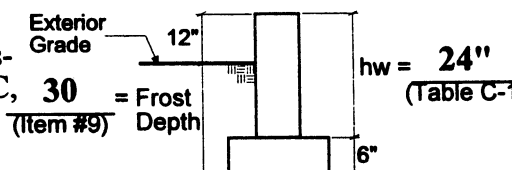
trial 1	trial 2	trial 3
2 or 4	2 or 4	2 or 4

	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 A_v ? (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? ($h_w + 6''$)

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.

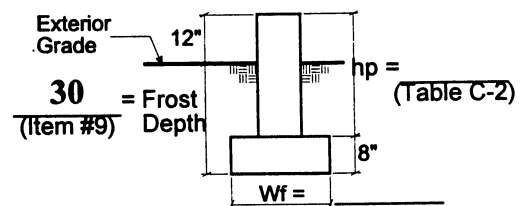
- 7) Is item #67a.6 greater than or equal to item #49?
If yes, continue. If no, change footing width to item #49.

☒ 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

	<u>Exterior</u>	<u>Interior</u> (when used)	
1) Using Table C-2, which capacity is greater than required A_v ? (#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 A_v ? (#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 A_v ? (#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 A_v ?
(From #52a, Design Wksht.)

_____ lbs./pier

	<u>Exterior</u>	<u>Interior</u>
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.

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

	<u>End Wall</u>	<u>Interior Wall</u>
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.

	<u>End</u>	<u>Interior</u>
1) Record the required horizontal force ($A_h \times W_t$) 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.	<u>1800</u>	<u>1800</u> lbs.
3) Number of bolts ($A_h \times W_t \div 1800$; 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.	<u>1800</u>	lbs.

- | | | |
|---|-------|--------|
| 3) Number of bolts ($C \div 1800$; 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 A_h ? (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 ($B \div 1800$; 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				
	Exterior	Interior	Marriage Wall 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.

	<u>Piers</u>				
	<u>Exterior</u>	<u>Interior</u>	<u>Marriage Wall Cont.</u>	<u>At Post</u>	
<u>Pier Footing Sizes</u> (largest of above)		<u>2.0</u>	<u>5.7</u>	<u>9.1</u>	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.)

	<u>Exterior</u>	<u>Interior</u>	
Number of anchor bolts			
Anchor bolt diameter			
Rebar size			
Lap splice			
Rebar hook length			
	<u>Exterior</u>	<u>Interior</u>	<u>Marriage Wall</u>
Footing depth: grade to bottom of footing			<u>30</u> sq.ft.
Pier footing and "dead-man" footing reinforcing bars:			<u>#4 at 10" o.c.</u>
"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.

	<u>End Wall</u>	<u>Interior Wall</u>	
Anchor bolt spacing	<u>72" o.c.</u>	<u> </u>	in
Rebar size	<u>#4</u>	<u> </u>	
Lap splice	<u>16"</u>	<u> </u>	in
Rebar hook length	<u>6"</u>	<u> </u>	in
<u>From #69a.2: wood:</u>			
Required nailing	<u> </u>	<u> </u>	
Minimum plywood nailer	<u> </u>	<u> </u>	
Anchor bolt diameter	<u> </u>	<u> </u>	
Anchor bolt spacing	<u> </u>	<u> </u>	
2. <i>For transverse short foundation walls completed with diagonal braces (#69b)</i>			
	<u>End</u>	<u>Interior</u>	
Number of pairs of diagonals (1 for single-section units, 2 for multi-section units) times number of short walls (end or interior) (#55a)	<u> </u>	<u> </u>	
Diagonal spacing (same as number of short walls)	<u> </u>	<u> </u>	
<u>From #69b: concrete / masonry:</u>			
Anchor bolt diameter	<u> </u>	<u> </u>	in
Number of bolts	<u> </u>	<u> </u>	
Rebar size	<u> </u>	<u> </u>	
Lap splice	<u> </u>	<u> </u>	i
Rebar hook length	<u> </u>	<u> </u>	i
3. <i>For vertical X-bracing planes in lieu of short walls. (#69c)</i>			
Number of X-brace locations (#59)		<u> </u>	

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.

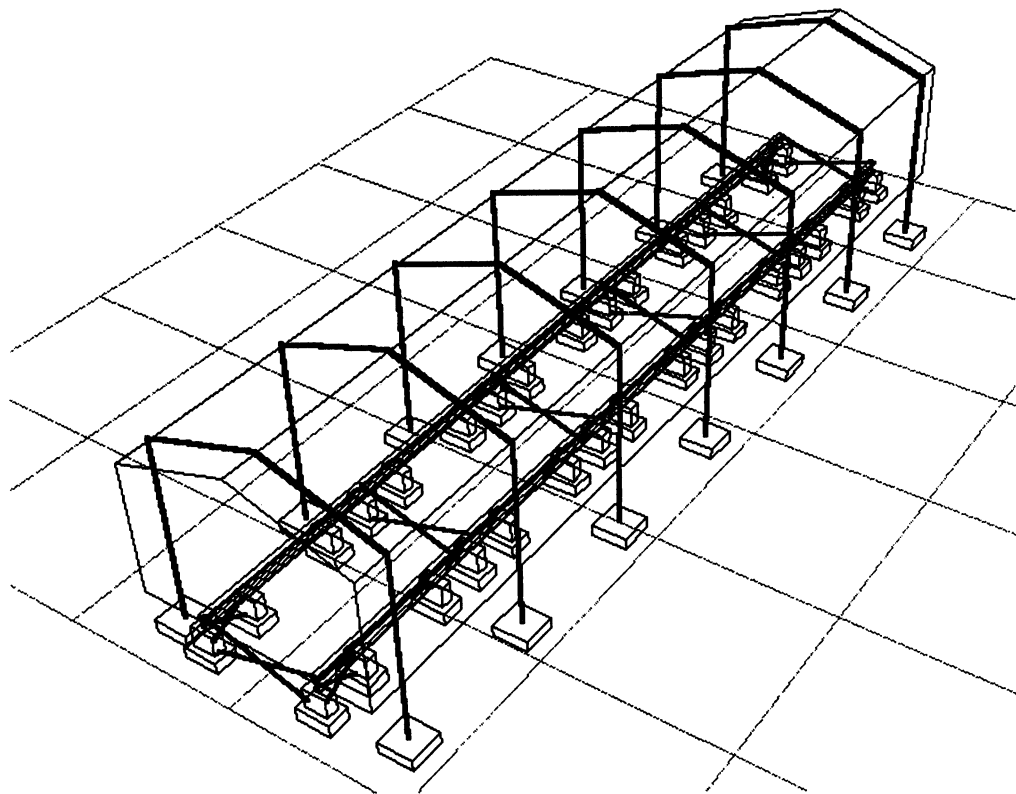
☐ **APPROVE**

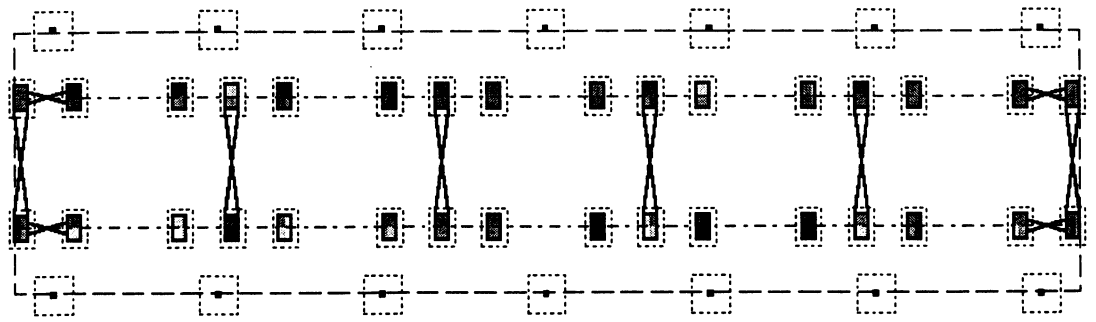
☐ **DISAPPROVE**

Appendix B

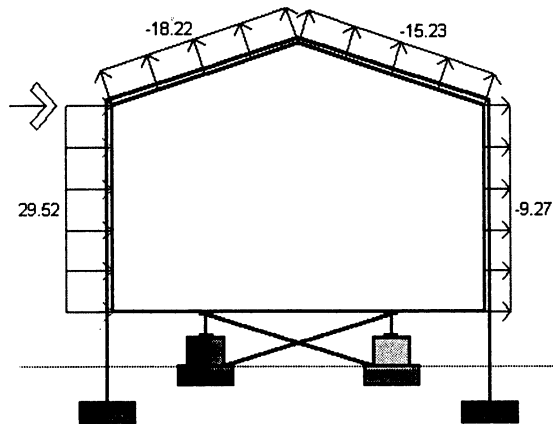
Example #2 - Foundation Concept Type C1

Single-Section Unit



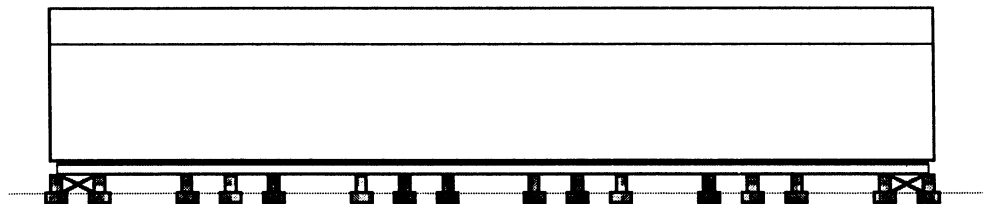


Foundation Plan



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?
 (Permits must be obtained for any alteration of the building site in a flood protection area.) yes no
6. Provide geotechnical report in areas of known high water table. (201-4) yes
7. Provide geotechnical report if adverse site conditions are found or suspected. (203) yes
8. Provide site-drainage plan complying with CABO R301.3 or local requirements. (301) no
9. Provide fill specifications if site is to be prepared with earth fill. (303-2) yes
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. 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" ft.
(Spacing)

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.)
5. What is the Base Flood Elevation or the Flood Protection Elevation (use highest value)?
6. Is the site to be graded, filled, or bermed?
(If no, skip to 9.)
7. If yes to 6, have all permits been provided?
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

_____ ft.

yes ☐ no

yes ☐ no

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) *
26. What is the heavy dead load value from Table 4-1?
(402-1.A.2) *
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)?
(See Ground Snow Load map, pages H-11, H-12 and H-13.) 0 *
- 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)?
(See Wind Speed map, page H-14.) 100 mph.
- 31b. If V is less than 80 mph, record MPS min. 80 mph for wind de-
sign. (402-3.A) 100 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 de-
tails? (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? ☐ yes ☐ no
(If no, proceed. If yes, seismic need not be considered, skip questions 39 to 41.)
39. Seismic performance category. B
(See H-300 for Special Requirements of Foundation Design.)
40. What is the applicant's proposed design concept? C1 *
41. Do the Foundation Design Concept Tables approve the foundation system for use in seismic areas of Question #38 above? ☐ yes ☐ no
(See Appendix A)
(If yes, proceed. If no, return to applicant for foundation design choice more suited to high seismic areas.)

PART 4: FINAL DESIGN PROCEDURE (Accompanies Chapter 6)

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

43. The nominal building width to be used in the Foundation Design Tables, (Aftg, Av & Ah) is Wt: 14'-0" ft.
(600-2.A and Figure 6-1)
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? yes no
(If yes, proceed. If no, return to Owner for clarification.)
46. Is Vertical Anchorage present? yes no
(601-2.B, 601-3.B & 601-4.B (Figures 6-7 & 6-8); Mfg. Wksht. #12 & #16)

APPENDIX A

47. What is the basic system type? C1 *
(From Part 3: #24; Mfg. Wksht. #2)
48. What is the spacing between piers? Exterior: 5.53'
(Mfg. Wksht. #11) Interior: 5.53'
(602-2)
- 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: _____ sq.ft.
(Also exterior piers for foundation type E)
- 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? Exterior 3,150 *
(#16b, Mfg. WkSht.) Interior _____ *
54. Is this value (#53) greater than the value given in #52a? ☒ yes ☐ no
(If yes, continue. If no, return to owner for clarification.)

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

- 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.

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

	trial 1	trial 2	trial 3	
56. Using the tables, find the Required Horizontal Anchorage (Ah). (Appendix B; Part 3)	858			End Wall Ah 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./ft
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 _i). (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.)

- Number of chassis beam lines used for vertical X-bracing planes.

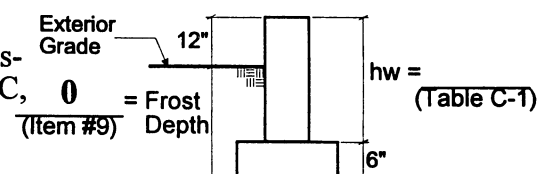
trial 1	trial 2	trial 3
☒ 2 or 4	2 or 4	2 or 4

	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 A_v ? (603-2.B.(1)) (#52a)

_____ lbs./ft.

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

_____ 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.

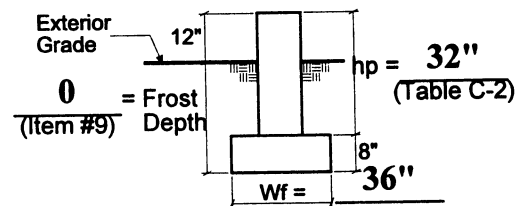
- 7) Is item #67a.6 greater than or equal to item #49?
If yes, continue. If no, change footing width to item #49.

yes no

- 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

	<u>Exterior</u>	<u>Interior</u> (when used)	
1) Using Table C-2, which capacity is greater than required A_v ? (#52a and #52c) (603-2.B.(2))	<u>2,824</u>	<u> </u>	lbs./pi
2) Using Table C-2, what is the height of the pier + footing for required withdrawal resistance? (hp + 8")	<u>40"</u>	<u> </u>	in. *
3) What is the required height of pier + footing for frost protection? (frost depth (#9) + 12")	<u> </u>	<u> </u>	in.
4) What is the greatest height #67b.2 or #67b.3?	<u>40"</u>	<u> </u>	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")	<u> </u>	<u> </u>	in.
6) Using Table C-2, what is the required width of the square footing if withdrawal resistance controls or if frost depth controls?	<u>36"</u>	<u> </u>	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)		<u>0</u>	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 A_v ? (#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 A_v ? (#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 A_v ?
(From #52a, Design Wksht.)

		lbs./pie
--	--	----------

	<u>Exterior</u>	<u>Interior</u>
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.

	<u>End Wall</u>	<u>Interior Wall</u>
a. <i>For continuous foundations.</i>		
Using Table C-5A (concrete & masonry) or C-5B (wood), which capacity is greater than the required (Ah) (603-3) (item #56)?	_____	_____ lbs./l
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	_____	_____ *

	<u>End Wall</u>	<u>Interior Wall</u>	
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.

	<u>End</u>	<u>Interior</u>	
1) Record the required horizontal force ($A_h \times W_t$) 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.	<u>1800</u>	<u>1800</u>	lbs.
3) Number of bolts ($A_h \times W_t \div 1800$; 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.	<u>4,637</u>	lbs.
2) Table C-5A capacity for one 1/2" diameter bolt at 12" o.c.	<u>1800</u>	lbs.

- | | | |
|---|--------------------------------------|----------|
| 3) Number of bolts ($C \div 1800$; one minimum) at top of a footing. | <u>3</u> | * |
| 4) Record the required tension force (T_t) from item #59e. | <u>5,373</u> | 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). | <u>5,600</u> | 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 A_h ? (602-6.E) (item #62a)

- | | | |
|----------------------------------|-------------------|----------|
| | <u> </u> | lbs./ft. |
| 1) Using Table C-5A, find: | | |
| a) Required anchor bolt diameter | <u> </u> | in. |
| b) Required anchor bolt spacing | <u> </u> | in. |
| c) Using Table C-3A: | | |
| (1) Rebar size | <u> </u> | * |
| (2) Lap splice | <u> </u> | in. |
| (3) Rebar hook length | <u> </u> | in. |
| 2) Using Table C-5B, find: | | |
| a) Required nailing | <u> </u> | * |
| b) Minimum plywood thickness | <u> </u> | in. |
| c) Required anchor bolt diameter | <u> </u> | in. |
| d) Required anchor bolt spacing | <u> </u> | 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. | <u>1,293</u> | lbs. |
| 2) Table C-5A capacity for one 1/2" diameter bolt at 12" o.c. | <u>1800</u> | lbs. |
| 3) Number of bolts ($B \div 1800$; one minimum) | <u>1</u> | * |
| 4) Record the required tension force (T_L) from item #62b.4. | <u>1,471</u> | 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). | <u>5,600</u> | 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			
	Exterior	Interior	Marriage Wall Cont.	At Post
Required Effective Footing Area from questions #49, #50, & #51.	<u>3.6</u>			
				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)	<u>9.0</u>			
				sq.ft.

	Piers			
	Exterior	Interior	Marriage Wall Cont.	At Post
<u>Pier Footing Sizes</u> (largest of above)	<u>3.6</u>	_____	_____	_____ sq.ft.
“Dead-man” footing size.	<u>9.0</u>	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:			<u>#4 at 10" o.c.</u>
“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.

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

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

	<u>End</u>	<u>Interior</u>	
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)	_____	_____	
<u>From #69b: concrete / masonry:</u>			
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)	<u>6</u>
-----------------------------------	----------

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

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