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## Permanent Foundations Guide for Manufactured Housing

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## Permanent Foundations Guide for Manufactured Housing

Prepared for: U.S. Department of Housing and Urban Development Office of Policy Development and Research

Prepared by: School of Architecture / Building Research Council University of Illinois at Urbana-Champaign Champaign, Illinois

September 1996



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### Foreword

*Permanent Foundations Guide for Manufactured Housing* is an update and revision of the 1989 handbook. Its current technical information, recommendations, and tables of analytical data will meet the support and anchorage requirements for foundations that are necessary to minimize manufactured home damage during high winds or earthquakes.

Whereas wind alone governed the information on overturning and sliding in the 1989 handbook, stringent seismic criteria now make it necessary to review both forces in order to determine which should control the foundation design. To account for this significant issue, the tables have been modified to include seismic data and highlight those values controlled by seismic considerations. In addition, the need to address current architectural preferences for open space required that the guide discuss large "marriage wall" openings for multi-section units. To make the Guide easier to comprehend, there has been a significant increase in the number of illustrations and clarification of the accompanying text.

Although many pages have been added, the *Permanent Foundation Guide* is a logically organized easy-to-use reference for the permanent foundation process and for the design of anchorages that will assure adequate structural performance for manufactured homes. There is also companion computer software and its guide available.

The *Permanent Foundation Guide* will be extremely useful to all who are involved in the approval of mortgage insurance for manufactured homes on permanent foundations: engineers, manufacturers, HUD Field Office Staff, and site owners.

Michael A. Stegman Assistant Secretary for Policy Development and Research

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### Ordering Information for the PERMANENT FOUNDATIONS GUIDE FOR MANUFACTURED HOUSING

Additional copies of the *Permanent Foundations Guide for Manufactured Housing* and the *Software User's Guide* and software can be downloaded from the Word Wide Web at <a href="http://www.huduser.org/publications/destech/permfound.html">http://www.huduser.org/publications/destech/permfound.html</a>

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### **Executive Summary**

- This Handbook updates and revises the <u>Permanent Foundation Guide for</u> Manufactured Housing :Handbook 4930.3, August, 1989. This work was commissioned by the U.S. Department of Housing and Urban Development, Office of Policy Development and Research. The Handbook has received a critical review and has been somewhat reorganized and supplemented with additional graphics to simplify its application. The major revisions include:
- The definition of Permanent Foundation has been expanded and clarified in Chapter 1.
- Design loads have been updated to the current loading requirements for snow, wind and seismic forces of the <u>Minimum Design Loads for Buildings and Other</u> Structures, ASCE 7-93 Edition. The load maps of Appendix H have been replaced by the new maps in ASCE 7-93.
- The Seismic portion of the Handbook, which showed no influence over wind in the previous code, has now become a significant factor in the ASCE 7-93 for consideration of overturning and sliding. Thus, the Tables of Appendix B have required reorganization and expansion. Seismic table values are grayed over to indicate that seismic controls over wind for the parameters of a given Table.
- All of the Foundation Concepts, except Type E2, have been retained in this updated edition. A survey was sent to all HUD field offices which substantiated this decision. Appendix D has been expanded to include sample formula derivations for all of these Foundation Concepts; this includes text and graphics for all single-section and multi-section units for added clarity.
- Appendix A Foundation Concept Details have been redrawn and revised to reflect the new ASCE 7-93 Loads document and their relationship to Appendix B Tables.
- This update now includes consideration of large openings along the length of marriage walls in multi-section units. Appendix B Tables includes openings that range from 10 to 20 feet in 2 foot increments.

Although many pages have been added, the Handbook has become a logically organized and easy to use reference in the permanent foundation selection process and in the anchorage design to assure adequate structural performance for Manufactured Homes.

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### Acknowledgments

This Handbook was prepared by the Building Research Council of the School of Architecture at the University of Illinois at Urbana/Champaign under contract to the Division of Program Monitoring and Research of the U.S. Department of Housing and Urban Development. Special thanks are extended to William E. Freeborne, the Government Technical Monitor for providing experience and counsel on the manufactured housing industry, for enthusiastic support of our contract proposals, for review and comments on drafts of the handbook, and for guidance and coordination for all meetings with the various housing organizations in Washington D.C.

Special thanks also goes to Smbat Hacopian, senior structural engineer of HUD's Manufactured Housing and Construction Standards Division for providing guidance and review of the draft handbook at various stages of its development, providing examples of foundations submitted by manufacturers for permanent foundation consideration, and providing insights on the Minimum Property Standards requirements that influenced the Handbook.

Special appreciation goes to Richard Mendlen, senior structural engineer at HUD for meticulously reviewing the Handbook drafts for correct phraseology, checking the charts and tables for numerical accuracy, and for spending many hours discussing current manufactured housing floor plans related to marriage wall openings.

Thanks also goes to individuals from other organizations for attending meetings and contributing suggestions for incorporation in the handbook:

Ashok Goswami<br/>Paul HancherHousing and Building Technology, Division of NCSBCS<br/>National Conference of States on Building Codes & Standards<br/>National Conference of States on Building Codes & Standards<br/>Housing and Building Technology, Division of NCSBCS<br/>Housing and Building Technology, Division of NCSBCS<br/>National Institute of Standards & Technology<br/>Frank Walter<br/>Michael WernerAshok Goswami<br/>Paul Hancher<br/>Housing and Building Technology, Division of NCSBCS<br/>National Institute of Standards & Technology<br/>Housing and Building Technology, Division of NCSBCS

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## **INTRODUCTORY COMMENTS**

### Preface

This Handbook is a guide for those approving manufactured homes on permanent foundations -- HUD Field Offices involved in the approval process and manufacturers and site owners who are seeking approval.

There are two acceptable methods for owners or developers to use in seeking HUD Approval: (1) Furnish foundation drawings anddesign calculations prepared and sealed by a licensed professional for foundation concepts shown in Appendix A and other foundation concepts not covered in the Handbook. The design criteria and requirements of Chapters 1-7 of the Handbook shall be followed in Method (1) and does not require the submittal of Appendix F (Appendix F instructions in paragraph 103 do not apply to Method 1.) Or (2) Furnish the Design Worksheet (Appendix F) prepared by a licensed professional in accordance with the Handbook. Method (2) does not require design calculations. Methods (1) & (2) both require submittals of Appendix E. See Table i - 1 on page ii.

The Foundation Concepts (Appendix A) are considered permanent foundations. Permanent foundations are those that have been engineered for safety and long-term satisfactory performance. These foundations were also designed specifically for use with manufactured homes. The Handbook contains construction recommendations that assure the home, the foundation and the site are all compatible. Because these recommendations are based on estimated conditions, it is important to have complete information for each manufactured home and its site.

### **Manufacturer-Supplied Information**

Information about the home must be provided by the manufacturer. To simplify the approval process, the manufacturer may wish to prepare a Manufacturer's Worksheet for each standard foundation system. The Manufacturer's Worksheet is in Appendix E.

### **Owner-Supplied Information**

Information about the building site must be provided by the owner. The size of the foundation, the depth of the footings, and the anchorage requirements depends on the building's site. This information should be submitted on the Owner's Site Acceptance Worksheet (Appendix E).

### Handbook: Site Conditions

Chapters 2 and 3 of the Handbook contain recommendations for site preparation. They also point out unusual site conditions that may call for additional geotechnical engineering reports, such as sloping sites and problem soils. This documentation must also be submitted if problem sites are found.

#### Handbook: Foundation Design Concepts

Companies building manufactured homes have assisted in the preparation of this handbook by providing foundation design concepts appropriate for manufactured housing. This information was assembled and used as the basis for the Foundation Design Concepts in Appendix A.

The Handbook provides information about three basic foundation types and six al-Appendix A shows which ternative types. foundation designs can be used on sites with special requirements, such as windy sites.

### Handbook: Design Verification

The Handbook's format is arranged for a licensed professional to progress through a se-

ries of logical steps designated to lead to approval. The HUD Field Office at their prerogative may review the Design Worksheet.

Technical assistance to determine acceptability of individual designs of permanent foundation systems should be obtained from a licensed professional engineer.

TITLE	Method (1)	Method (2)
Foundation Drawings (Prepared & Sealed by Licensed Professional)	Yes	No
Design Calculations (Prepared & Sealed by Licensed Professional)	Yes	No
Design Criteria Chapters 1-7	Yes	Yes
Appendix A - Foundation Concepts	Yes	Yes
Other Foundation Concepts	Yes	No
Appendix E (Owner's Site Acceptability & Manufacturer's Worksheets)	Yes	Yes
Appendix F Design Worksheet (Prepared & Sealed by Licensed Professional)	No	Yes

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# LIST OF ACRONYMS

	ANSIAmerican National Standards Institute
	APAAmerican Plywood Association
	ASCEAmerican Society of Civil Engineers
	ASTMAmerican Society of Testing Materials
	BOCABuilding Officials and Code Adminis-
	trators International
	CABOCouncil of American Building Offi-
	cials
	ELFEquivalent Lateral Force
ć	FEMAFederal Emergency Management
	Agency
	HUDU.S. Department of Housing and
	Urban Development

ICBO ......International Conference of Building Officials

RUNY	INIS
MHCSS.	Manufactured Home Construction and Safety Standards
MPS	Minimum Property Standards
	National Bureau of Standards Institute for Research
NCSBCS.	National Conference of States on
	Building Codes and Standards, Inc.
NEHRP	National Earthquake Hazard Reduction
· • • • · · ·	Program
NIST	. National Institute of Standards and
	Technology
SBCCI	. Southern Building Code Congress
	International
	the second se

### **CHAPTER 1 - GENERAL INFORMATION**

### 100. APPLICATION

100-1. GENERAL. Manufactured homes, as addressed by this handbook, are manufactured in accordance with 24 CFR Chapter XX, Part 3280, Manufactured Home Construction and Safety Standards (MHCSS), and are sited on a permanent foundation in accordance with Handbook 4145.1, REV-2, Change 1, Feb. 14, 1992, Architectural Processing and Inspections for Home Mortgage Insurance, paragraph 3-4.

A. Description of Manufactured Unit. Designs and approval for foundations in this manual are based on the following assumptions about the manufactured home:

- 1. Transportable in one or more sections.
- 2. Between 11'-4" and 16'-0" in width in transport mode.

3. Minimum 400 sf. in area for a single section unit.

- 4. Exterior wall height of 7'-6" or 8'-0" from top of wall to foundation.
- 5. Built on permanent chassis with minimum distance between main chassis beams of:

Mfg. Home Width	Beam Spacing
12' nom.	6'-3"
14' nom.	6'-10"
16' nom.	8'-0"

Note: Smaller beam spacing will require design by a professional engineer.

- Chassis beams 10" deep for 12' and 14' nominal unit widths, and 12" deep for 16' nominal unit width.
- 7. Roof slope varies from a minimum 1/2:12 to a maximum 4.4:12 (20°).
- Set on permanent foundation of piers, or of continuous, cast-in-place concrete, concrete-block masonry, all-weather wood, or other approved systems.
- 9. Double width units are assumed connected to behave structurally as a single box.

**B.** Chassis Removal. The chassis of a manufactured home, under the *Federal Manufactured Housing and Construction safety Standards*, is not permitted to be removed. Accordingly, foundations in this manual are designed for manufactured homes that DO NOT HAVE THEIR CHASSIS REMOVED.

C. Definition of Permanent Foundation. Permanent foundations must be constructed of durable materials; i.e. concrete, mortared masonry, or treated wood - and be site-built. It shall have attachment points to anchor and stabilize the manufactured home to transfer all loads, herein defined, to the underlying soil or rock. The permanent foundations shall be structurally developed in accordance with this document or be structurally designed by a licensed professional engineer for the following:

1. Vertical stability:

- a. Rated anchorage capacity to prevent uplift and overturning due to wind or seismic forces, whichever controls. Screw-in soil anchors are <u>not</u> considered a permanent anchorage.
- b. Footing size to prevent overloading the soil-bearing capacity and avoids soil settlement.
   Footing shall be reinforced concrete to be considered permanent.
- c. Base of footing below maximum frost-penetration depth.
- d. Encloses a basement of crawl space with a continuous wall (whether bearing or nonbearing) that separates the basement of crawl space from the backfill, and keeps out vermin and water.
- 2. Lateral stability. Rated anchorage capacity to prevent sliding due to wind or seismic forces, whichever controls, in the transverse and longitudinal directions.

100-2. DEFINITIONS. These are terms used throughout the Handbook and the Design Worksheet. Additional terms are used in Appendix D, where the derivation of equations is shown. These terms are defined in Appendix D, and illustrated in Figure 6-2.

Anchorage: Connection between superstructure and foundation, by means of welds, bolts, and various light gage metal plates. Anchorage does not refer to any type of soil anchor. *Chassis:* The structural system running beneath the manufactured home. Example: Pair of steel beams.

*Exterior Foundation Wall:* Foundation walls placed directly below the exterior perimeter walls of the unit. These walls may, or may not, be structurally used as bearing walls under gravity loads, and/or used as shear walls under horizontal loads. If these walls are not used structurally they are called non-bearing walls or skirt walls:

*Exterior Piers:* Piers inside the exterior walls, needed to support the chassis beams nearest the longitudinal foundation walls.

#### Foundation Types:

*Type C:* Foundation system supported and anchored at chassis only, to equally spaced piers.

*Type E:* Foundation system supported at chassis and exterior wall but anchored for uplift and overturning at exterior wall only.

*Type I:* Foundation system supported at chassis and exterior wall but anchored for uplift and overturning at exterior piers only.

Interior Piers: Piers nearest the marriage wall and supporting the chassis in multisection units.

Longitudinal Foundation Walls: Two walls beneath the long dimension of the unit (in its transport mode) which are structurally used as foundation shear walls that resist applied wind or seismic forces from the superstructure's shear walls in the longitudinal direction. **Longitudinal Direction:** Direction of horizontal wind or seismic forces applied parallel to long dimension of unit. See Figure 1-1.

*Marriage Wall:* The wall where two single-section units are structurally joined to form a multi-section unit. The marriage wall may contain openings that permit interior spaces to expand to two units wide.

*Marriage Wall Piers:* Piers placed beneath a continuous marriage wall in multisection homes are assumed to be equally spaced. Piers are also placed at the ends of openings, beneath the posts that transfer concentrated loads from the roof.

Superstructure Shear walls: Vertical elements (usually walls) of the superstructure's lateral load resistance system. These vertical elements structurally transfer horizontal wind or seimsic forces, applied to the roof and floor planes of the unit, to the foundation system.

**Transverse Foundation Walls:** Walls across the short dimension of the unit which are structurally designed to function as foundation shear walls that resist horizontal applied wind or seismic forces from the superstructure's shear walls in the transverse direction.

**Transverse Direction:** Direction of horizontal wind or seismic forces applied perpendicular to long dimension of unit. See Figure 1-1.

<u>Aa</u>: The seismic coefficient representing the effective peak acceleration as determined by the seismic map 1.

<u>Av</u>: The seismic coefficient representing the effective peak velocity-related acceleration as determined by the seismic map 2.



Av: Vertical anchorage force requirement for the unit; (Pier load in lbs. or wall load in lbs./LF). Example; Anchorage force to prevent uplift and overturning in the transverse direction of applied wind or seismic forces.

**Ah:** Horizontal anchorage force requirement (lbs./ft.). Example; Anchorage force to keep unit from sliding in the transverse and longitudinal directions of applied wind or seismic forces.

Aftg: Foundation footing size for the isolated unit pier spread footing area (sq. ft.) & continuous wall footing width (ft.).

*hn:* The height of the manufactured unit exterior wall.

*hp*: The depth at which a pier footing must be placed to prevent it from pulling out of the soil (ft.).

*hw:* The depth at which a continuous foundation wall must be placed to prevent it from pulling out of the soil (ft.).

*L*: Length of manufactured home (ft.).

W: Actual self (dead load) weight of the unit (lbs.).

w: The distributed weight of the unit (lbs./ft). W/L = w; therefore weight per foot of length.

Wt: Actual measured width of the unit (ft.) between superstructure walls, excluding roof projections. A single-section unit has one width measurement (Wt). A double-section unit is composed of 2 single-section widths (2Wt).

100-3. LICENSED **PROFESSIONALS.** Those using this handbook are referred to using licensed professionals when design considerations require additional information or when a particular site, foundation system, or superstructure (manufactured home) falls outside the design assumptions and parameters of the handbook. As used herein, the term Geotechnical Engineer is a professional engineer registered under the appropriate laws of the State to practice in the field of Geotechnical Engineering. The term Structural Engineer is a professional or structural engineer registered under the appropriate laws of the State to practice in the field of Structural Engineering . And the term Architect is a professional architect registered under the appropriate laws of the State to practice Architecture.

### 101. LOCAL CODES AND STAN-DARDS

**101-1. NEW CONSTRUCTION.** This handbook has been developed for use at all new permanent manufactured home sites, communities, and set-ups.

**101-2. EXISTING CONSTRUCTION.** The practices recommended in the Handbook are not intended to be applied retroactively to existing sites unless the authority in the jurisdiction considers such application essential for safety

and health of occupants. Upgrade of existing anchorages and footings shall meet the intent of the definition of permanent foundation stated herein.

101-3. **RESPONSIBILITY.** This handbook does not relieve the installer of responsibility for compliance with local ordinances, codes, and regulations established by authorities having jurisdiction.

101-4. OTHER FOUNDATION DESIGNS. Manufacturers of home designs not covered by this handbook or recommending a foundation system not included in this handbook shall submit drawings and structural calculations prepared and sealed by a licensed professional to the owner.

### **102. REFERENCED STANDARDS**

102-1. CODES GOVERNING SUBSUR-FACE INVESTIGATION

A. HUD Minimum Property Standards for Housing 1994 Ed. Handbook 4910.1; Final Rule-24 CFR Part 200.926 contain provisions that apply to permanent foundation installations recommended in this handbook.

**B.** Engineering Report. If adverse site conditions are discovered, specific recommendations by a Geotechnical Engineer shall be included with the Design Worksheet (Appendix F).

### 102-2. CODES GOVERNING BUILD-INGS AND SITES

A. Seismic, Wind and Snow Loads for each type of structure were computed based on ASCE 7-93: *Minimum Design Loads for Buildings and Other Structures*. Minimum wind and minimum roof live load were based Buildings and Other Structures. Minimum wind and minimum roof live load were based on MPS HUD Document 4910.1, Appendix K, art. 200.926e (a) & (c).

**B.** Grading, Drainage and Fill. The HUD Land-Planning Data Sheets (79g), Handbooks 4140.3 and 4145.1, should be used for grading, drainage and fill specifications.

C. Manufactured Homes on Elevated Foundations should follow standards in Manufactured Home Installation in Flood Hazard Areas, FEMA 85/September 1985.

**D.** Additions to CABO One and Two Family Dwelling Code, 1992 Ed. (including 1993 Amendments) that apply to construction in this manual are found in CABO, Appendix C -- Section C-101, C-102, C-201, C-301, C-302, C-303, C-304, C-305, C-306, C-307, C-401, C-501, C-502, C-503, C-504, C-505, C-506, C-507, C-600, C-601, C-602, C-603, C-604, C-605.

E. Rural Housing Service (RHS) Formerly Rural Housing and Community Development Service, formerly Farmers Home Administration (FmHA). Provisions for the approval of direct loans for manufactured homes on permanent foundations are contained in Subpart A of Part 1944: Section 502 Rural Housing Loan Policies and Authorizations and for guaranteed loans in Subpart D of Part 1980: Rural Housing Loans. The provisions for acceptable site development, installation and setup are contained in Subpart A of Part 1924 Exhibit J: Manufactured Home Sites, Rental Projects and Subdivisions. These Agency instructions are available in any RHS field office.

F. Superstructure HUD Code - Federal Manufactured Home Construction and Safety Standards Oct. 25, 1994. The structural design of the superstructure of the manufactured home has been assumed to be in conformance with HUD Code Section 3280.305 and .306 (a)(2) which anticipates the manufactured unit to make provision for the support and anchoring system forces required by this document.

### **103. GENERAL PROCEDURE**

103-1. SUBMISSIONS. Three worksheets must be filled out before evaluation of the foundation system can begin, the "Owner's Site Acceptability Worksheet and Manufacturer's Worksheet" in Appendix E, and the "Design Worksheet" in Appendix F. Refer to Table i - 1 in the Introductory Comments, which indicates requirements and submissions.

103-2. BEGINNING THE APPROVAL PROCESS. If the worksheets in Appendices E and F have been filled out, the approval process can begin. See Chapter 2, "Site Acceptability Criteria" and the Design Worksheet, Appendix F. Persons using the handbook should fill out the Design Worksheets while progressing through the chapters in the Handbook. Questions on the Design Worksheet are tied to sections of the Handbook and the section numbers are noted on the Worksheet.

### **CHAPTER 2 - SITE ACCEPTABILITY CRITERIA**

**200. GENERAL.** Before approval of the site can begin, preliminary information about the site must be provided. Information to be provided appears in Appendix E.

**201. SITE SUITABILITY.** Site conditions can determine whether a given foundation design will be suitable for the manufactured home. Problem soils, flood-prone building sites, sloping sites, and ground-water level can affect decisions about foundation design. An investigation of the problem site by a qualified geotechnical engineer is recommended to assure that site conditions will not adversely affect foundation performance.

**201-1. EXISTING GRADE ELEVA-TION(S)** must be provided using a level and known benchmarks if any of the following are true:

A. The elevation is to be altered by grading or fill; or

**B.** The site is near a flood zone (e.g. lakes, rivers, streams, or coastal areas); or

C. The site is or will be incorporated in subdivisions and communities.

**201-2.** FLOOD-PRONE SITES. Building sites near lakes, rivers, streams and oceans are likely flood-prone areas. Information about whether the site is flood-prone should be obtained from FEMA Flood Maps. Determine whether the building site is in a flood zone. Refer also to the map showing distribution of great floods in the United States, page H-3.

A. Sites in Flood Zones. If the building site is within a flood zone, the finish grade of the building site must be located above the 100-year return frequency flood elevation, and in accordance with HUD Handbooks 4135.1 REV.2 and 4145.1.

**B. Elevated Homes** within flood zones can be built on specially-designed elevated foundations.

- 1. Refer to Manufactured Home Installation in Flood-Hazard Areas, FEMA-85 / Sept. 1985.
- 2. Homes built on elevated foundations must comply with requirements of the National Flood Insurance Program to qualify for flood insurance. (N.F.I.P.)

201-3. FROST PENETRATION DEPTH. Verify the frost penetration depth with local building code department. Refer to the Maximum Annual Frost Penetration map on page H-4. The base of the foundation footing must be below the maximum frost penetration depth. Foundations in permafrost must be designed by an engineer registered in Alaska.

201-4. GROUND WATER TABLE ELE-VATION. Water table elevations vary from season to season and/or by locations. Building structures, streets, paved areas, and utilities shall be located or engineered to minimize the adverse effects of a high water table.

**A. Subdivisions.** A subsurface investigation by a Geotechnical Engineer is required to determine water table elevation.

- Developed portions of a site which can be adversely affected by a potentially high ground water table shall be drained where possible (based on recommendations by Geotechnical Engineer) by subsurface drainage facilities adequate for the disposal of excess ground water or by provision of surface drainage and surface ponds.
- 2. A Geotechnical Engineering Report shall be submitted in subdivision applications.

**B.** Exceptions. For individually-sited homes, the water table elevation may be based on local records if available; otherwise, determine by subsurface investigation.

### 202. SOIL BEARING CAPACITY

202-1. GENERAL. Soil conditions typically vary with depth. Subsurface investigations to a minimum recommended depth below the footing depth by a Geotechnical Engineer, using appropriate laboratory tests, are recommended to identify soil type and bearing capacity.

202-2. REQUIRED SUBSURFACE IN-VESTIGATION. For subdivisions and communities, a subsurface investigation is required.

**A. Preliminary Design.** Other sources may be consulted for presumptive bearing pressures for preliminary design purposes.

1. Allowable bearing pressures based on national model codes:

- a. BOCA Basic National Building Code
- b. SBCC Standard Building Code

- c. ICBO Uniform Building Code
- d. CABO One and Two Family Dwelling Code
- 2. Local authority having jurisdiction
- 3. Soil Conservation District
- 4. United States Geological Survey
- 5. Soil Conservation Service of the U.S. Dept. of Agriculture
- 6. Highway Department
- 7. Utility Company Records

**B.** Exceptions. For individually-sited homes, the bearing capacity may be determined based on local building codes, unless the site is located in an area of known or suspected adverse soil conditions (as defined in Section 203), then a subsurface investigation may be required.

# 203. PROBLEM SOIL AND SITE CONDITIONS

### 203-1. ORGANIC SOILS

A. Soil Identification. If any of the following soil types is identified at the proposed site by a Geotechnical Engineer (or soil conservation maps), removal of the problem soil type and replacement with an engineered fill is permitted if submitted and approved by a Geotechnical Engineer.

> 1. Loess. Deposits of windblown organic silts. Susceptible to moisture and frost action and excessive settlement.

- 2. *Peat.* River or water deposits of organic matter and silts, susceptible to excessive settlement.
- 3. *Topsoil*. Top organic layer of soil, susceptible to excessive settlement.
- 4. Others (As defined by Geotechnical Engineer). Refer to overview map of expansive soils, Appendix F.

**203-2.** UNSTABLE CLAYS have potential for large movements.

### A. Conditions Causing Instability:

- 1. Expansive characteristics
- 2. Highly plastic characteristics
- 3. High compressibility
- 4. Other conditions as noted by Geotechnical Engineer.

**B.** Foundations for Unstable Clays. The presence of unstable clays indicates that special foundation treatment as recommended by a Geotechnical Engineer be included in the approval plan.

#### 203-3. SLOPING SITES

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**A. General.** There is the potential for slope instability and soil movement if the following conditions occur:

- 1. Loading on the slope by fill, home, or foundation.
- 2. Removal of lateral supports by construction.

- 3. Inherent characteristics of soil material and slope geometry.
- 4. Changes in the water content of the soil.
- 5. Refer to overview map of landslide problems on pages H-6 and H-7, and National Academy of Sciences Report *Reducing Losses from Landsliding in the United States.*

**B.** Local Records. Refer to local Geotechnical records and ordinances for guidance.

C. Identification. Subsurface investigation by a Geotechnical Engineer is recommended for sloping sites. This is the primary method of determining slope instability.

#### 203-4. SUBSIDENCE

A. General. Subsidence refers to the potential for lowering or collapse of the land surface. Its causes are:

- 1. Dissolving of soluble materials below the surface to form cavities.
- 2. Underground mining.
- 3. Withdrawal of gas, oil, and water from subterranean cavities
- 4. Other causes as noted by Geotechnical Engineer.

**B.** Identification. Areas where subsidence occurs can be identified by local geological records or by subsurface investigation by a Geotechnical Engineer. Refer to the maps showing cave locations and coal field locations on pages H-8 and H-9, NBSIR 81-2215 Construction of Housing in Mine Subsidence Ar-

eas, and National Academy of Sciences Report Mitigating Losses from Land Subsidence in the United States.

**C.** Stipulations. Construction on the site should be determined by a Geotechnical Engineer.

203-5. TERMITE HAZARD. Refer to the map on page H-10 for locations and intensity of termite infestation. Wood selection and treatment, and wood members in close proximity to the ground shall be in accordance with CABO One & Two Family Dwelling Code (all provisions listed in section R-309) or with local ordinances.

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### **CHAPTER 3 - SITE PREPARATION**

**300. GENERAL.** Site preparation must conform to referenced standards in Chapter 1.

### **301. DRAINAGE**

**301-1. RAIN DIVERSION.** Provide the best available routing of run-off water to assure that buildings or other important facilities will not be endangered by the path of a major emergency flood run-off which would occur if the site storm drainage system is exceeded.

**301-2.** SITE-PLAN. Arrange structures on sites to retain natural drainage patterns (*MPS* HUD Document 4910.1, Chapter 3).

**301-3. ROOF DRAINAGE.** Control roof drainage by use of gutters and downspouts. Route away from foundation walls.

### 302. SITE-GRADING

**302-1. GENERAL.** Site-grading plan must be approved by HUD, according to the *Land Planning Data Sheet 79g* and *HUD Handbook 4145.1* (Appendix 8). Site grading and drainage must be performed to provide diversion of surface water away from the foundation and off the site, to prevent standing water. Design the new slope to tie in with natural grading. **302-2. RECOMMENDED TESTS.** Obtain soil analysis, bearing tests, or special foundation design where soil stability is questionable.

### 303. FILL

**303-1.** GENERAL. Bearing for footings or foundations on engineered fill is permitted where determined acceptable by HUD Field Office and Geotechnical Engineer.

**303-2.** FILL SPECIFICATIONS. Fill must be engineered fill, (to 90% compaction, Modified Proctor Test, ASTM D1557) free of organic material such as weeds, or grasses, or other organic matter.

**303-3.** ENGINEERED FILL. Engineered fill shall have a minimum load bearing capacity as recommended by a Geotechnical Engineer. Use HUD *Land Planning Data Sheet 79g* for preparation requirements.

**304.** FINISH GRADE ELEVA-TION. The finish grade must be in accordance with *HUD Handbook 4145.1*, paragraph 3-4.A.6).
## CHAPTER 4 - DESIGN LOADS FOR PERMANENT FOUNDATIONS

**400. GENERAL.** Design and construction must insure that the load bearing portion of the home's foundation will remain stable and maintain its capacity to transmit all imposed loads to the ground.

**400-1. FOUNDATION DESIGNER.** The foundation designer must be aware of the structural limitations of the home to accommodate differential foundation movement. This is especially important with differential soil settlement or movement of problem soils.

**400-2. REFERENCED STANDARDS.** All structural design shall be based on generally accepted engineering practice. All loads shall be in accordance with ASCE 7-93, except as shown otherwise in this manual. Local codes must be reviewed for requirements that may be more stringent than ASCE 7-93.

400-3. DESIGN STANDARDS. Foundation design criteria is based on foundation criteria for conventional housing as defined in the *Minimum Property Standards*, and is not based on the *Manufactured Home Construction and* Safety Standards (Part 3280). Foundation De-

sign Load Tables, Appendix B, were developed based on average ASCE *Minimum Design Dead Loads*. See Table 4-1 below. (See Derivation of Foundation Design Load Tables, Appendix D.)

401. BUILDING STRUCTURE AND SIZE. Information must be provided by the manufacturer to assist in determining the suitability of a manufactured home for a particular site and foundation system. The inspector shall do a preliminary check to verify that all information has been prepared by the manufacturer. (The Manufacturer's Worksheet can be found in Appendix E, page E-3.)

## 402. DESIGN LOADS

## 402-1. DEAD LOADS

A. Computation of Forces. Two design dead load values are used in this guide. The values are based on typical materials used in construction of homes.

1. The lightest combination of loads is used for computation of horizontal

Range of Dea (Average pounds pe					•		
Nominal unit width:		feet		feet	16 feet		
Dead load:	light	heavy	light	heavy	light	heavy	
Single-Section	260	380	290	425	320	470	
Type C, E, I							
Multi-Section	500	715	560	805	615	895	
Note: Refer to the "Manufacturer's							
Worksheet" Appendix E for unit type.		1 					

#### Table 4 - 1

and vertical anchorage forces for wind related overturning and sliding stability.

2. The heaviest combination of loads is used for computation of: (1) footing bearing area and (2) equivalent lateral inertia forces applied at roof and floor levels for seismic related overturning and sliding stability.

**B. Dead Load Values.** The design light and heavy dead load values are shown in Table 4-1 for manufactured home type and nominal unit width.

**C. Distributed Weight Calculation.** The manufacturer shall provide the total weight (W) and the length (L) of the manufactured housing unit, including mechanical equipment. These values are used to convert the weight (W) into the distributed value of pounds per lineal foot (w). Use the following formula to make this conversion:

$$w = \frac{W}{L}$$

Where: L = length of home (Mfr. Wksht. #3) W = total weight (Mfr. Wksht. #8)

**D. Distributed Weight Comparison.** The distributed home weight (w) shall be compared with the average calculated values in Table 4-1.

> 1. If the manufacturer's distributed value (w) is less than the light load or greater than the heavy load, the structural engineer will be required to design the foundation system and anchoring system. Proceed no further until an approved system, cer

tified by a licensed structural engineer, has been provided. DO NOT USE THE TABLES. The tables are based on estimated conditions. Once outside those limits, the results will not be valid.

2. If the manufacturer's value falls within the light and heavy load limits ( $\pm$  5%), USE THE TABLES IN THIS MANUAL and proceed with the verification process.

**E.** Other Dead Loads. Manufactured home partitions and other known loads caused by special installations such as stationary equipment, i.e. water heater, furnace, etc., shall be included to arrive at applicable dead loads.

## 402-2. SNOW LOAD

A. General. Ground snow loads are based on values from ASCE 7-93. The Ground Snow Load map on pages H-11, H-12, H-13, shall be used to determine a ground snow load value (Pg) for the manufactured home location. For areas where ground snow load values are not shown, consult local weather data or governing code authority. Ground snow loads (Pg) are converted to roof design snow loads (Ps) by multiplication on  $0.7 \times Pg$ . See Appendix D for derivation. The tables in Appendix B use Pg values from the map. Roof snow loads are assumed to be horizontally projected over the roof area.

**B. Heavy Snow Loads.** If the ground snow load value (Pg) exceeds 100 psf, consult a licensed structural engineer for footing design.

**C. Minimum Roof Live Load.** Roofs shall be designed for a minimum horizontally

projected live load in accordance with MPS HUD Document 4910.1, Appendix K, art.200.926e. The load magnitude is related to roof slope as follows: greater than 3 in 12: 15 psf; less than or equal to 3 in 12: 20 psf. The larger magnitude, between the design roof snow load and the minimum roof live load, shall be used for design. Note that a 20 psf ground snow load (Pg) corresponds closely to a 15 psf minimum roof live load (i.e.  $0.7 \times 20 =$ 14 psf rounded to 15 psf) and a 30 psf ground snow load corresponds closely to a 20 psf minimum roof live load (i.e.  $0.7 \times 30 = 21$  psf rounded to 20 psf in the Foundation Design Load Tables).

#### 402-3. WIND LOAD

A. General. Wind loads must be based on values from ASCE 7-93. The Basic wind speed map on page H-14 must be used to determine the basic wind speed (v) for the manufactured home location. Refer to Appendix D for factors influencing wind load. Map values below 80 mph shall conform to the minimum wind speed of 80 mph in accordance with *MPS* HUD Document 4910.1, Appendix K, art. 200.926e.

NOTE: Tornadoes have not been considered in the development of the basic wind speed map, and resistance to such conditions is not included in this manual.

**B.** Coastal or Inland Sites. Coastal regions include any locations within 100 miles of the Atlantic Ocean or Gulf of Mexico hurricane coastlines. All other locations are to be considered Inland regions. Exposure Category C has been assumed regardless of Coastal or Inland location in accordance with *MPS* HUD Document 4910.1, Appendix K, art. 200.926e.

C. Severe Wind and Design Pressures. In hurricane zones, or where severe wind pressures occur, foundations and anchoring for manufactured homes will require special treatment.

- 1. Foundations may be required to resist greater uplift and overturning than values shown in this manual.
- Heavier, more deeply buried foundations may be required than values shown in the tables. It may be necessary to provide additional foundation shear walls and/or specially designed cantilever piers.
- 3. Home-to-foundation connections must be strengthened.
- 4. Refer to Mobile Home Anchoring Systems and Related Construction and An Engineering Analysis: Mobile Homes in Windstorms, Institute for Disaster Research in Lubbock, Texas.

**D. Design Verification.** The field office must verify the existence of engineered drawings showing connection and anchorage details. The connection details shall be engineered to resist wind speeds at the building site.

**E. High Wind Design.** For high wind areas, foundation designs must be those that are suited to both high wind and other site conditions, such as seismic or soil conditions.

#### 402-4. SEISMIC LOADS

A. General. Seismic design loads and requirements are based on criteria and values from ASCE 7-93, which are taken from the NEHRP *Recommended Provisions for the De-*

velopment of Seismic Regulations for New Buildings (NEHRP 1991). The two seismic maps on pages H-15 and H-16 shall be used to determine the seismic values Aa and Av for the manufactured home location (county). Seismic values of Aa and Av that equal or exceed 0.3 shall conform to the special requirements of seismic performance category C and D (cited on page H-17) as they apply to foundation design and detailing. When Av values from the map on page H-16 are less than 0.15, the seismic provisions of ASCE 7-93 need not be considered, and anchorage design is then based on wind considerations alone. In seismic areas where Av and/or Aa  $\geq 0.3$ , foundations must be designed by a professional engineer licensed in the applicable state.

**B.** Design Verification. The design concept proposed in question 10 of the "Manufacturer's Worksheet", found in Appendix E, should be compared with information in the Foundation Design Concept Tables (Appendix A) to determine whether the foundation is potentially suitable for location in a seismic zone.

C. Characteristic Differences between Wind and Seismic Loading.

> 1. Wind loads subject the exterior building envelope to pressures and suctions on each wall or roof surface. Thus, exposed surface area is important. Seismic loads are generated by the ground's acceleration being transferred to the foundation, according to the site soil characteristics (S) and then the building's structural system characteristics (R). This modified acceleration excites the building mass, which generates the inertia forces ( $F = m \times a$ ) at each

level (i.e. floor and roof). Thus, the entire building participates in the creation of seismic force, while only the exterior envelope participates in wind load generation.

- 2. Wind loading is usually long duration with short duration gusting that usually creates slow stress reversals, while seismic events are of short duration, creating accelerations that generate rapid oscillations in all directions with sudden stress reversals.
- 3. The slow structural response from wind loading permits frictional resistance from gravity loads to be considered for sliding resistance between superstructure and foundation. The simultaneous horizontal and vertical acceleration during a seismic event, generally negates the frictional resistance from gravity loads. Thus, friction is ignored as a potential resistance between superstructure and foundation for seismic loading. Even when wind loads exceed seismic loads, positive connections between superstructure and foundation are required for areas with Av equal to or greater than 0.15.

**D.** Seismic / Wind Force Comparisons. Overturning and sliding anchorage forces found in the Foundation Design Load Tables of Appendix B are based on the largest lateral forces from a consideration of wind and equivalent lateral seismic inertia forces. The results were as follows:

- 1. Wind controls for single or multisection units subjected to (1) overturning from lateral forces in the transverse direction (perpendicular to long dimension of unit) and (2) uplift forces in the vertical direction. Both conditions require vertical anchorage.
- 2. Wind or seismic may control for single or multi-section units subjected to sliding in the transverse and/or longitudinal direction. Values in the tables of Part 3 and 4 of Appendix B are grayed if seismic controls.

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# **CHAPTER 5 - FOUNDATION REQUIREMENTS**

**500. GENERAL.** This section outlines general material and quality standards for all foundations in this manual.

## 501. EXCAVATION

501-1. FOOTING DEPTH. Excavation for footings or foundation walls shall extend below depth of soil subjected to seasonal or characteristic volume change to undisturbed soil that provides adequate bearing. Select the greatest depth required by any of the provisions below, reference Figure 5-1.

A. Maximum Frost Penetration Depth. The bottom of footings shall extend at least to the depth indicated on the map on page H-4.

**B.** Alternate Seasonal Wetting and Drying. This is especially important with expansive soils. If expansive soils exist, consult a geotechnical engineer to obtain required footing depth.

**C.** Footing Depth. The footings shall be deep enough to provide required uplift capacity. (This value may need to be determined for high wind areas after the calculations needed to determine footing bearing have been completed.)

**502.** FOUNDATION MATERIALS. Footings and foundations shall be constructed of solid materials such as masonry, concrete, or treated wood, based on the Foundation Design Concept Selection (Appendix A) and Foundation Capacity Tables. (Appendix C) (For masonry and concrete refer to CABO R-302.2, R-304.1 and R-304.3; for wood refer to CABO R-302.1 and R-304.5.)

## 503. STRUCTURAL REQUIRE-MENTS

503-1. FOUNDATION REQUIREMENTS. All exterior walls, matriage walls, matriage wall posts, columns and piers, must be supported on an acceptable foundation system that must be of sufficient design to support safely the loads imposed, as determined from the character of the soil.

**A. Height Above Grade.** Foundation walls shall extend at least 8" above the finished grade adjacent to the foundation at all points. See Figure 5-1.

**B.** Minimum Foundation Wall and Wall Footing Thickness. For masonry or concrete construction, the minimum foundation wall will be 6 inches. The minimum reinforced concrete footing thickness will be 6 inches or 1-1/2 times the length of the footing projection from the foundation wall, whichever is greater.

503-2. PIER AND COLUMN FOOTING REQUIREMENTS. Footings for pier foundations shall be reinforced concrete and should be placed level on firm undisturbed soil of adequate bearing capacity and below the frost penetration depth. They can also be placed on engineered, compacted fill, approved by a licensed geotechnical engineer.

A. Unusual Conditions. Where unusual conditions exist, the spacing of piers and pier size and the load bearing capacity of the soil shall be determined specifically for such conditions.

5-1

**B.** Minimum Pier and Pier Footing Thickness. The minimum thickness for a pier is 8 inches. The minimum thickness for pier footings is 8 inches or 1-1/2 times the length of the footing projection from the pier, whichever is greater.

503-3. FOOTING REINFORCING (HORIZONTAL). Reinforce footings when the projection on each side of the wall, pier, or column exceeds 2/3 of the footing thickness, or when required because of soil conditions.

503-4. MASONRY PIERS AND WALLS. All masonry piers and walls shall have mortared bed and head joints. Reinforcing and grouting shall be in accordance with the foundation concept selected from Appendix A and designed in Appendix C.

503-5. CRAWL SPACE REQUIRE-MENTS (Basementless spaces)

A. Height Requirement. Ground level must be at least 18 inches below bottom of wood floor joists and 12 inches below bottom of chassis beam. Where it is necessary to provide access for maintenance and repair of mechanical equipment located in the under floor space, the ground level in the affected area shall not be less than 2 feet below wood floor joists. (Refer to CABO, Section R-309.) See Figure 5-1.

**B.** Interior vs. Exterior Ground Level. The interior ground level must be above the outside finish grade unless:

> 1. Adequate gravity drainage to a positive out fall is provided, or

> 2. The permeability of the soil and the location of the water table is such that water will not collect in the crawl space, or

3. Drain tile and automatic sump pump system are provided.

C. Openings. Locations of crawl space openings and ventilation openings should be on long foundation walls. Avoid any openings on short foundation walls. Sill plates or other structural members should not be randomly cut to accommodate openings. Continuity of struc-



Minimum Clearances and Footing Depth

Figure 5 - 1

tural members must be maintained.

503-6. FOUNDATION WALLS FOR BASEMENTS. The design and reinforcing of basement walls is NOT in the scope of this document. Refer to local codes and ordinances for guidance. Refer also to CABO, Section R-304: "Foundation Walls." Design the unit's foundation based on soil conditions present at the site.

503-7. BACK FILL. Material used for back fill must be clean and free of wood scraps or

other deleterious substances and must be placed carefully against walls.

503-8. STEEL BEAMS AND COLUMNS. The analysis and design of steel transverse girders, steel longitudinal girders potentially used under marriage walls to reduce the number of steel pipe columns within a basement, and the steel pipe columns themselves are **NOT** within the scope of this document for system Types E5, E6 and E7

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## **CHAPTER 6 - FOUNDATION DESIGN**

600. DESIGN PROCEDURE. In this chapter information about the building site and the building structure are combined and used to determine the size of footings, reinforcing for the foundation, and the size and spacing of anchorage used to the the unit to the foundation.

### 600-1. GENERAL

A. Foundation Appendices. The foundation design information in Appendices A, B, & C may be used to design new foundation systems or to verify the design of proposed or existing systems. Appendix A, Foundation Design Concepts, shows design concepts suitable for a variety of manufactured home types and site conditions. Appendix B, Foundation Design Load Tables, provides design requirements for anchorage of the manufactured home to the foundation and recommended footing sizes. Appendix C, Foundation Capacities Tables. provides design capacities for foundation uplift and withdrawal, based on the foundation type chosen (wood, concrete masonry or cast-inplace concrete).

**B.** Design Verification Sequence. The three Appendices (A, B, & C) are intended to be used in sequence.

- 1. Appendix A, Foundation Design Concepts, is used to identify acceptable foundation designs based on the manufactured home type and the site conditions.
- 2. Appendix B, Foundation Design Load Tables, is used to determine the required footing sizes and the required vertical and horizontal an-

chorage forces to be transferred to the foundation.

3. The required anchorage values are used in Appendix C, Foundation Capacities Tables, to determine the materials, dimensions, and construction details of the foundation.

**C.** Design Criteria and Design Loads. The design criteria and loads are needed for the Foundation Design Load Tables (Appendix B).

- 1. Width of Unit. The measured width of the manufactured home, converted to a nominal width is needed.
- Height of Unit. The unit is assumed 8'-0" tall from bottom of floor framing to eave at roof. Ceilings may be horizontal (flat) or cathedral sloped.
- 3. Design Loads. The design ground snow load, wind speed, seismic ground acceleration and seismic performance category are needed. Refer to Appendix H to determine the design load values.

**D.** Effective Footing Area (Aftg). The footings for the permanent foundation must be sized to prevent sinking or settlement of the manufactured home. Footing area is given the abbreviation (Aftg). The values for (Aftg) are given in square feet (sf) for pier footings and feet (ft) for wall footing width. Refer to Appendix D for the derivation of equations for the determination of effective footing areas.

E. Vertical Anchorage (Av). The manufactured home must be securely anchored to the foundation. One critical anchorage requirement is for the structure to resist uplift and overturning from wind activity in the transverse direction. This is vertical anchorage and it can be achieved at the chassis beams or along longitudinal wall locations, or both locations. It is given the abbreviation (Av), and the (Av) values are all given in pounds (lbs. per pier or lbs. per foot of foundation wall). Refer to Appendix D for the derivation of the equations for determination of required vertical anchorage force.

F. Horizontal Anchorage (Ah). Another critical anchorage requirement is for the manufactured home to resist horizontal sliding forces in both the transverse and longitudinal directions. Horizontal forces are a result of wind or seismic activity. Horizontal anchorage is given the abbreviation (Ah). The transverse or longitudinal direction relates to the direction of force application and to the orientation of the resistance elements, such as the transverse vertical X-bracing planes or the longitudinal walls of the unit respectively (see Figure 1-1). The values for (Ah) are given in pounds per foot (lbs./ft.). Refer to Appendix D for the derivation of equations for determination of required horizontal anchorage force.

G. Loads Included and Load Combinations. All applicable gravity loads (dead, occupancy and snow or minimum roof live) and all lateral loads (wind or seismic) have been considered in the development of the Foundation Design Load Tables of Appendix B. Chapter 4 gives a brief description of each load and Appendix D derives the equations upon which the magnitude of these loads is determined for any geographic location and unit Type. Appropriate load combinations have been selected from ASCE 7-93 for allowable stress design as follows:

- 1. The load combination used for The Foundation Design Footing Tables (Appendix B, Part 1) is:
  - DL (heavy) + LL (occupancy) + LL (attic) + SL (or min. roof LL).
- 2. The load combination used for The Foundation Design: Anchorage Tables (Appendix B, Part 2,3,4) is:

(Wind or Seismic\*) ± DL (light)

\* Heavy DL was used to calculate the roof and floor inertia forces only.

600-2 DETERMINATION OF BUILDING WIDTH

A. Building Width for Use of Appendix B Tables. The actual measured building width must be converted into the nominal building width for use in the Foundation Design Footing Tables and Anchorage Tables. The nominal building width should be calculated as follows:

> 1. To obtain the nominal building width for use in the Foundation Design: use the following information:

Actual Building Width	Nominal Width
11'-4" to 12'-0"	12'
13'-4" to 14'-0"	14'
15'-4" to 16'-0"	16'

 The tables are based upon the width of each section as it is transported. A multi-section superstructure classified as a nominal 14-foot width



classified as a nominal 14-foot width could be 26'-8" to 28'-0" in actual width.

3. The nominal width to be used in the Foundation Design Load Tables should be recorded.

**B.** Width Illustration. If there is a question about which dimension is actually the width of the structure, see Figure 6-1. The width of the home is shown as Wt (nominal 12', 14', or 16'.)

600-3. DETERMINATION OF DESIGN GROUND SNOW LOAD. Verify the geographic location where the unit will be sited. Refer to the ground snow load map on pages H-11, H-12 and H-13, and read the pound per square foot (psf) isobar for the intended site. Note that a mandatory minimum roof live load may be greater than the roof snow load. Refer to section 402-2.A and C for further clarification.

600-4. DETERMINATION OF DESIGN WIND SPEED. Verify the geographic location where the unit will be sited. Refer to the wind speed map on page H-14 and read the MPH wind speed isobar for the intended site. Note that a minimum wind speed of 80 MPH is required by the *Minimum Property Standards*, even if the map isobar shows a smaller MPH value. Establish if the site is Inland or Coastal (section 402-3.B).

# 600-5. DETERMINATION OF DESIGN SEISMIC FACTORS.

A. Determine Design Seismic Ground Acceleration Values.

- 1. Verify the geographic location where the unit will be sited.
- Refer to the two Ground Acceleration Contour Maps on pages H-15 and H-16 and read (<u>Aa</u>) from map 1 and (<u>Av</u>) from map 2 for the isobar closest to the site.
- 3. The manufactured home is exempt from seismic requirements if the map value for  $(\underline{Av})$  is less than 0.15; therefore, wind becomes the only lateral load design issue. If  $(\underline{Av})$  is equal to or greater than 0.15 seismic provisions must be met (Section 402-4).

# B. Determine the Required Seismic Performance Category.

- A seismic hazard exposure group of (I) is assumed for single family residences.
- 2. The seismic value (Av) and the Seismic Hazard Exposure Group (I) are used to assign the manufactured home to a Seismic Performance Category. Refer to the Seismic Performance Category Table on page H-17, enter the Table with these two values and record either (C) or (D) as applicable. Note that if (C) is the correct Category, it is required to comply with the requirements for Category (A) and (B) as well as (C). If Category (D) is the correct Category, then the requirements for Category (A) through (D) must be met. These requirements, as they pertain to permanent foundations for manufactured housing are listed in Section H-300 as a reference. The Foundation Concepts illustrated in Appendix A can meet the intent

of the foundation requirements of Section 9.7 of ASCE 7-93 for Seismic Performance Categories (A) through (D).

3. The manufacturer shall verify that the unit provides continuous load paths with adequate strength and stiffness to transfer all forces from the point of application to the point of resistance at the foundation. The design and detailing of the unit shall comply with Section 9.3.6 of ASCE 7-93 for the Seismic Performance Category assigned in step 2 above.

## 601. VERIFYING THE FOUNDA-TION DESIGN CONCEPT (APPENDIX A)

601-1. LOCATION OF FOUNDATION SUPPORTS

A. Definition of Support. Support is herein defined as the location where the gravity loads (dead, occupancy, snow, minimum roof live load) within and applied to the unit are





Figure 6 - 2

transferred to the foundation system.

**B.** Illustration of Support Locations. The acceptable locations where foundation piers and walls support the unit are illustrated in Figure 6-2. Terms that appear throughout Appendices A, B and C are also defined. Some or all of the illustrated locations may be used, but symmetry of the support system must be maintained. Note that marriage walls may be continuous walls, or contain specifically located openings with posts at the ends of each opening.

C. Determine the Location of Foundation Supports. Single-section or multi-section units are supported by equally spaced piers along their chassis beams, by exterior longitudinal walls or both. Multi-section units may possibly have additional equally spaced pier supports along a continuous marriage wall, and have piers placed according to post locations at the ends of specific marriage wall openings. Select one of the following unit support options:

- Type C: Piers are equally spaced along the chassis beams for singlesection units. Additional piers may exist below continuous marriage walls and under posts at the ends of openings within the marriage wall, that exist for multi-section units. If no support exists below the marriage wall the unit is defined as a Type **Cnw**, and no openings can be permitted in the marriage wall. It must be a continous wall, supported by the floor and chassis beam system.
- Type E or I: A combination of longitudinal exterior walls and equally spaced piers under the chassis beams are used for single-



section or multi-section units. The same discussion regarding continuous marriage walls and marriage walls with openings within them, as found under Type C, applies to Type E and I.

## 601-2 LOCATION OF VERTICAL AN-CHORAGE (Av) IN THE TRANSVERSE DIRECTION.

A. Definition of Vertical Anchorage. Vertical anchorage exists in the transverse direction when a mechanical connection is made between the manufactured home unit and the foundation to resist wind related overturning and uplift forces. Overturning is the tendency for the unit to rotate about a pivot point either at the bearing point between chassis beam and support pier, or the bearing between the unit and the longitudinal exterior wall. This rotation lifts the unit off its other bearing points; therefore, requiring vertical anchorage (tiedown) to resist the force. Uplift of the unit occurs as wind passes over the roof surface, tending to lift the unit. Vertical anchorage resists this force. See Figure 6-3 for illustration of both of these effects in the transverse direction. Analysis for both effects in the transverse direction indicates that overturning forces are greater than uplift forces. Thus, Appendix B, Part 2 Vertical Anchorage Tables are based on overturning behavior with the knowledge that uplift forces will also be handled. Locations for this mechanical connection exist either along the chassis beams and/or along the exterior longitudinal walls. Vertical anchorage and gravity support may exist at the same locations, but other combinations of support and anchorage may exist. Connection types include anchor bolts, welds, or a broad range of framing anchors and fasteners common to the wood industry. A unit that merely sits on its foundation, does not constitute vertical anchorage of the unit. A physical connection of adequate capacity is required for vertical anchorage to exist.

**B.** Determine Locations of Vertical Anchorage (Av). The character of the foundation support Type selected in section 601-1.C must be reviewed for vertical anchorage capability. The manufactured home unit may be anchored by any of the methods described in section 601-2.A. Select one of the following vertical anchorage options:

- Type C: Vertical anchorage is along the chassis beams only, and occurs at the equally spaced support piers for single-section units. Multi-section units may utilize the exterior chassis beams (2 ties) or all the chassis beams (4 ties) for vertical anchorage to the support piers.
- Type C1: Vertical anchorage is typically provided by external straps which wrap over the top and down the sides of the unit. Short vertical ties, which attach directly to the home's exterior wall structure, are a possible alternate. These straps or ties attach to concrete "dead man" footings set at the appropriate depth below grade. The straps or ties are generally spaced to match support pier locations; however, variations are possible. These anchorage types are limited to single-section units. It is required that the first external straps or ties be a minimum of 2 feet in from each end of the unit with the remainder equally spaced.

Type E: Vertical anchorage is only along the exterior longitudinal walls for single-section units. Multi-section units may vertically anchor to exterior longitudinal walls (2 ties) or vertically anchor to exterior longitudinal walls and interior chassis beams at the equally spaced piers (4 ties).

Type I: Vertical anchorage is along the chassis beams only, and occurs at the equally spaced support piers for single-section units. Type I vertical anchorage differs from Type C vertical anchorage only in its pivot point location for overturning. Multi-section units may utilize the exterior chassis beams (2 ties) or all of the chassis beams (4 ties) for vertical anchorage at the equally spaced support piers.

## 601-3. LOCATION OF HORIZONTAL ANCHORAGE (Ah)

A. Definition of Horizontal Anchorage. Horizontal anchorage exists when a mechanical connection is made between the manufactured home unit and the foundation to resist sliding due to wind or seismic lateral forces. Sliding can occur in the transverse direction or the longitudinal direction, and both directions must independently be checked. Sliding involves horizontal movement in the transverse or longitudinal direction of the unit, and if the wind or seismic event is of large enough magnitude, these horizontal forces can result in the unit sliding off its foundation. Anchorage between unit and foundation to avoid this situation is accomplished in one of two ways: (1) utilizing bolts, welds or other acceptable means to connect the unit to foundation walls that are made

of concrete masonry, treated wood or concrete, or (2) utilizing vertical X-bracing planes of galvanized rod or wire diagonal ties or straps between the top side of the steel chassis beams diagonally down to the top of the concrete footings.

**B.** Determine Locations of Horizontal Anchorage (Ah). Horizontal sliding must be resisted both in the transverse and longitudinal directions. Options for each direction are as follows:

> 1. Transverse Direction: Anchorage location options include 2, 4, or 6 transverse walls (shear walls) or a select number of vertical planes of X-bracing (trussing) with galvanized rods, wires or straps. Figure 6-4 illustrates these individual options for a single-section unit and Figure 6-5 illustrates one combination of these options, also for a single-section unit. Selection of transverse horizontal anchorage location option is not influenced by the selection of Type C, E or I unit for support or vertical anchorage in the transverse direction as done in sections 601-1 and 601-2.

 Longitudinal Direction: Anchorage location options include either the two exterior longitudinal walls (for single or multi-section units) or the chassis beam lines (2 for singlesection units, or 4 for multi-section units), where vertical planes of Xbracing with galvanized rods, wires or straps are possible. Illustration of the two choices is shown in Figure 6-6 for a single-section unit. Selection of longitudinal horizontal anchorage location option is not influenced by the selection of Type C, E or I unit for support or vertical anchorage in the transverse direction as done in sections 601-1 and 601-2.

601-4. FOUNDATION CONCEPT SE-LECTION. Whether designing a new permanent foundation or upgrading an existing foundation to a permanent foundation, confirmation of a foundation concept from Appendix A is required. The permanent foundation type is a function of the support option selected in section 601-1.C and the vertical anchorage option selected in section 601-2.B. Note: The horizontal anchorage option is independent of these two issues and does not influence selection of foundation type.

A. Three Basic Foundation Types. A summary of the structural characteristics required for each type of permanent foundation system follows:

- Type C: Support and vertical anchorage occurs at equally spaced points along the Chassis beam lines only. This is true for single-section or multisection units.
- Type E: Support occurs at the Exterior longitudinal foundation walls as well as at equally spaced points along the chassis beam lines. Vertical anchorage occurs continuously along the exterior longitudinal foundation walls for single-section or multi-section units (2 ties), or a combination of vertical anchorage can occur continuously along the exterior longitudinal foundation walls and along the equally spaced

pier locations along interior chassis beams (4 ties).

Type I: Support occurs at the exterior longitudinal foundation walls as well as at equally spaced piers along the chassis beam lines, just as for Type E, for single-section or multisection units. Vertical anchorage occurs at the equally spaced piers along the chassis beam lines only for single-section or multi-section units (2 ties or 4 ties).

**B. Illustration of Foundation Types and Concepts.** Single-section foundation types and detailing concepts are illustrated in Figure 6-7 and Appendix A. Multi-section foundation types and detailing concepts are illustrated in Figure 6-8 and Appendix A. The meaning of the arrow orientation in both Figures is as follows:

Type C: concepts C2 to C4

- Type E: concepts E1 and E8 (E2 omitted in this revision)
- Type I: included here as possible future design concepts. None were currently submitted by manufacturers.

**C. Determine Foundation Concept.** Based on the foundation type selected, choose one of the several concept options below:



Figure 6 - 4

6-9



Sliding Resistance - Combination Option - Transverse Direction

Figure 6 - 5

**D.** Additional Foundation Types and Concepts. Some combinations of support and vertical anchorage, other than the basic Types **C**, **E** and **I**. Should that be the case, select one of the concept options below:

Type C1: concept C1 (Single-section)

Type E: concept E3, E4 (single-section) concept E3 (multi-section) concept E5, E6, E7 (multisection)

Type **Cnw**: concepts C2, C3, C4 (type Cnw stands for a Type C multisection with no marriage wall)





# 602. USING THE FOUNDATION DESIGN TABLES (APPENDIX B)

602-1. GENERAL. The Foundation Design Load Tables (Appendix B) are used to determine foundation footing sizes required, plus vertical and horizontal anchorage forces to be resisted for all the foundation types. This section gives step-by-step instructions for using the Foundation Design Load Tables.







Foundation Design Concepts: Multi-Section Units

**602-2. FOUNDATION VOCABULARY.** Figure 6-9 illustrates the following foundation terms.

A. Pier Foundations. The longitudinal variety of spacing of piers under the chassis beam lines as shown in the Foundation Design Load Tables is 4, 5, 6, 7, 8 and 10 feet. If pier spacings other than those shown are contemplated, use the next largest spacing (i.e. for 4.5 feet use 5 feet). Piers placed under continuous marriage walls are assumed equally spaced, while piers must be placed under posts that define the ends of a large opening in a marriage wall. These openings are assumed to range from 10 to 20 feet in 2 foot increments. All marriage wall piers are assumed to only participate in transferring gravity loads, thus they do not participate in resistance to overturning or sliding. Piers may be made of concrete, concrete masonry or steel. Reinforcing is required for all concrete or masonry pier concepts in seismic regions with <u>Av</u> greater than or equal to 0.3. The values shown in the Foundation Design Load Tables are values based on the pier spacing in pounds per pier (lbs) for (Av), and square feet for (Aftg), whether exterior, interior or marriage wall piers.

**B.** Transverse Foundation Walls. Transverse foundation walls can occur at the exterior ends of a single-section or multisection unit, as well as at selected interior locations along the length of the unit. A continuous concrete footing must exist under the transverse walls regardless of the wall material: concrete, concrete masonry or treated wood. Interior transverse foundation walls of concrete or masonry can: (1) box around the chassis beams and provide direct continuous connec-



Figure 6 - 7

tion to the floor structure of the unit, or (2) the wall can stop at the underside of the chassis beams and utilize diagonal steel straps or diagonal wood ties to complete connection between the transverse wall and the unit's floor structure. Appendix A illustrates these approaches. Reinforcement will be required for most transverse wall concepts. The values shown in the Foundation Design Load Tables (Appendix B) for horizontal anchorage (Ah) are values based on pounds per lineal foot (lbs./ft.) of wall.

C. Longitudinal Foundation Walls. Longitudinal Structural foundation walls are provided for foundation Types E and I. A continuous concrete footing must exist under the longitudinal foundation walls regardless of the wall material: concrete, concrete masonry or treated wood. Reinforcement will be required for all longitudinal wall concepts. The values shown in the Foundation Design Load Tables (Appendix B) for: (1) vertical anchorage (Av) are values based on a continuous wall support in pounds per lineal foot (lbs./ft.) of wall, (2) horizontal anchorage (Ah) are values based on pounds per linear foot (lbs./ft.) of wall and (3) footing width values are in feet (ft) for (Aftg).

## 602-3. REQUIRED FOOTING AREAS (Aftg) (APPENDIX B, PART 1)

A. General. The foundation must be capable of transmitting the total gravity load to the soil without exceeding the net allowable soil bearing pressure. The gravity loads consist of the unit dead weight, snow load or minimum roof live load, and occupancy live load. Bearing against the soil is accomplished with square concrete footings under piers and continuous linear concrete footings under walls. Compliance with this requirement should prevent excessive differential settlement.

**B.** Determine Design Ground Snow Load / Minimum Roof Live Load. This step has been done in section 600-3 and is required for single-section and multi-section units.

**C. Occupancy Live Loads.** The residential occupancy floor live load is 40 psf in all the model codes and has been used as the floor live load in the Tables of Appendix B, Part 1. Attic live load is assumed to be 10 psf.

**D. Determine Net Allowable Soil Bearing Pressure.** The maximum net allowable soil bearing pressure shall be based on a geotechnical investigation, a national model code presumptive value, or an assigned value by the local authority having jurisdiction, as described in Chapter 2. The Tables in this document assume a minimum of 1000 psf. The value for design should be recorded in the Owner's Site Acceptability Worksheet (Appendix E, question # 10 or #11).

**E.** Determine (Aftg) Value from the Tables. Refer to Appendix B, Part 1 of the Foundation Design Load Tables. Several steps must be followed to arrive at the pier and/or wall footing sizes:

- Select the correct Table based on the foundation type (C, Cnw, E,I or E5; single-section or multi-section) and the unit nominal width (12, 14 or 16 feet).
- 2. Enter the selected Table with the design ground snow load or minimum roof live load. This step is slightly different depending on unit Type as follows:

Type C (single-section or multisection), Type Cnw, and Type E, I multi-section: Blocks of values

have headings for the various ground snow load and minimum roof live load magnitudes. Select

0

Example 1: Type: C - Single-Section Unit; Location: Tampa, FL.; Wt = 14 ft.; L = 60 ft.; Roof Slope: 2 in 12; 4 Transverse Shear Walls; Pier Spacing: 5 ft.; Pg = 0 psf.; Min. Roof LL = 20 psf.; V = 100 mph.; Coastal; Seismic Av = 0.05; Aa = 0.05; Allowable Soil Pressure: 2000 psf.

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Ļ	100 1300	3.5 2.3	2.8	4.9 3.2	5.6 3.7	6.2 4.2	7.6 5.1	1000	3.7	4.4	5.1 3.4	5.9 3.9	6.6 4.4	8.1	
	2000	1.7	2.1	2.4 1.9	2.8 2.2	3.1 2.5	3.8 3.1	2000 2500	1.8 1.5	2.2 1.8	2.6	2.9	3.3	5.4 4.1	
	3000 3500	1.2 1.0	1.4 1.2	- 1.6 1.4	1.9 1.6	2.1 1.8	2.5 2.2	3000 3500	1.2 1.0	1.5	1.7	2.4 2.0	2.7 2.2	3:2 2.7	
	4000	10	1.0	1.2	1.4	1.6	1.9	4000	1.0	1.3 1.1	1.5	1.7 1.5	1.9 1.7	2.3 2.0	

Example 2: Type: E - Multi-Section Unit; Location: West Yellow Stone, MT.; Wt = 14 ft.; L = 60 ft.; Roof Slope: 2 in 12; 4 Transverse Walls; Pier Spacing: 5 ft; Pg = 70 psf.; V = 80 mph.; Inland; Seismic Av = 0.40; Aa = 0.40; Allowable Soil Pressure: 2000 psf. Marriage wall opening width = 14'-0".

Required Effective Footing Area - Aftg (sqft) \*

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Multi-Section Width	

the correct ground snow load block of values.

Type E or I single-section: Snow load is included in the loading combination but is not required to move to the next step.

3. Select the row for the required net allowable soil bearing pressure and proceed horizontally until the desired, or manufacturer's recommended, pier spacing is located (see the Manufacturer's Worksheet in Appendix E, item #10 or #11). Read and record on the Design Worksheet (Appendix F) the required footing areas for interior and exterior pier footings and continuous marriage wall footings (as required).

4. When the marriage wall of a multisection unit has a large opening, the lower portion of the block of values is also required. Re-use the net allowable soil bearing pressure and move horizontally until the selected opening width is found. Read the required effective footing area (Aftg) for the piers required at the ends of the opening. Record on the Design Worksheet (Appendix F).

<u>Note</u>: For Types E and I. the exterior wall footing is a minimum 1'-0" wide for single or multisection units. Read the footnotes at the bottom of each table for special cases where for certain ground snow loads in combination with an allowable soil pressure of 1000 psf other minimum footing widths are required.

## 602-4. REQUIRED VERTICAL AN-CHORAGE (Av) IN THE TRANSVERSE DIRECTION (APPENDIX B, PART 2)

A. General. The foundation must provide enough structural capacity to resist uplift and overturning forces due to wind pressure and suction. These forces are resisted by connections to anchors at the piers or to anchors along the longitudinal foundation walls. Seismic inertia forces generated from the ground acceleration and the mass of roof and floor planes of the manufactured housing unit were **not** found to control over wind for overturning in the transverse direction, regardless of whether a single-section or multi-section unit was analyzed, and regardless of seismic, wind or snow zone.

**B.** Determine Design Wind Speed. This step has been done in section 600-4, and is required for single-section and multi-section units.

**C.** Determine (Av) Value from the Tables. Refer to Appendix B, Part 2 of the Foundation Design Load Tables. Several steps must be followed to arrive at the Required Vertical Anchorage in the Transverse Direction:

- Select the correct Table based on the foundation type (C, C1, E or I for single-section units and C, E or I for Multi-section units); 2 tiedowns or 4 tie-downs; 12, 14 or 16 foot nominal unit width).
- 2. Enter the selected Table and move down the wind speed column until the design wind speed magnitude

(for Inland or Coastal region) is reached. Read horizontally across the row until the desired, or manufacturer recommended, pier spacing is reached.

3. Read (Av) and record on the Design Worksheet (Appendix F) the value with its appropriate units as shown in the table. Steps 1 through 3 were described for Type C, C1 or I single-section units. For Type E single-section units or multi-section units with 2 tie-downs, values must be multiplied by the anticipated spacing of connections along the exterior longitudinal walls. For Type C or I multi-section units select the Table for 2 tie-downs or 4 tie-downs (whichever applies) and proceed as above to find the correct value. For Type E multi-section units with 4 tie-downs read two values, first for interior pier locations, and second for exterior longitudinal wall locations.

**D.** Comparison With Home Manufacturer's Values (Optional). The value for (Av) determined from the Tables must be compared to the value supplied by the manufacturer. The home manufacturer's uplift resistance value must be equal or greater than the vertical anchorage requirement from the Tables.

## 602-5. REQUIRED HORIZONTAL AN-CHORAGE (Ah) IN THE TRANSVERSE DIRECTION (APPENDIX B, PART 3)

Example 1: Required Vertical Anchorage - Av (lbs) Single-Section Wind Speed Pier Spacing (ft) [2] Width (mph) 5 1 6 8 10 Inland 960 1200 1710 1690 80 1450 1930 2410 90 1370 2060 2400 2740 3430 100 2280 1830 2740 3200 3660 4570 2330 10 3500 4080 4660 5830 Coastal 1120 1680 1960 2240 2800 1570 2360 2750 3140 3930 100 2590 3110 3630 4150 5180 2630 110 3940 4600 5260 6570 Example 2: Required Vertical Anchorage - Av (lbs) **Multi-Section** Wind Speed Exterior 14 Width Interior Tiedowns

( <u>1</u> ( <u>m</u> r	$\frac{2}{1}$ (mph) (lbs/f		) Pier Spacing (ft)									
		<u> </u>	4	5	6	7	8.	10				
Inland	80	80	210	270	320	370	420	530				
	-90	160	390	490	580	680	780	970				
	100	230	590	730	880	1030	1170	1470				
· · ·	110	<u>32</u> 0	810	1010	1210	1410	1610	2010				
Coastal	80	110	280	350	420	490	560	700				
	90	190	480	590	710	830	950	1190				
	100	280	690	870	1040	1210	1390	1730				
	<u>110</u>	370	930	1170	_1400	1640	1870	2340				

A. General. The attachment of the unit to the foundation must provide sufficient structural anchorage for the manufactured home to resist sliding forces due to wind pressures and suctions or seismic inertia forces, whichever controls. Analysis, based on the conservative load assumptions of this handbook, has shown that in the transverse direction for single-section units and for multi-section units, it is necessary to check both wind and seismic to determine which force controls. These horizontal forces are resisted by connection of the unit to anchors along the exterior walls, plus any additional interior transverse

Example 1:	(14) A set of the s
	Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)
Single-Section	2 Wind Seismic Ground 4
16 Width Short Walls	Speed $3$ Aa Snow Locationength (it)
Short wans	(mph) (psf) 40 50 60 70 80 90 100
	Coastal 80 05-30 0-100 end 480 600 720 830 950 1070 1190
	<u></u>
ት ት ት	90 All Seismic end 600 760 910 1060 1210 1360 1510
	100 All Seismic end 750 930 1120 1310 1490 1680 1870
	110 All Seismic end 900 1130 1350 1580 1810 2030 2260

## Example 2:

	Required Horizo	ntal Anchor	age - Al	i - Tra	nsvers	se Din	ection	(lbs/ft	t)		
ि 🕄	Wind Seismic	Ground			5			. •		Multi-Section	1 <b>€,E,I</b> ,I
Ē	Specd <u>Aa</u>	Snow Locati	กก		<u>ل</u>	ngth (fi)	n nin N		25	Width	14
1	(mgh)	(psf)	40	50	60	70	80	90	100	Short Walls	4
	Inland 80 05.20		90	120	140	160	190	210	230	· · · · ·	
l		int	180	230		320	370	420	470		
		0-60 cnd	90	120	<u>80</u>	160	190	210	230		
			180	230	80	320	370	420	470		
	4	int 70 end	300	120	40	170	190	210	230 470	- 恭	<u>.    </u>
	Ų į	int	190	240	30	330	380	210 420	470		
		80 end	HAL	330	<b>1</b>	180	200	230	250	- 日本	5. E
		int	210	260	210	360	<b>H</b> 10	460	510		
		90 end	王10	140	<b>10</b>	190	220	250	280	·	
		int	220	-280	<u>, 50</u>	390	颒	300	550		
		100 end	120	130	\$0	210	240	270 530	300		
		int	240	-300	E 60	420	<b>780</b>	530	<u>.590</u> 230	·	
	.40	40 end	90	120	40	160	190	210			
	· • • • • • • •	int	180	230	180	320	370	420	470		
	· · ·	50 end		130		130	210	230	260		
		int	2.0	250	誕	360	<u>#10</u>	260	<u> 310</u>		
		60 end	120	140		200		200	280		
		int int	220	_ 290		4.3,	460	210	-24		
		70 - enu	100	+10.74 =320	190	1.1	250	280	SU		
· · ·	-	int int	2015	<u>=320</u>	<u>380</u> 210	1 440 240	<u>1000</u>	560	0.01		
		80 end	341	170			270	310	(9 <b>4</b> 0)		
	-	int	Zolt	340	410	480	550	610	000		
		and the second second									

walls; or by connection of the unit to a combination of exterior and interior vertical planes of X-bracing at pier locations. Interior transverse walls may be either full height or short of the chassis beams and completed with some form of diagonal bracing. See illustration of options in Appendix C.

**B.** Determine Design Ground Snow Load. This step has been done in section 600-3 and is only required for multi-section units, where it may influence seismic values.

**C.** Determine Design Wind Speed. This step has been done in section 600-4, and is required for single-section and multi-section units.

**D.** Determine Design Seismic Ground Acceleration Values and Required Seismic Performance Category. This step has been done in section 600-5 and is required for single-section and multi-section units.

E. Determine Horizontal Anchorage (Ah) in the Transverse Direction from the Tables. Refer to Appendix B, Part 3 of the Foundation Design Load Tables. Several steps must be followed to arrive at the Required Horizontal Anchorage in the Transverse Direction:

> Select the correct Table based on single-section or multi-section unit, nominal unit width of 12, 14 or 16 feet, and whether 2, 4, or 6 transverse walls (the handbook has limited the number of transverse walls to 6). Note that the foundation type does not influence the required horizontal anchorage force, thus the heading for all the Tables read: Type C, E or I.

2. Enter the selected Table at the far left and move down either the Inland or Coastal wind speed column, as appropriate, until the required MPH value is reached. Slide to the next column to the right within the block of numbers covered by that wind speed.

- 3. Select the next smaller block of numbers based on the required seismic (<u>Aa</u>). Move to the right to the next column and locate the required ground snow load. The seismic (<u>Aa</u>) and ground snow load columns will in many cases include a range of values (i.e. .05-.30, or 0-100 psf respectively, which means that the group of values covers all values in that range). These column movements define a unique pair of rows of values taking into account wind and seismic lateral forces.
- 4. Move to the right until the column for the known unit length is The intersection of that reached. column and the already located rows represents the correct horizontal anchorage values (Ah) for design in (lbs./ft.). If the values are grayed, seismic controlled the magnitude of the values. In the case of two transverse walls, they will be located at the ends of the unit. The Location column in the Table will state end. If 4 or 6 transverse walls are selected, there will be two rows of values: one for end walls and one for interior walls.
- help: Choosing the number of transverse foundation walls. As a

guide, increasing the number of transverse foundation walls reduces the force per anchor/connection and permits an increased spacing between anchors. Thus, the user should begin with the fewest number of transverse walls - two (2). Comparison of (Ah) with the horizontal anchorage capacities in Appendix C can be simultaneously verified during the completion of the Design Worksheet (Appendix F). A greater number of transverse foundation walls (4 or 6)

may be required. Multi-section units may be stable enough so that only two transverse foundation walls are required. Long, narrow single-section units, or units in windy or high seismic areas, may require more than two transverse walls.

F. Comparison with Manufacturer's Values (Optional). The value for the horizontal anchorage force required for design in the transverse direction must be compared to the value supplied by the manufacturer. The manu-





Figure 6 - 8

facturer's horizontal anchorage value must be equal to or greater than the horizontal anchorage requirements from the Tables. See the Manufacturer's Worksheet, item # 16(c) and example number 1 in Appendix G.

G. Horizontal Anchorage with Diagonal bracing atop transverse shear walls or complete Vertical X-Bracing planes. Diagonal members may be used to complete transverse walls that stop at the underside of the chassis beams, or complete X-bracing can be used in lieu of shear walls for transverse foundation walls. Refer to the Transverse Foundation Wall Concepts for Types C, E and I in Appendix A, and example number 2 in Appendix G.

- 1. To use diagonal steel straps or wood diagonals to complete the transverse foundation walls. The required Horizontal Anchorage Table value of (Ah) for single-section or multi-section units must be converted to a diagonal tension ( $T_t$ ) to size the strap.
  - a. Multiply the required (Ah) by (Wt) to calculate the total horizontal force at the transverse wall under a pair of chassis beams. Note: two sets of diagonals, using this force, are required for multi-section units.
  - b. Divide this value by the cosine of the angle of the diagonal to arrive at the tension  $(T_t)$  in the diagonal. See Figure 6-10 for an illustration of this condition. The equation is as follows:

 $T_t = \frac{Ah \times Wt}{\cos \theta_t}$ 

- To use Vertical X-Bracing Planes with steel straps or rods instead of transverse foundation walls. This method is possible for Foundation Concepts C1, C2, E1, E3 and E4 only. The required Horizontal Anchorage Table value of (Ah) must be modified as follows:
  - a. Select the required (Ah) value from the Table for two (2) transverse foundation walls for single-section or multi-section units.
  - b. Multiply (Ah) times (Wt), regardless if single-section or multi-section unit and then multiply that by 2. Finally divide that total by the unit length (L) to generate a horizontal force (H) in pounds per foot of unit length. The equation follows:

# H (lbs./ft. of length) = $\frac{Ah \times Wt \times 2}{I}$

c. Multiply (H), horizontal force, by the spacing between vertical X-bracing planes to determine the horizontal force (C) to be resisted at each X-brace location. Thus, for multi-section units (C) is the applied force at both X-bracing locations in the vertical plane. This spacing should be some multiple of the pier spacing. The equation follows:  $C (lbs./X-brace) = H \times spacing$ 

 d. Divide (C), horizontal force, by the cosine of the angle of the diagonals as illustrated in Figure 6-10, to arrive at the required diagonal tension force in pounds. The equation follows:

$$T_t$$
 (lbs/diagonal) =  $\frac{C}{\cos\theta_t}$ 

e. Compare the required tension force  $(T_t)$  and the required horizontal force per X-brace (C) with the rated capacities supplied by the manufacturer in the Manufacturer's Worksheet, items #16(c and e). See Figures 6-4 and 6-5 for illustrations.

602-6 REQUIRED HORIZONTAL AN-CHORAGE (Ah) IN THE LONGITUDI-NAL DIRECTION (APPENDIX B, PART 4).

A. General. The attachment of the unit to the foundation must provide sufficient structural anchorage for the manufactured home to resist sliding forces due to wind pressures and suctions, or seismic inertia forces, whichever controls. Analysis, based on the conservative assumptions used in this handbook, has shown that wind or seismic may control in the longitudinal direction for singlesection or multi-section units, thus it is necessary to check both wind and seismic for all units. These horizontal forces are resisted by connection of the unit to anchors in the exterior longitudinal walls, or by connection of the unit to vertical planes of X-bracing under and along the chassis beams (between piers).

**B.** Determine Design Ground Snow Load. This step has been done in section 600-3 and is required for single-section or multi-section units.

**C.** Determine Design Wind Speed. This step has been done in section 600-4 and is required for single-section or multi-section units.

**D.** Determine Design Seismic Ground Acceleration Values and Required Seismic Performance Category. This step has been done in section 600-5 and is required for single-section or multi-section units.

E. Determine Design Horizontal Anchorage (Ah) in the Longitudinal Direction from the Tables. Refer to Appendix B, Part 4 of the Foundation Design Load Tables. Several steps must be followed to arrive at the Required Horizontal Anchorage in the Longitudinal Direction:

- Select the correct Table based on single-section or multi-section unit and nominal unit width (Wt) of 12, 14 or 16 feet. Note that the foundation type does not influence the required horizontal anchorage force in the longitudinal direction, thus the heading for the Tables read: Type C, E or I.
- 2. Enter the selected Table and move down the left-most column until the required Seismic (<u>Aa</u>) value is reached. This defines a large block of values. Move to the right to the next column and locate the required ground snow load. This defines a smaller block of values. Move to the next column to the right and locate the inland or coastal block of

values and lastly find the required wind speed within that same column. This now defines a single row of values that represents comparison of seismic and wind effects.

3. Select the column which represents the length of the unit. The intersection of that column and the already determined row locates the required horizontal anchorage value (Ah) in the longitudinal direction along two lines; either the two exterior longitudinal walls for Type E or I or along the two exterior chassis beams for Type C.

Help: for Type E or I units, longitudinal exterior walls will exist, and will suffice as shear walls in the longitudinal direction. See example number 1 in Appendix G. For Type C units, vertical X-bracing planes under and along the exterior chassis

#### Example 1:

ſ

	Required H	orizontal	Anchorag	e - A	h - Lo	ngitud	linal I	Directi	on (lb	s/ft)
2	Sesmic Grou	w Sp	ind eed			3 L	ength (ft)	3		-
· . '	(psf	<u> </u>	<u>ph)</u>	_40	50	60	70	80	.90	100
	.0510 0-10	0 Inland	80	41	33	-76-	23	20	18	16
			90	52	41	35	30	26	23	21
		•	100	64	51	49	37	32	28	26
		Coastal	110		62	<u></u>		_ 39	34	31
		Coastai		45	36	<b>2</b>	26	23	20	18
					46	- 50	33	29	25	23
				/I 95	20	47	40	35	31	28
				85	68	27	49	43	38	34



Multi-Section Width

## Example 2:

Required Horizontal Anchorage - Ah - Longitudinal Direction (lbs/ft)

	_				-								
2	Seimic Aa	Ground Snow	W Sp	ind eed			3	Length					
	<u> </u>	(psf)		ph)	40	50	60	(ft) 70	80.	. 90	100		
	.40	0 30	Inland	80	100	<b>52</b> 2	ŤЙ	97	92	92	92		
	L		ļ	<b>9</b> 0	127	101	221	921	92	025	92		
				100	156	125	104	0)?	62	02	503		
				. 110	189	151	126	108 108	94	92:	:021		
			Coastal	80	110	1924 112	Z 24	-07	97	92	192		
				90	139	112	13	:07	52	<b>6</b> 7	107		
			:	100	172	138	115	98 98	92 92	921	0.5		
				110	208	167	119	119	104	93	-07		
		40	Inland	80-100	180	T80	110	1804	1202	180	130		
				110		1804	a lo	<b>TS0</b>	1801	180	180		
			Coastal	80-100	150	180	710	180	1801	180	180		
				110	208	1805	6-03	180	180	1180	187		
		0 .	Inland	80-110	202	202	202	202	202	202	202		
			Coastal	80-100	202	202	202	2021	202	202	202		
		↓ ·		110	208	202	26	202	202	207	507		
		<b>60</b>	Ally	Vind 1	2741	222	24-	224	1224	274	274		
		70	All V	Vind	×241+	-24.5	247	247	242	247	247		
		<u>80</u>	L'UN	Vind	2691	2691	2001	269	262	269	269		
		90		Vind	29E	7291	29E	29H	203	201	201		
		100	All V	Vind	313	313	313	311	313	313	513		

beam lines (between piers) are required. See Section 602-6.F for guidance.

F. Horizontal Anchorage with Xbracing for the Longitudinal Direction. Diagonal members under and along the exterior chassis beams may also be used in lieu of exterior longitudinal shear walls. If galvanized steel diagonal members are used instead of full height exterior foundation walls, the required Horizontal Anchorage Table value of (Ah) must be modified as follows:

- 1. Select the required (Ah) value from the Tables in Part 4, Appendix B for single-section or multi-section units.
- 2. Multiply (Ah) times the manufactured home unit length (L) and divide by the selected number of Xbrace locations (n) along one exterior chassis beam to generate the total horizontal force (B) to be resisted at each X-brace location along each chassis beam for singlesection units, and along each exte-

rior chassis beam for multi-section units. As an example, there are three (n = 3) X-brace locations along each chassis beam for the single-section unit in Figure 6-6. The equation follows:

$$B(lbs./X-brace) = \frac{Ah \times L}{n}$$

**Note:** For multi-section units using all four (4) chassis beam lines as vertical X-bracing lines, divide the above equation by 2 (see Fig.D-26 for an example).

3. Divide (B) by the cosine of the angle of the diagonals as illustrated in Figure 6-11, to arrive at the required diagonal tension force in pounds. The equation follows:

$$T_{L}$$
 (lbs./diagonal) =  $\frac{B}{\cos\theta_{L}}$ 

4. Compare the required tension force  $(T_L)$  and the horizontal force to each



Horizontal Anchorage with X-bracing - Longitudinal Direction Figure 6 - 11 X-brace (B) with the rated capacities supplied by the manufacturer in the Manufacturer's Worksheet, items #16(c and e), or supplied by another vendor.

## 603. USING THE FOUNDATION CAPACITIES TABLES (APPEN-DIX C)

**603-1. GENERAL.** The Foundation Capacities Tables in Appendix C will be used to find the required size and depth of footings, the required sizes and spacing of anchors, and necessary reinforcement. There are three conditions that will be investigated: 1) Vertical Anchorage (uplift and overturning) requirements for longitudinal foundation walls and piers, 2) Horizontal Anchorage (sliding) in the transverse direction (for transverse foundation walls that function as shear walls), and 3) Horizontal Anchorage (sliding) in the longitudinal direction (for longitudinal foundation walls that function as shear walls).

## 603-2. REQUIRED VERTICAL AN-CHORAGE: LONGITUDINAL FOUNDA-TION WALLS AND PIERS

A. Determining Footing Depth for Longitudinal Foundation Walls and Piers. This involves selecting sufficient counterweight of material dead loads (wall or pier, footing and soil) to resist the required uplift. The field officer determines how deep the footings must be placed. In frost-prone areas, the footing must at least be placed below the extreme frost depth below grade (map, page H-4). In windy or seismic areas, it may also be necessary to place the footing deeper in the soil than frost protection alone would require. Burying the footing deeper gives it greater withdrawal resistance--it is harder to pull it out of the soil.

**B.** Determine Required Withdrawal Resistance. It is necessary to compare the values obtained from the Foundation Design Load Table for (Av) with Tables C-1 or C-2 of Appendix C.

- 1. For longitudinal foundation walls, compare the required value for (Av) with the numbers in the columns in Table C-1 (for foundation Type E).
  - a. Find a number in the table that is greater than (Av). There may be several numbers that meet this criteria.
  - b. Any number that is greater than (Av) means that the foundation type and footing width (found at the top of the column) can be used. The number (hw) in the column on the left indicates how deep the footing should be placed to resist the uplift and overturning force. Example calculations are included in Appendix C if alternate footing widths are desired.
- For isolated pier foundations and concrete tie-down blocks (Concept Type C1), compare the value for the required (Av) with the numbers in the columns in Table C-2 (for foundation Types C or I and type E with 4 tie downs).
  - a. Find a number in the table that is greater than (Av). There may

be several numbers that meet this criteria.

b. Any number that is greater than (Av) means that the width of the square footing (found at the top of the column) can be used. The number hw in the left-hand column indicates how deep the footing should be placed to provide adequate withdrawal resistance. Example calculations are included in Appendix C if alternate footing widths are desired. The same Table C-2 can conservatively be used for oncrete deadman footing sizes for concept Type C1.

**C. Foundation System Verification.** The HUD field office should verify that the foundation system selected has sufficient depth to withstand uplift. Regardless of the required depth for uplift or overturning, the footing must always be placed below the extreme frost depth below grade.

**D.** Determine Required Anchorage and Reinforcement for Longitudinal Foundation Walls and Piers. The field officer will now verify the kinds of anchorage (steel anchor bolts) and reinforcement (steel reinforcing bars) that will be needed to tie together the footing, wall or pier, and the unit itself. The field officer will refer to Table C-3: Vertical Anchor Capacity for Piers and Table C-4A or C-4B: Vertical Anchor Capacity for Longitudinal Foundation Walls (Appendix C).

1. For piers, use Table C-3.

a. Compare the required value of (Av) with the capacity numbers.

- b. Find a capacity number that is greater than the required value for (Av). The number of anchor bolts is listed at the top of the column. The diameter of the anchor bolt is listed in the left column.
- c. Move to Table C-3A to find the reinforcing size, lap splice, and reinforcing-bar hook requirements, based on the anchor bolt diameter selected in Table C-3.
- d. Refer to the illustration next to Table C-2 for the required footing reinforcement.
- e. Refer to the Foundation Type C1 (Appendix A) Design Concept for the tie-down bar size.
- f. Sample calculations are included in Appendix C if alternate reinforcement sizes, spacings or material grades are desired.
- 2. For longitudinal foundation walls, start with Table C-4A for concrete or concrete masonry walls, or C-4B for a treated wood wall.
  - a. Compare the required value for (Av) with the numbers in the left hand column of Table C-4.
  - b. Find a number that is greater than the required (Av).
    - c. Read across the column and find:
- 1) For masonry and concrete foundations (Table C-4A):
  - (a) Anchor bolt size and spacing.
  - (b) From Table C-3A, reinforcing-bar size, lap splice, and hook length.
  - 2) For treated wood foundations (Table C-4B):
    - (a) The required nailing.
    - (b) The minimum plywood nailer thickness.
    - (c) The required anchor bolt size and spacing.
  - Example calculations are included in Appendix C if alternate reinforcement sizes, spacings or material grades are desired.

## 603-3. REQUIRED HORIZONTAL AN-CHORAGE: TRANSVERSE FOUNDA-TION WALLS

A. Horizontal Anchorage in the Transverse Direction. This involves connections to avoid sliding between the unit and its foundation. The field officer will compare the required value for (Ah) with Tables C-5 of Appendix C: Horizontal Anchor Capacity for Transverse or Longitudinal Foundation Walls. See example number 1 in Appendix G.

1. Compare the required value for (Ah) with the numbers in the left hand column of Table C-5A or C-5B.

- 2. Find a number that is greater than the required (Ah).
- 3. If none of the numbers is greater than (Ah), go back to Section 602-5.E and increase the number of transverse foundation walls until the required value of (Ah) is small enough to be used in the Horizontal Anchor Capacities Tables C-5A or C-5B.
- 4. The required anchorage for the transverse foundation wall can be read across the columns for:
  - a. Masonry and Concrete Foundations (Table C-5A):
    - 1) Anchor bolt diameter.
    - 2) Reinforcing bar size.
    - 3) Anchor bolt spacing.
    - 4) Based on the anchor bolt size, refer back to Table C-3A to obtain the following values:
      - (a) Minimum lap splice.
      - (b) Reinforcing bar hook.
  - b. Treated Wood Foundations (Table C-5B):
    - 1) Required nailing.
    - 2) Minimum plywood nailer thickness.
    - 3) Anchor bolt diameter.

#### 4) Anchor bolt spacing.

5. Example calculations are included in Appendix C if alternate reinforcement sizes, spacings or material grades are desired.

#### 603-4 REQUIRED HORIZONTAL AN-CHORAGE: LONGITUDINAL FOUNDA-TION WALLS

A. Horizontal Anchorage in the Longitudinal Direction. This involves connections to avoid sliding between the unit and its foundation in the longitudinal direction. The field officer will check compliance with the required value for (Ah) in the longitudinal direction with Tables C-5 of Appendix C: Horizontal Anchor Capacity for Transverse or Longitudinal Foundation Walls. The process is identical with that of section 603-3 for transverse walls and will not be repeated here. See example number 1 in Appendix G.

#### 603-5 DIAGONALS USED TO COM-PLETE TRANSVERSE WALLS

A. Horizontal Anchorage. Determine the required horizontal anchorage force by multiplying the required (Ah) by the unit width (Wt). Reference section 602-5.G.1.a and Figure 6-10 for the required horizontal force (Ah)  $\times$ (Wt).

- Compare this value with the bottom number in the left hand column of Table C-5A. The capacity listed for 1/2" bolts at a 12" spacing is equal to the single-bolt capacity for horizontal anchorage of diagonals.
- 2. Divide  $(Ah) \times (Wt)$  by the number in the table to determine the number

of bolts required for diagonal anchorage.

603-6 REQUIRED VERTICAL X-BRACING PLANES IN THE TRANS-VERSE AND/OR LONGITUDINAL DI-RECTIONS IN PLACE OF TRANSVERSE WALLS

A. Horizontal Anchorage with Diagonal Members. This involves connection of the ends of the diagonal straps to the unit and to the foundation. The HUD Field Office will compare the required horizontal anchorage value at each diagonal with Table C-5A of Appendix C to verify adequacy of connection between diagonal and footing. See example number 2 in Appendix G.

- 1. *Transverse Direction*. Use the horizontal anchorage force (C) per diagonal found in section 602-5.G.2.c and Figure 6-10.
  - a. Compare the value for (C) with the bottom number in the left hand column of Table C-5A. The capacity listed for 1/2" bolts at a 12" spacing is equal to the single-bolt capacity for anchorage of diagonals.
  - b. Divide (C) by the number in the table to determine the number of bolts required for diagonal an-chorage.
  - c. Refer back to Table C-3A, to obtain the following value.
    - 1) Minimum lap splice.
    - 2) Reinforcing bar hook.

- 2. Longitudinal Direction. Use the horizontal anchorage force (B) per diagonal found in section 602-6.F and Figure 6-11..
- a. Repeat steps (a.) to (c.) as for the transverse direction, using (B) instead of (C).

**603-7. CONCLUSION.** Values for the verification of the manufactured home foundation have now been obtained.

с. С

## **CHAPTER 7 - FINAL CHECK**

700. GENERAL. Design values determined for the foundation sizes and detailing, that have been derived using procedures in the preceding chapters, will now be summarized. Follow the procedure near the end of the Design Worksheet of Appendix F for assembling relevant foundation information.

#### 700-1. BEARING AREA AND VERTI-CAL ANCHORAGE.

A. Pier Footings and Piers under Chassis Beams.

- 1. Determine the area required for pier footings by comparing two values:
  - a. The Required Effective Footing Area (Aftg).

b. The Required Footing Area to resist overturning and uplift from withdrawal capacities found in Appendix C, where required.

2. Select the largest of the above two values. This value will determine the Pier Footing Size. The size and spacing of anchor bolts and the selection of reinforcing bar size, lap splice length, and reinforcing bar hook length for the piers has already been determined. The depth of the footings for frost and for withdrawal (where required) has also been determined. Bring these values forward. **B.** Pier Footings and and Piers under Marriage Walls. Marriage walls only occur in multi-section units. Their piers only carry gravity loads and never participate in uplift or sliding. There are two pier situations that may occur at marriage walls: (1) the marriage wall is continuous without openings, or (2) there are locations where large openings in the marriage wall are intended to enlarge a room's space.

- 1. Where marriage walls are continuous: determine the area required for pier footings by using one value:
  - a. The Required Effective Footing Area (Aftg) for marriage wall piers from the multi-section unit Foundation Design Tables in Appendix B.
  - b. The piers are assumed equally spaced under the continuous portion of the wall.
- 2. Where marriage walls have a large opening: determine the area required for piers at the ends of the opening by using one value:
  - a. The Required Effective Footing Area (Aftg) for marriage wall piers from the bottom of each multi-section unit Foundation Design Table in Appendix B by using the length of the opening.
- b. These piers are located at the ends of the opening directly under the

posts that support the beam at the top of the opening.

### C. Longitudinal Foundation Wall Footings and Longitudinal Foundation Walls.

- Determine the correct footing size for longitudinal foundation walls, Types E & I, by comparing two values:
  - a. The Required Effective footing width (Aftg).
  - b. The Required footing width to resist uplift and overturning from the withdrawal capacities found in Appendix C, where required.
- 2. Select the largest of the above two values and use it as the appropriate footing size.
- 3. The foundation system brought forward can either be wood, concrete or masonry.
- 4. Bring forward values for the wall and footing as follows:
  - a. Depth of footing
  - b. Reinforcing bar size
  - c. Lap splice length
  - d. Reinforcing bar hook length
  - e. Size and spacing of anchor bolts
  - f. Treated wood foundation nailing requirements

#### 700-2. HORIZONTAL ANCHORAGE IN THE TRANSVERSE DIRECTION: TRANSVERSE FOUNDATION WALLS.

A. Transverse Foundation Walls: Exterior (at unit ends) and Interior (to Underside of Chassis).

- 1. The number of transverse walls, wall footing sizes, anchorage requirements and foundation wall reinforcement have been determined to resist sliding, based on capacities found in Appendix C. Bring all these values forward where continuous transverse foundation walls are used.
- 2. The foundation system brought forward can either be wood, concrete or concrete masonry.

#### **B.** Transverse Foundation Walls Completed with Diagonal Braces.

- 1. Connection sizes and anchorage requirements have been determined. Bring these values forward where transverse foundation walls are completed with diagonal braces.
- 2. The foundation wall system brought forward can be only concrete or masonry. The galvanized steel diagonal straps connect to the top of chassis beams under the unit and to the top of masonry or concrete wall option selected.

C. Vertical X-Bracing Planes in Lieu of Walls. This applies only to Concept Design Types C1, C2, E1, E3 and E4 for either single or multi-section units.

- Number, spacing and detailing information has been determined. Bring these values forward where vertical X-bracing planes are used.
- 2. The foundation system brought forward can be only galvanized steel diagonal straps connected to the top of chassis beams under the unit and to the top of concrete footings.

## 700-3 HORIZONTAL ANCHORAGE IN THE LONGITUDINAL DIRECTION: LONGITUDINAL FOUNDATION WALLS.

#### A. Longitudinal Exterior Foundation Walls - Type E or I Units.

- Connection sizes and anchorage requirements have been determined based on capacities found in Appendix C. Bring these values forward where longitudinal exterior foundation walls are used.
- 2. The foundation system brought forward can be wood, concrete or masonry.

## B. Vertical X-Bracing Planes under Chassis Beam Lines-Type C Units Only.

- Number, spacing and detailing information has been determined. Bring these values forward where vertical X-bracing planes are used.
- 2. The foundation system brought forward can by only galvanized steel diagonal straps connected to the bottom of chassis beams under

the unit and to the top of concrete footings.

701. FINAL APPROVAL. All considerations important in the installation of the manufactured home should have been checked. If answers fall within the boundaries of this document, the foundation may be approved.  $\frac{1}{2} \left( \frac{1}{2} - \frac{1}{2} \right) = \frac{1}{2} \left( \frac{1}{2} - \frac{1}{2} \right) \left( \frac{1}{2}$ 

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## APPENDIX A FOUNDATION DESIGN CONCEPT SELECTION

**A-100. GENERAL.** The foundation systems presented in this section were condensed from over 40 systems submitted by the manufactured housing industry. When a number of systems were similar in their detailing and the way they distributed loads, the system that was most representative of that group was selected for presentation in this section. Many variations from the detailing shown here are possible.

Some of the original systems are not included. The most common reason for rejecting a foundation system was lack of positive vertical anchorage. The superstructures of manufactured homes are too light to rely upon their mass to provide all resistance to overturning and uplift and must rely on the assist of their foundation to achieve adequate resistance.

**A-100.1. IDENTIFICATION** OF AC-CEPTABLE FOUNDATION DESIGN CONCEPTS. The foundation systems are organized by the pattern of superstructure support and vertical anchorage. These two issues have been used to characterize the types of systems used in the Foundation tables: Types C, E, and I. There are no Type I systems presented in this chapter only because none were submitted by the industry for consideration. Type I systems were included in the Foundation Design tables due to their potential use. Their absence is not intended to imply that such systems are not viable, only that none are currently in use.

A-100.2. DELETIONS FROM THE FIRST EDITION. Concept E2 was deleted from this revision. It does not meet the permanent foundation criteria outlined in section 100-1.C. Specifically concrete footings are required for all foundation systems. It has been left in this Appendix but crossed out as a reminder to field officers of its inability to perform to the standard of this document.

A-100.3. LOADS THAT GOVERN. In many cases, the wind forces govern over seismic inertia forces in the design of foundation systems for manufactured homes. However, there are high seismic activity areas where seismic inertia forces control over wind. The detailing of some systems is better suited to regions with such high seismic activity. The selection of systems suitable for use in high seismic regions is based upon complete continuity in the connections between the superstructure and the foundation (and all its parts).

A-100.4. ECONOMIC FACTORS. Economics are not addressed in identifying the regional applicability of the different systems. Some systems would become economically unfeasible in regions with higher wind loads due to the size and depth required for their elements to provide anchorage. It is assumed that those who use this handbook as a design tool will discover the economic limitations of specific foundation systems on a case by case basis.

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

Foundation Type	Hig	h Wind 2	Zone		ieering I Require		Se	ismic Zo	one	Frost Zone
	All	Some	None	Yes	No	Maybe	All	Some	None	
C1 Reinforced ma- sonry piers w/wire tie-downs & diagonal tie		X				X		X		
C2 Reinforced ma- sonry or concrete piers	X				X		X			<b>X</b>
C3 Isolated deep piers	X			X			X			X
C4 Mat slab w/isolated piers	X			X			X			X
E1 Reinforced pe- rimeter wall, un- reinforced piers at chassis			X		X			X		X
E2 Treated wood perimeter wall on gravel, unan chored metal piers	D	ELETE See E8	X D		X			X		X
E3 Reinforced ma- sonry or concrete perimeter walls & piers	X				X		X			X

# Table A - 1 FOUNDATION SELECTION TABLE

A - 2

Foundation Type	Hig	h Wind :	Zone	Engi	neering I Require		<b>S</b>	eismic Zo	one	Frost Zone
	All	Some	None	Yes	No	Maybe	All	Some	None	1
E4 Reinforced pe- rimeter walls & piers w/transverse footings	X					X	X			X
E5 Reinforced pe- rimeter basement wall w/transverse steel girders	X					ан 1 <b>Х</b> 1 <b>Х</b> 1 ал	X			X
E6 Perimeter grade beam on deep piers w/transverse steel girders	X			X						x
E7 Reinforced con- crete perimeter wall w/transverse steel girders	X					X	X	. A -		X
E8 Treated wood perimeter wall on concrete footing w/unanchored metal pier			X			X		X		X



\* SEE APPENDIX C FOR PLYWOOD NAILING REQUIREMENTS

FOUNDATION TYPE Reinforced masonry piers w/ wire tie downs and d	iagonal tie		SYSTEM NUMBER
SUPERSTRUCTURE TYPE		 	01
Chassis supported single-wide			

#### SINGLE-WIDE



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



## **C**1

TABLES

Use single-wide Type C for required footing areas ( $A_{ftg}$ ). Use single-wide Type C1 for vertical anchorage ( $A_v$ ). Use single-wide Type C, E, I for transverse and longitudinal sliding anchorage ( $A_h$ ).

#### **REGIONAL APPLICATIONS**

1. Requires installation by qualified installers.

2. Not suitable for high wind conditions and seismic  $A_v \ge 0.3$ . Requires design by registered engineer.

3. Not suitable for high frost penetration depth.

#### NOTES

- 1. Anchoring device is a 3/4" diameter hot dipped galvanized steel rod embedded into a block of concrete. Refer to Appendix B and C for concrete block size and depth.
- 2. Capacity of diagonal wires is most effective when located at manufactured home end and interior transverse shear walls which should align with chassis beam pier locations.
- 3. Guidance for design of transverse and longitudinal x-bracing options to resist sliding is found in Figures 6-4 and 6-10 and Figures 6-6 and 6-11 respectively. Requires design and detailing by a registered engineer.
- 4. Screw-in-ground anchors are not permitted as permanent foundation anchorage.

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#### SINGLE-WIDE

#### **MULTI-WIDE**





BUILDING SECTION BUILDING SECTION

FOUNDATION TYPE Reinforced masonry or concrete piers	SYSTEM NUMBER
SUPERSTRUCTURE TYPE	
Chassis supported single- and multi-wide	



FOUNDATION SHEAR WALL

C2

#### TABLES

Use C tables for required effective footing area (Aftg) for single-wide and multi-wide units. Use Cnw tables if there are no marriage wall piers.

Use C tables for vertical anchorage (A<sub>v</sub>).

Use C, E, I tables for transverse and longitudinal sliding anchorage  $(A_h)$  for single-wide and multi-wide units.

#### **REGIONAL APPLICATIONS**

1. Suitable for all seismic zones with proper footing size and depth.

2. Suitable for all wind regions with proper footing size and depth.

3. Suitable in areas with high frost penetration with proper footing depth.

NOTES

- 1. Chassis may be anchored to resist overturning and uplift either with anchor bolt with clamps, as pictured, or weld plates as shown in system C3.
- 2. Horizontal sliding in the transverse direction can be resisted by foundation shear walls as shown, or alternately by several x-bracing options shown in Figures 6-4 and 6-10.
- 3. Horizontal sliding in the longitudinal direction is best accommodated with pairs of x-bracing as shown in Figures 6-6 and 6-11.

4. Design details for items 2 and 3 shall be prepared by a registered engineer.

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#### FOUNDATION PLAN

#### FOUNDATION PLAN



## SINGLE-WIDE

## MULTI-WIDE

SYSTEM NUMBER
C3





TRANSVERSE END CHASSIS PIER EXTERIOR AND INTERIOR CHASSIS PIERS

MARRIAGE WALL PIER

## **C3**

#### TABLES

Use C tables for required effective footing area ( $A_{ftg}$ ) for single-wide and multi-wide units. Use Cnw tables if there are no marriage wall piers.

Use C tables for vertical anchorage  $(A_v)$ .

Use C, E, I tables for transverse and longitudinal sliding anchorage (A<sub>h</sub>) for single-wide and multi-wide units.

#### REGIONAL APPLICATIONS

1. Suitable in permafrost conditions with non-insulated side enclosures.

2. Suitable in any wind or seismic region with proper design.

- 3. Suitable in areas with high frost penetration with proper footing depth.
- 4. Design of piers by registered architect or engineer required in allcases. Piers to resist horizontal sliding in transverse and longitudinal directions (A<sub>h</sub>) by bending resistance and interaction with the soil.

#### ACCEPTABLE ALTERNATIVES

1. Chassis may be anchored either with weld plate as pictured, or anchor bolts with clamps as in system C2. as shown in system C3.

FOUNDATION TYPE Mat slab w/ isolated piers	SYSTEM NUMBER
SUPERSTRUCTURE TYPE Chassis supported single-wide	<b>C</b> 4





FOUNDATION PLAN



FOUNDATION TYPE Mat slab w/ isolated piers	 		• •	SYSTEM NUMBER
SUPERSTRUCTURE TYPE Chassis supported single-wide	···· · ·	. :		<b>C</b> 4



## **C**4

#### TABLES

Use C tables for required effective footing area  $(A_{ftg})$  for single-wide and multi-wide units. Use Cnw tables if there are no marriage wall piers. Use C tables for vertical anchorage  $(A_v)$ . Use C, E, I tables for transverse and longitudinal sliding anchorage  $(A_p)$  for

single-wide and multi-wide units.

#### **REGIONAL APPLICATIONS**

1. Useful in poor soil conditions with proper design by registered architect or engineer.

2. Suitable in any wind or seismic region with proper design.

3. Suitable in areas with high frost penetration with proper footing depth.

4. Design by registered architect or engineer required in all cases.

#### ACCEPTABLE ALTERNATIVES

1. Chassis may be anchored either with weld plate as pictured, or anchor bolts with clamps as in system C2.



SUPERSTRUCTURE TYPE Exterior anchored, chassis supported single- and multi-wide

Reinforced perimeter wall, unreinforced piers at chassis

FOUNDATION TYPE

SYSTEM NUMBER H



## **E1**

#### TABLE 3

Use type E, I tables for required effective footing area (Aftg) for single-wide or multi-wide units.

Use type E tables for vertical anchorage (Av) for single and multi-wide units.

Use type C, E, I tables for transverse and longitudinal sliding anchorage (A h) for single-wide and multi-wide units.

#### **REGIONAL APPLICATIONS**

1. Requires solid concrete or fully grouted block and sufficient depth in coastal regions with wind speed (V) greater than 90 mph.

- 2. Not recommended in seismic areas  $A_v = 0.3$  or 0.4 unless use reinforced piers.
- 3. Suitable in areas with high frost penetration with proper footing depth.
- 4. Suitable for most "normal" soil conditions.

#### ACCEPTABLE ALTERNATIVES

1. Treated wood perimeter wall anchored to concrete spread footing.

#### NOTES

- 1. Horizontal sliding in the transverse direction can be resisted by foundation shear walls as shown in plan, or alternately by several x-bracing options shown in Figures 6-4 and 6-10.
- 2. Horizontal sliding in the longitudinal direction is best accommodated by the exterior walls as shear walls.
- 3. Design details for item 1 shall be prepared by a registered engineer.





SYSTEM CANNOT BE USED-NOT A PERMANENT FOUNDATION

FOUNDATION TYPE	· · · · · · · · · · · · · · · · · · ·		SYSTEM
Reinforced masonry or concrete perimeter walls and piers	· · · ·		NUMBER
SUPERSTRUCTURE TYPE			100
Exterior and chassis anchored single- or multi-wide			E3
		·	



#### MULTI-WIDE



A - 17



END TRANSVERSE FOUNDATION SHEAR WALL LONGITUDINAL FOUNDATION SHEAR WALL CHASSIS PIER

MARRIAGE WALL PIER

PIER

## Ë3

#### TABLES

Use type E, I tables for required effective footing area ( $A_{ftg}$ ) for single-wide and multi-wide units. For vertical anchorage ( $A_v$ ) for single-wide units use Type E3 table.

For vertical anchorage (A<sub>v</sub>) for multi-wide units use Type E and apply magnitude at exterior pier, and also to interior pier.

Use type C, E, I tables for transverse and longitudinal sliding anchorage (A h) for single-wide and multi-wide units.

#### **REGIONAL APPLICATIONS**

1. Suitable in all wind and seismic regions under "normal" soil conditions. Reinforced piers required for seismic areas  $A_{v}$ = 0.3 and 0.4.

2. Suitable in areas with high frost penetration.

#### ACCEPTABLE ALTERNATIVES

1. Chassis beam may be anchored with weld plates as pictured in system C3.

#### NOTES

- 1. Anchor bolts and clip angles are required at interior and exterior piers.
- 2. Horizontal sliding in the longitudinal direction is best accommodated by the exterior walls as shear walls.
- 3. Horizontal sliding in the transverse direction can be resisted by foundation shear walls as shown, or alternately by several x-bracing options shown in Figures 6-4 and 6-10.



A - 19





## **E4**

#### TABLES

Use type E, I tables for required effective footing area ( $A_{ftg}$ ) for single-wide units. For vertical anchorage ( $A_v$ ) for single-wide units use Type E table. Use type C, E, I tables for transverse and longitudinal sliding anchorage ( $A_h$ ) for single-wide units.

#### REGIONAL APPLICATIONS

- 1. Suitable in all wind and seismic zones under "normal" soil conditions. Reinforced piers required for seismic areas with  $A_v=0.3$  and 0.4.
- 2. Suitable in problem soils with proper design by registered architect or engineer.
- 3. Suitable in areas with high frost penetration with proper footing depth.

#### ACCEPTABLE ALTERNATIVES

- 1. Continuous longitudinal footings at piers.
- 2. Anchor bolts with clamps instead of weld plates.

#### NOTES

- Steel base plate optional. If used to provide an additional factor of safety, use A<sub>v</sub> divided by 2 to determine the footing size and reinforcing for withdrawal capacity.
- 2. Horizontal sliding in the longitudinal direction is best accommodated by the exterior walls as shear walls.
- 3. Horizontal sliding in the transverse direction can be resisted by foundation shear walls as shown, or alternately by several x-bracing options shown in Figures 6-4 and 6-10.



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## E5

#### TABLES

Use multi-wide type E5 tables for required effective pier footing area (Aftg) and exterior wall footing width(Afta).

Use multi-wide type E tables for vertical anchorage (Ay).

Use multi-wide type C, E, I tables for horizontal anchorage (A<sub>h</sub>) due to sliding in the transverse end longitudinal direction.

#### **REGIONAL APPLICATIONS**

1. Suitable in high wind and seismic regions under "normal" soil conditions.

2. Suitable in areas with high frost penetration with proper footing depth.

#### ACCEPTABLE ALTERNATIVES

1. Reinforced concrete block acceptable though coursing may be difficult to resolve.

#### NOTES

1. Horizontal sliding in the longitudinal direction is best accommodated at the exterior foundation walls.

- 2. Horizontal sliding in the transverse direction is best handled by reinforced poured concrete or concrete block shear walls @ end of unit and at interior locations as required. See details above.
- 3. Transverse girders to be designed by licensed professional.





#### FOUNDATION PLAN







END TRANSVERSE FOUNDATION SHEAR WALL

LONGITUDINAL FOUNDATION SHEAR WALL

#### MARRIAGE WALL PIER

## **E6**

#### TABLES

Use multi-wide type E5 tables for required effective pier footing area (A<sub>ftg</sub>) and exterior wall footing width(A<sub>ftg</sub>).

Use multi-wide type E tables for vertical anchorage (Av).

Use multi-wide type C, E, I tables for horizontal anchorage (A<sub>h</sub>) due to sliding in the transverse and longitudinal direction.

#### **REGIONAL APPLICATIONS**

- 1. Suitable in high wind and seismic zones with proper design.
- 2. Suitable in high frost areas with proper location or design of bottom of grade beam.

#### NOTES

- 1. Requires design by registered architect or engineer in all cases.
- Horizontal sliding anchorage (A<sub>n</sub>) in the longitudinal direction is best accommodated at exterior grade beams with moment transfer to the deep piers and lateral soil bearing.
- Horizontal sliding anchorage (A<sub>h</sub>) in the transverse direction is best accommodated by transfer of the sliding force to the steel girders, to steel base plates (instead of treated shim) and then to the deep piers in bending and lateral soil bearing.





FOUNDATION PLAN



**BUILDING SECTION** 



#### **E7**

#### TABLES

Use multi-wide type E7 tables for required effective pier footing area ( $A_{ftg}$ ) and exterior wall footing width( $A_{ftg}$ ). Use multi-wide type E tables for vertical anchorage ( $A_v$ ).

Use multi-wide type C, E, I tables for horizontal anchorage (A<sub>h</sub>) due to sliding in the transverse end longitudinal direction. Multiply (A<sub>ftg</sub>) by allowable soil bearing pressure to obtain column load in pounds.

#### **REGIONAL APPLICATIONS**

1. Suitable in high wind and seismic regions.

2. Suitable in areas with high frost penetration.

#### ACCEPTABLE ALTERNATIVES

- 1. Solid reinforced concrete walls.
- 2. Partially reinforced, grouted masonry wall, as required.
- 3. All-Weather-Wood walls anchored to spread concrete footing.
- 4. All-Weather-Wood walls on gravel base suitable in low wind and low seismic areas.

#### NOTES

- 1. Requires drain tile, granular backfill and moisture-proofing membrane for basement fill.
- 2. Requirements for reinforced concrete and masonry walls and Ali-W eather-Wood wall design
- based on local soil conditions. Requires engineered design.
- 3. Engineering design required if central steel girder desired under marriage wall and below steel transverse beams, to reduce number of basement columns. Footings will need to be resized as well. Central steel girder may also be required to carry posts from large openings along marriage wall. See detail above. Use multi-section C tables to obtain marriage wall post location required effective footing area (Aftg). Divide (Aftg) by the allowable soil pressure and subtract the marriage wall pier weight used to obtain the post load in pounds for design of the girder.
- 4. Horizontal sliding anchorage force (A<sub>h</sub>) in the longitudinal direction is best accommodated by the exterior longitudinal walls.
- 5. Horizontal sliding anchorage force (A<sub>h</sub>) in the transverse direction is best accommodated by the transfer from the chassis beams anchored and bearing on the perimeter pilasters. The horizontal force thus is resisted by the passive soil pressure. Engineering design is required to base design on existing soil conditions.

FOUNDATION TYPE Treated wood perimeter wall on concrete footing w/ unanchored metal pier	1	SYSTEM NUMBER
SUPERSTRUCTURE TYPE		TO
Chassis supported single- and multi-wide		E E S



FOUNDATION PLAN

SINGLE-WIDE

#### FOUNDATION PLAN





## **E8**

#### TABLES

Use E, I tables for required effective footing area (A<sub>ftg</sub>) for single and multi-wide units. Use type E tables for vertical anchorage (A<sub>v</sub>) for single and multi-wide (2 tie-downs) units. Use type C, E, I tables for horizontal sliding anchorage (A<sub>h</sub>) in the transverse and longitudinal directions for single and multi-wide units.

#### REGIONAL APPLICATIONS

- 1. Not suitable in high wind areas. Consult tables for exact limitations.
- 2. Not suitable in seismic areas where  $A_v = 0.3$  or 0.4.
- 3. Suitable in areas with high frost penetration with proper footing depth.
- 4. Not recommended in areas of high termite action unless wood is pressure treated.
- 5. Below-grade fasteners must be stainless steel.

#### NOTES

1. Horizontal anchorage is limited to the perimeter shear walls for lateral and longitudinal sliding.
## APPENDIX B FOUNDATION DESIGN LOAD TABLES

#### B-100. USE OF THE FOUNDA-TION DESIGN LOAD TABLES.

**B-100.1 GENERAL.** The Foundation Design Load Tables provide design values specific to the four conditions of foundation design: items A thru D below. Refer to Figure B-1 for diagrams of anchorage locations designed to resist wind or seismic forces acting on the structure, and footing size to prevent settlement. Refer to Appendix D for a more detailed derivation of the Foundation Design Load Tables. The four conditions are:

A. The required footing area based on the allowable soil bearing capacity under full gravity loading. The footing area is found in the Required Effective Footing Area Tables - Part 1 (pgs. B-3 to B-32).

**B.** The required anchorage to prevent uplift and overturning  $(A_V)$  - Required Vertical Anchorage Tables - Part 2 (pgs. B-33 to B-42).

C. The required anchorage to prevent sliding (Ah) in the transverse direction - Re-

quired Horizontal Anchorage Tables - Part 3 (pgs.B-43 to B-59).

**D.** The required anchorage to prevent sliding (Ah) in the longitudinal direction - Required Horizontal Anchorage Tables - Part 4 (pgs. B-60 to B-84).

**B-100.2. REQUIRED EFFECTIVE FOOT-ING AREA (Aftg).** These tables provide the required effective footing area that will not exceed the allowable soil bearing capacity under full gravity loading of dead load plus live load.

B-100.3 REQUIRED VERTICAL AN-CHORAGE (Av).

A. The Vertical Anchorage Table provides the required anchorage to resist uplift due to wind suction and overturning at the perimeter foundation wall or pier locations. Refer to Figure B-1.

**B.** Assumption: Uplift and overturning is resisted by anchorage to the piers and/or foundation walls.





#### B-100.4 REQUIRED HORIZONTAL AN-CHORAGE (Ah) IN THE TRANSVERSE DIRECTION.

A. The Horizontal Anchorage Table provides the required anchorage to prevent sliding at the short foundation shear wall locations. Refer to Figure B-1.

**B.** Assumption: Sliding is resisted by anchorage to the short foundation shear walls and a portion of the dead load.)

C. Shear walls in the manufactured home are walls that have been designed and constructed by the manufacturer to resist lateral loads. The home's shear walls transfer lateral loads to the floor frame.

**D.** Assumption: Shear walls inside the unit are reasonably close to the location of short foundation shear walls for proper load transfer.

#### B-100.5 REQUIRED HORIZONTAL AN-CHORAGE (Ah) IN THE LONGITUDI-NAL DIRECTION.

A. The Horizontal Anchorage Table provides the required anchorage to prevent sliding at the long foundation shear wall locations. Refer to Figure B-1.

**B.** Assumption: Sliding is resisted by anchorage to the long foundation shear walls and a portion of the dead load.

C. Shear walls in the manufactured home are walls that have been designed and constructed by the manufacturer to resist lateral loads. The home's shear walls transfer lateral loads to the floor frame.

**D.** Assumption: Shear walls inside the unit are reasonably close to the location of long foundation shear walls for proper load transfer.

Part 3 - Required Horizontal Anchorage -

B-52

B-53 to B-54

B-55 to B-56

B-58 to B-59

B-60 to B-64

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Multi-Section C

Multi-Section E

Multi-Section E3

(Ah) Transverse Direction

Single-Section C, E, I

Multi-Section C, E, I

Multi-Section I

Part 1 - Required Efecti (Aftg)	ve Footing Area
Single Section C	B-3 to B-6
Single Section E, I	B-7
Multi-section C	B-8 to B-16
Multi-Section Cnw	B-17 to B-20
Multi-Section E, I	B-21 to B-29
Multi-Section E5, E6	B-30 to B-38
Multi-Section E7	B-39 to B-47

Part 2	<ul> <li>Required</li> </ul>	Vertical	Anchorage -	(Av)

Sing tion C	B-48	Part 4 - Required Hor	
Sing tion C1	B-49	(Ah) Longitudinal Direc	
Single Section E	B-50	Single-Section C, E, I	B-81 to B-89
Single-Section E3	B-51	Multi-Section C, E, I	B-90 to B-100

Part 1 Required Effective Footing Area - Aftg

# **Single-Section C**

Required Effective Footing Area - Aftg (sqft) \*

	· ]	Min. R	oof: 15	psf					
Net Soil	Soil Pier Spacing (ft)								
Pres (psf)	4	5	6	7	8	10			
1000	3.0	3.5	4.1	4.7	5.2	6.3			
1500	2.0	2.3	2.7	3.1	3.5	4.2			
2000	1.5	1.8	2.0	2.3	2.6	3.2			
2500	1.2	1.4	1.6	1.9	2.1	2.5			
3000	1.0	1.2	1.4	1.6	1.7	2.1			
3500	1.0	1.0	1.2	1.3	1.5	1.8			
4000	1.0	1.0	1.0	1.2	1.3	1.6			

Ground Snow: 25 psf								
Net Soil	Pier Spacing (ft)							
Pres (psf)	4 .	5	6	7	8	10		
1000	3.0	3.6	4.2	4.8	5.3	6.5		
1500	2.0	2.4	2.8	3.2	3.6	4.3		
2000	1.5	1.8	2.1	2.4	2.7	3.2		
2500	1.2	1.4	1.7	1.9	2.1	2.6		
3000	1.0	1.2	1.4	1.6	1.8	2.2		
3500	1.0	1.0	1.2	1.4	1.5	1.9		
4000	1.0	1.0	1.0	1.2	1.3	1.6		

Ground Snow: 40 psf								
Net Soil		P	ier Spacin	g (ft)	· ·			
Pres (psf)	4	5	6	7	8	10		
1000	3.3	3.9	4.5	5.2	5.8	7.1		
1500	2.2	2.6	3.0	3.5	3.9	4.7		
2000	1.6	2.0	2.3	2.6	2.9	3.6		
2500	1.3	1.6	1.8	2.1	2.3	2.8		
3000	1.1	1.3	1.5	1.7	1.9	2.4		
3500	1.0	I.I .	1.3	1.5	1.7	2.0		
4000	1.0	1.0	11	1.3	1.5	1.8		

Ground Snow: 60 psf								
Net Soil		P	ier Spacin	g (ft)-	. 1			
Pres (psf)	4	5	6	7	8	10		
1000	3.6	4.3	5.0	58	6.5	7.9		
1500	2.4	2.9	34	3.8	4.3	5.3		
2000	1.8	2.2	2.5	29	3.2	4.0		
2500	1.4	1.7	2.0	23	2.6	3.2		
3000	1.2	1.4	17	19	2.2	2.6		
3500	1.0	1.2	14	1.6	1.9	2.3		
4000	1.0	1.1	1.3	14	1.6	2.0		

\* Minimum exterior and interior pier area is 1.0 sqft.



Single-Section

Width

Aftg

С

12'

Ground Snow: 50 psf								
Net Soil	Pier Spacing (ft)							
Pres (psf)	4	5	6	7	8	. 10		
1000	3.4	4.1	4.8	5.5	6.2	7.5		
1500	2.3	2.7	3.2	3.6	4.1	- 5.0		
2000	1.7	2.1	2.4	2.7	3.1	3.8		
2500	1.4	1.6	1.9	2.2	2.5	3.0		
3000	1.1	1.4	1.6	1.8	2.1	2.5		
3500	1.0	1.2	1.4	1.6	1.8	2.1		
4000	1.0	1.0	1.2	1.4	1.5	1.9		

Ground Snow: 70 psf							
Net Soil		P	ier Spacin	g (ft)			
Pres (psf)	4	5 .	Ĝ	7	8	10	
1000	3.8	4.5	5.3	6.0	6.8	8.3	
1500	2.5	3.0	3.5	4.0	4.5	5.6	
2000	1.9	2.3	2.6	3.0	3.4	4.2	
2500	1.5	1.8	2:1	2.4	2.7	3.3	
3000	1.3	1.5	1.8	2.0	2.3	2.8	
3500	1.1	1.3	1.5	1.7	1.9	2.4	
4000	1.0	1.1	1.3	1.5	1.7	2.1	

ABa	
C	Single-Section
12'	Width

Ground Snow: 80 psf									
Net Soil Pier Spacing (ft)									
Pres (psf)	4	5	6	7	8	10			
1000	3.9	4.7	5.5	6.3	7.1	8.7			
1500	2.6	3.1	3.7	4.2	4.8	5.8			
2000	2.0	2.4	2.8	3.2	3.6	4.4			
2500	1.6	1.9	2.2	2.5	2.9	3.5			
3000	1.3	1.6	1.8	2.1	2.4	2.9			
3500	1.1	1.3	1.6	1.8	2.0	2.5			
4000	1.0	1.2	1.4	1.6	1.8	2.2			

Ground Snow: 100 psf								
Net Soil	•	Pi	ier Spaci	ng (ft)				
Pres (psf)	. 4	5	6	7	8	10		
1000	4.2	5.1	6.0	6.9	7.8	9.6		
1500	2.8	3.4	4.0	4.6	5.2	6.4		
2000	. 2.1	2.6	3.0	3.4	3.9	4.8		
2500	1.7	2.1	2.4	2.8	3.1	3.8		
3000	1.4	1.7	2.0	2.3	2.6	3.2		
3500	1.2	1.5	1.7	2.0	2.2	2.7		
4000	1.1	1.3	1.5	1.7	· 1.9	2.4		



andi Mari	Width
	Min. Roof: 15 pst
	Pier Spacing (ft)

Net Soil	Pier Spacing (ft)							
Pres (psf)	4	5	6	7	. 8 .	10		
1000	3.3	4.0	4.6	5.3	5.9	7.2		
1500	2.2	2.6	3.1	3:5	3.9	4.8		
2000	1.7	2.0	2.3	2.6	3.0	3.6		
2500	1.3	1.6	1.8	2.1	2.4	2.9		
3000	1.1	1.3	1.5	1.8	2.0	2.4		
3500	1.0	1.I	1.3	1.5	1.7	2.1		
4000	1.0	1.0	1.2	1.3	1.5	1.8		
						. '		

Groun	d Snov	v: 30 p	sf & N	lin. Ro	of: 20 p	osf	
Net Soil	Pier Spacing (ft)						
Pres (psf)	4	5	.6	7 :	8	10	
1000	3.5	4.2	4.9	5.6	6.2	7.6	
1500	2.3	2.8	3.2	3.7	4.2	5.1	
2000	1.7	2.1	2.4	2.8	3.1	3.8	
2500	1.4	1.7	1.9	2.2	2.5	3.1	
3000	1.2	1.4	1.6	1.9	2.1	2.5	
3500	1.0	1.2	1.4	1.6	1.8	2.2	
4000	1.0	1.0	1.2	1.4	1.6	1.9	

\* Minimum exterior and interior pier area is 1.0 sqft.

### Required Effective Footing Area - Aftg (sqft) \*

	G	round S	Snow: 9	90 psf		
Net Soil		P	ier Spacin	g (ft)		
Pres (psf)	4	5	6	7	. 8	10
1000	4.1	4.9	5.8	6.6	7.5	9.1
1500	2.7	3.3	3.8	4.4	5.0	6.1
2000	2.0	2.5	2.9	3.3	3.7	4.6
2500	1.6	2.0	2.3	2.6	3.0	3.7
3000	1.4	1.6	1.9	2.2	2.5	3.0
3500	1.2	1.4	1.6	1.9	2.1	2.6
4000	1.0	1.2	1.4	1.7	1.9	2.3

Required Effective Footing Area - Aftg (sqft) \*

Ground Snow: 25 psf									
Net Soil Pier Spacing (ft)									
Pres (psf)	. 4	5	6	7	8	- 10			
1000	3.4	4.0	4.7	5.4	6.1	7.4			
1500	2.3	.2.7	3.1	3.6	4.0	4.9			
2000	1.7	2.0	2.4	2.7	3.0	. 3.7			
2500	1.4	1.6	1.9	2.2	2.4	3.0			
3000	1.1	1.3	1.6	1.8	2.0	2.5			
3500	1.0	1.2	1.3	1.5	1.7	2.1			
4000	1.0	1.0	1.2	1.3	1.5	1.8			

Ground Snow: 40 psf									
Net Soil		Pier Spacing (ft)							
Pres (psf)	4	5	6	·· 7	8	10			
1000	3.7	4.4	5.1	5.9	6.6	8.1			
1500	2.4	2.9	3.4	3.9	4.4	. 5.4			
2000	1.8	2.2	2.6	2.9	.3.3	4.1			
2500	1.5	1.8	2.1	2.4	2.7	3.2			
3000	1.2	1.5	1.7	2.0	2.2	2.7			
3500	1.0	1.3	1.5	1.7	1.9	2.3			
4000	1.0	1.1	1.3	1.5	1.7	2.0			

ļ

Ground Snow: 50 psf									
Net Soil Pier Spacing (ft)									
Pres (psf)	4	5	6	7	. 8	10			
1000	3.9	4.6	5.4	6.2	7.0	8.6			
1500	2.6	3.1	3.6	4.1	4.7	5.7			
2000	1.9	2.3	2.7	3.1	3.5	4.3			
2500	1.5	1.9	2.2	2.5	2.8	3.4			
3000	1.3	1.5	1.8	2.1	2.3	2.9			
3500	1.1	1.3	1.6	1.8	2.0	2:5			
4000	1.0	1.2	1.4	1.6	1.8	2.1			

Ground Snow: 70 psf										
Net Soil Pier Spacing (ft)										
4	. 5	Ĝ	7	. 8	10					
4.2	5.1	6.0	6.9	7.8	9.5					
2.8	3.4	4.0		5.2	6.4					
2.1	2.6	3.0			4:8					
1.7	2.0	2.4	2.8		3.8					
1.4	1:7	2.0			3.2					
1.2	1.5	1.7			2.7					
1.1	1.3	1.5	1.7	1.9	2.4					
	4 4.2 2.8 2.1 1.7 1.4 1.2	P           4         5           4.2         5.1           2.8         3.4           2.1         2.6           1.7         2.0           1.4         1.7           1.2         1.5	Pier Spacin           4         5         6           4.2         5.1         6.0           2.8         3.4         4.0           2.1         2.6         3.0           1.7         2.0         2.4           1.4         1.7         2.0           1.2         1.5         1.7	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Pier Spacing (ft)           4         5         6         7         8 $4.2$ $5.1$ $6.0$ $6.9$ $7.8$ $2.8$ $3.4$ $4.0$ $4.6$ $5.2$ $2.1$ $2.6$ $3.0$ $3.4$ $3.9$ $1.7$ $2.0$ $2.4$ $2.8$ $3.1$ $1.4$ $1.7$ $2.0$ $2.3$ $2.6$ $1.2$ $1.5$ $1.7$ $2.0$ $2.2$					

Ground Snow: 90 psf										
Net Soil Pier Spacing (ft)										
Pres (psf)	4	5	Ĝ	7	8	- 10				
1000	4.6	5.6	6.6	7.6	8.5	10.5				
1500	3.1	3.7	4.4	5.0	5.7	7.0				
2000	2.3	2.8	3.3	3.8	4.3	5.3				
2500	1.8	2.2	2.6	3.0	3.4	4.2				
3000	1.5	1.9	2.2	2.5	2.8	3.5				
3500	1.3	1.6	1.9	2.2	2.4	3.0				
4000	1.2	1.4	1.6	1.9	2.1	2.6				

# Required Effective Footing Area - Aftg (sqft) \*

[1] A set of the se										
Min. Roof: 15 psf										
Net Soil Pier Spacing (ft)										
Pres (psf)	4	.5	6	7	8	10				
1000	3.6	4.4	5.1	5.8	6.6	8.0				
1500	2.4	2.9	3.4	3.9	4.4	5.4				
2000	1.8	2.2	2.5	2.9	3.3	4.0				
2500	1.5	1.7	2.0	2.3	2.6	3.2				
3000	1.2	1.5	1.7	1.9	2.2	2.7				
3500	1.0	1,2	1.5	1.7	1.9	23				
4000	1.0	1.1	1.3	1.5	1.6	20				

. [		Aftg
	Single-Section	C
	Width	14'
	and the second	

Ground Snow: 60 psf									
	P	ier Spacin	g (ft)	<u>~~~~</u>					
4	5	6	<b>.</b> 7		· 10				
4.0	4.9	5.7	6.6	7.4	9.1				
2.7	3.3	3.8	4.4	4.9	6.0				
2.0	2.4	2.9	3.3	3.7	4.5				
1.6	2.0	2.3	2.6		3.6				
1.3	1.6	1.9	2.2	2.5	3.0				
1.2	1.4	1.6	1.9	2.1	2.6				
- 1.0	1.2	1.4	1.6	1.8	2.3				
	4 4.0 2.7 2.0 1.6 1.3 1.2	P           4         5           4.0         4.9           2.7         3.3           2.0         2.4           1.6         2.0           1.3         1.6           1.2         1.4	Pier Spacin           4         5         6           4.0         4.9         5.7           2.7         3.3         3.8           2.0         2.4         2.9           1.6         2.0         2.3           1.3         1.6         1.9           1.2         1.4         1.6	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				

	G	ound S	Snow: 8	30 psf		·
Net Soil		ب <u> </u> ا				
Pres (psf)	4	.5	6	7	8	10
1000	4.4	5.4	6.3	7.2	8.2	10.0
1500	.3.0	3.6	4.2	4.8	5.4	6.7
2000	2.2	2.7	3.1	3.6	4.1	5.0
<b>250</b> 0	1.8	2.1	2.5	2.9	3.3	4.0
3000	1.5	1.8	2.1	2.4	2.7	3.3
3500	1.3	1.5	1.8	2.1	2.3	2.9
4000	1.1	1.3	1.6	1.8	2.0	2.5

Ground Snow: 100 psf											
Net Soil Pier Spacing (ft)											
Pres (psf)	4	5	6	7	. 8	10					
1000	4.8	5.8	6.9	7.9	8.9	11.0					
1500	3.2	3.9	4.6	5.3	6.0	7.3					
2000	2.4	2.9	3.4	3.9	4.5	5.5					
2500	1.9	2.3	2.7	3.2	3.6	4.4					
3000	1.6	1.9	2.3	2.6	3.0	3.7					
3500	1.4	1.7	2.0	2.3	2.6	3.1					
4000	1.2	1.5	1.7	2.0	2.2	2.7					

Single-Section	Aftg C
Width	16'

Ground Snow: 25 psf										
Net Soil		P	ier Spacin	g (ft)	-					
Pres (psf)	4	5	6	7	8	10				
1000	3.7	4.5	5.2	6.0	6.7	8.2				
1500	2.5	3.0	3.5	4.0	4.5	5.5				
2000	1.9	2.2	2.6	3.0	3.4	4.1				
2500	1.5	1.8	2.1	2.4	2.7	3.3				
3000	1.2	1.5	1.7	2.0	2.2	2.7				
3500	1.1	1.3	1.5	1.7	1.9	2.3				
4000	1.0	1.1	1.3	1.5	1.7	2.1				

Aftg C 16 <sup>°</sup>	Single-Section Width
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Groun	d Snov	w: 30 p	sf & M	lin. Ro	of: 20 p	osf		
Net Soil Pier Spacing (ft)								
Pres (psf)	4	5	6	7	8	10		
1000	3.8	4.6	5.4	6.2	6,9	8.5		
1500	2.5	3.1	3.6	4.1	4.6	5.7		
2000	1.9	-2.3	2.7	3.1	3.5	4.2		
2500	1.5	1.8	2.2	2.5	2.8	3.4		
3000	1.3	. 1.5	1.8	2.1	2.3	. 2.8		
3500	1.1	1.3	. 1.5	1.8	2.0	2.4		
4000	1.0	1.1	1.3	1.5	1.7	2.1		

	Ground Snow: 50 psf										
Net Soil											
Pres (psf)	4	5	ier Spacin 6	7	8	10					
1000	4.3	5.1	6.0	6.9	7.8	9.6					
1500	2.8	3.4	4.0	4.6	5.2	6.4					
2000	2.1	2.6	3.0	3.5	3.9	4.8					
2500	1.7	2.1	2.4	2.8	3.1	3.8					
3000	1.4	1.7	2.0	2.3	2.6	3.2					
3500	1.2	. 1.5	1.7	2.0	2.2	2.7					
4000	1.1	1.3	1.5	1.7	2.0	2.4					

Ground Snow: 70 psf										
Net Soil		P	ier Spacin	g (ft)						
Pres (psf)	4	5	6	7	8	10				
1000	4.7	5.7	6.7	7.7	8.7	10.7				
1500	3.1	3.8	4.5	-5.1	5.8	. 7.1				
2000	2.3	2.8	3.3	3.8	4.3	5.3				
2500	1.9	2.3	2.7	3.1	3.5	4.3				
3000	1.6	1.9	2.2	2.6	2.9	3.6				
3500	1.3	1.6	1.9	2.2	2.5	3.0				
4000	1.2	1.4	.1.7	1.9	2.2	2.7				

Ground Snow: 90 psf										
Net Soil Pres (psf)	4	Pier Spacing (ft) 4 5 6 7 8								
1000	5.1	6.2	7.3	8.4	9.5	11.7				
1500	3.4	4.1	4.9	5.6	6.4	7.8				
2000	2.6	3.1	3.7	4.2	4.8	5.9				
2500	2.0	2.5	2.9	3.4	3.8	4.7				
3000	1.7	2.1	2.4	2.8	3.2	3.9				
3500	1.5	1.8	2.1	2.4	2.7	. 3.4				
4000	1.3	1.6	1.8	2.1	2.4	2.9				

\* Minimum exterior and interior pier area is 1.0 sqft.

## Required Effective Footing Area - Aftg (sqft) \*

Ground Snow: 40 psf											
Net Soil Pier Spacing (ft)											
Pres (psf)	4	5	6	7	. 8.	10					
1000	4.0	4.9	5.7	6.5	7.4	9.0					
1500	2.7	3.2	3.8	4.4	4.9	6.0					
2000	2.0	2.4	2.9	3.3	3.7	4.5					
2500	1.6	1.9	2.3	2.6	2.9	3.6					
3000	1.3	1.6	1.9	2.2	2.5	3.0					
3500	1.2	1.4	1.6	1.9	2.1	2.6					
4000	.1.0	1.2	1.4	1.6	1.8	2.3					

							2.0
		G	round S	Snow:	60 psf		
	Net Soil		· F	ier Spacin	ng (ft)		
	Pres (psf)	4	5	6	7	8.1.1	10
	1000	4.5	5.4	6.4	7.3	8.2	10.1
	1500	3.0	3.6	4.2	4.9	5.5	6.7
÷	2000	2.2	2.7	3.2	3.6	4.1	5.1
	2500	1.8	2.2	2.5	2.9	3.3	4.0
	3000	1.5	1.8	2.1	2.4	2.7	3.4
۰.	3500	1.3	1.5	1.8	2.1	2.4	2.9
	4000	1.1	1.4	1.6	1.8	2.1	2.5

Ground Snow: 80 psf										
Net Soil Pier Spacing (ft)										
Pres (psf)	4	5	6	7	. 8 .	10				
1000	4.9	6.0	7.0	8.1	91	11.2				
1500	3.3	4.0	4.7	5.4	6.1	7.5				
2000	2.5	3.0	3.5	4.0	4.6	5.6				
2500	2.0	2.4	2.8	3.2	3.6	4.5				
3000	1.6	2.0	2.3	2.7	3.0	3.7				
3500	1.4	1.7	2.0	2.3	2.6	3.2				
4000	1.2	1.5	1.8	2.0	2.3	2.8				

Gr	00 psf				
	P	ier Spacin	g (ft)		
4	5	Ĝ	7	8	- 10
5.3	6.5	7.7	8.8	10.0	12.3
3.6	4.3	5.1	5.9	6.6	8.2
2.7	3.2	3.8	4.4	5.0	6.1
2.1	2.6	3.1	3.5	4.0	4.9
1.8	2.2	2.6	2.9	3.3	4.1
1.5	1,9	2.2	2.5	2.8	3.5
1.3	1.6	1.9	2.2	2.5	3.1
	4 5.3 3.6 2.7 2.1 1.8 1.5	P 4 5 5.3 6.5 3.6 4.3 2.7 3.2 2.1 2.6 1.8 2.2 1.5 1.9	Pier Spacin           4         5         6           5.3         6.5         7.7           3.6         4.3         5.1           2.7         3.2         3.8           2.1         2.6         3.1           1.8         2.2         2.6           1.5         1.9         2.2	Pier Spacing (ft)           4         5         6         7           5.3         6.5         7.7         8.8           3.6         4.3         5.1         5.9           2.7         3.2         3.8         4.4           2.1         2.6         3.1         3.5           1.8         2.2         2.6         2.9           1.5         1.9         2.2         2.5	4         5         6         7         8           5.3         6.5         7.7         8.8         10.0           3.6         4.3         5.1         5.9         6.6           2.7         3.2         3.8         4.4         5.0           2.1         2.6         3.1         3.5         4.0           1.8         2.2         2.6         2.9         3.3           1.5         1.9         2.2         2.5         2.8

# Single-Section E, I

## Required Effective Footing Area - Aftg (sqft) \*

Net Soil	- 	Pi	er Spaci	ng (ft)		
Pres (psf)	. 4	5	6	7	8	10
1000	1.7	. 1.9	2.2	2.4	2.7	3.2
1500	1.1	1.3	1:5	1.6	1.8	2.1
2000	1.0	1.0	1.1	1.2	1.3	1.6
2500	1.0	1.0	1.0	1.0	1.1	1.3
3000	1.0	1.0	1.0	1.0	1.0	1.1
3500	1.0	1.0	1.0	1.0	1.0	1.0
4000	1.0	1.0	1.0	1.0	1.0	1.0
N	· ·			· .		•.
					e la	

### Required Effective Footing Area - Aftg (sqft) \*

Interior Piers

Net Soil		· · · Pie	r Spacir	ıg (ft)	11.00		
Pres (psf)	4	5	6	7.	8	10	1. C
1000	1.8	2.1	2.4	2.7	2.9	3.5	11
1500	1.2	1.4	1.6	1.8	2.0	2.3	
2000	1.0	1.1	1.2	1.3	1.5	1.8	
2500	1.0	1.0	1.0	1.1	1.2	1.4	
3000	1.0	1.0	1.0	1.0	1.0	1.2	
3500	1.0	1.0	1.0	1.0	1.0	1.0	
4000	1.0	1.0	1.0	1.0	1.0	1.0	÷ .

### Required Effective Footing Area - Aftg (sqft) \*

	·				1.1		
Interior Pier Net Soil	s	Pi	er Spaci	no (ft)		1	•
Pres (psf)	. 4	5	6 6	7	8	10	
1000	2.0	2.3	2.6	2.9	3.3	3.9	
1500	1.3	1.5	1.7	2.0	2.2	2.6	
2000	1.0	1.1	1.3	1.5	1.6	1.9	
2500	1.0	1.0	1.0	1.2	1.3	1.6	
3000	1.0	1.0	1.0	1.0	1.1	1.3	
3500	1.0	1.0	1.0	1.0	1.0	1.1	
4000	1.0	1.0	1.0	1.0	1.0	1.0	





	Aftg
Single-Section	E, I
Width	14'

	Aftg
Single-Section	E,Ĭ
Width	16'

\* Minimum interior pier area is 1.0 sqft. Minimum exterior foundation wall footing width is 1'-0"; except for a 16' wide unit when the snow load is 100 psf and the allowable soil pressure is 1000 psf, use 1'-2".

# **Multi-Section C**





· .		Grou	nd Sno	ow: 25	5 psf		
Net So	il –		Pi	ier Spaci	ng (ft)	1	
Pres (p	osf)	4	5	6	7	8	10
1000	ext, int	3.0	3.6	4.2	4.8	5.3	6.5
<u></u>	marriage	3.1	3.7	4.4	5.0	5.6	6.9
1500	ext, int	2.0	2.4	2.8	3.2	3.6	4.3
	marriage	2.1	2.5	2.9	3.3	3.7	4.6
2000	ext, int	1.5	1.8	2.1	2.4	2.7	3.2
	marriage	1.6	1.9	2.2	2.5	2.8	3.4
2500	ext, int	1.2	1.4	1.7	1.9	2.1	2.6
	marriage	1.2	1.5	1.7	2.0	2.2	2.8
3000	ext, int	1.0	1.2	1.4	1.6	1.8	2.2
	marriage	1.0	1.2	1.5	1.7	1.9	2.3
3500	ext, int	1.0	1.0	1.2	1.4	1.5	1.9
	marriage	1.0	1.1	1.2	1.4	1.6	2.0
4000	ext, int	1.0	1.0	1.0	1.2	1.3	1.6
	marriage	1.0	1.0	1.1	1.2	1.4	1.7
Net So	il	N	1arriage V	Vall Ope	ning Widt	h (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	6.7	7.9	9.1	10.3	11.5	12.7
1500	marriage	4.5	5.3	6.1	6.9	7.7	8.5
2000	marriage	3.3	3.9	4.6	5.2	5.8	6.4
2500	marriage	2.7	3.2	3.6	4.1	4.6	5.1
3000	marriage	2.2	2.6	3.0	3.4	3.8	4.2
3500	marriage	1.9	2.3	2.6	2.9	3.3	3.6
4000	marriage	1.7	2.0	2.3	2.6	2.9	3.2

#### Required Effective Footing Area - Aftg (sqft) \*

		Mi	n. Roo	f: 15 p	osf		
Net Sc	oil		Р	ier Spaci	ng (ft)	·	
Pres (p	osf)	4	5	6	7	8	10
1000	ext, int	3.0	3.5	4.1	4.7	5.2	6.3
	marriage	3.0	3.6	4.2	4.8	5.4	6.6
1500	ext, int	2.0	2.3	2.7	3.1	3.5	4.2
	marriage	2.0	2.4	2.8	. 3.2	3.6	4.4
2000	ext, int	1.5	1.8	2.0	2.3	2:6	3.2
	marriage	1.5	1.8	2.1	2.4	2.7	3.3
2500	ext, int	1.2	1.4	1.6	1.9	2.1	2.5
	marriage	1.2	1.4	1.7	1.9	2.2	2.6
3000	ext, int	1.0	1.2	1.4	1.6	1.7	2.1
	marriage	1.0	1.2	1.4	1.6	1.8	2.2
3500	ext int	1.0	1.0	1.2	1.3	1.5	1.8
	marriage	1.0	1.0	1.2	1.4	1.5	1.9
4000	ext, int	1.0	1.0	1.0	1.2	1.3	1.6
	marriage	1.0	1.0	1.0	1.2	1.3	1.6
Net So	il 👘	M	farriage V	Vall Oper	ung Widt	th (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	6.4	7.5	8.7	9.9	11.0	12.2
1500	marriage	4.3	5.0	5.8	6.6	7:3	8.1
2000	marriage	3.2	3.8	4.3	4.9	5.5	6.1
2500	marriage	2.6	3.0	. 3.5	3.9	4.4	4.9
3000	marriage	2.1	2.5	2.9	.3.3	- 3.7	4.1
3500	marriage	1.8	2.2	2.5	2.8	3.1	3.5
4000	marriage	1.6	1.9	2.2	2.5	2.8	3.0
				· · · ·	1.1		

Net So	round Si	liow.				1. 20 p	51
		,		ier Spaci	0		
Pres (p		4	5	6	7	8	10
1000	ext, int	3.1	3.7	4.3	4.9	5.5	6.7
	marriage	3.3	3.9	4.6	5.3	5.9	7.3
1500	ext, int	2.1	2.5	2.9	3.3	3.7	4.5
	marriage	2.2	2.6	3.1	3.5	4.0	4.9
2000	ext, int	1.5	1.8	2.1	2.4	2.7	3.3
	marriage	1.6	2.0	2.3	2.6	3.0	3.6
2500	ext, int	1.2	1.5	1.7	2.0	2.2	2.7
	marriage	1.3	1.6	1.8	2.1	2.4	2.9
3000	ext, int	1.0	1.2	1.4	1.6	1.8	2.2
	marriage	1.1	1.3	1.5	1.8	2.0	2.4
3500	ext, int	1.0	1.1	1.2	1.4	1.6	1.9
	marriage	1.0	1.1	1.3	1.5	1.7	2.1
4000	ext, int	1.0	1.0	1.1	1.2	1.4	1.7
	marriage	1.0	1.0	1.2	1.3	1.5	1.8
Net So	il	N	farriage V	Vall Oper	ning Widt	h (ft)	••••••
Pres (p	sf)	10	12	. 14	16	18	20
1000	marriage	7.1	8.4	9.7	11.0	12.3	13.6
1500	marriage	4.7	5.6	6.5	7.3	8.2	9.0
2000	marriage	3.5	4.2	4.8	5.5	6.1	6.8
2500	marriage	2.8	3.4	3.9	4.4	4.9	5.4
3000	marriage	2.4	2.8	3.2	3.7	4.1	4.5
3500	marriage	2.0	2.4	2.8	3.1	3.5	3.9
4000	marriage	1.8	2.1	2.4	2.7	3.1	3.4

Multi-Section	Aftg C
Width	12'

		Grou	ind Sn	ow: 40	) psf		
Net So	il .		F	ler Spaci	ng (ft)		
Pres (p	sf)	4	5	6	7	8	10
1000	ext, int	3.3	3.9	4.5	5.2	5.8	7.1
	marriage	3.6	4.3	5.1	5.8	6.6	8.1
1500	ext, int	2.2	2.6	3.0	3.5	3.9	4.7
	marriage	2.4	2.9	3.4	3.9	4.4	5.4
2000	ext, int	1.6	2.0	2.3	2.6	2.9	3.6
	marriage	1.8	2.2	2.5	2.9	3.3	4.1
2500	ext, int	1.3	1.6	1.8	2.1	2.3	2.8
	marriage	1.4	1.7	2.0	2.3	2.6	3.2
3000	ext, int	1.1	1.3	1.5	1.7	1.9	2.4
	marriage	1.2	1.4	1.7	1.9	2.2	2.7
3500	ext, int	1.0	1.1	1.3	1.5	1.7	2.0
	marriage	1.0	1.2	1.5	1.7	1.9	2.3
4000	ext, int	1.0	1.0	1.1	1.3	1.5	1.8
· · ·	marriage	1.0	1.1	1.3	1.5	1.6	2.0
Net So	11	N	farriage V	Wall Oper	ning Widt	h (ft)	
Pres (p		10	12	14	16	18	20
1000	marriage	7.9 🗄	9.4	10.8	12.3	13.7	15.2
1500	marriage	5.3	6.2	7.2	8.2	9.2	10.1
2000	marriage	4.0	4.7	5.4	6.1	6.9	7.6
2500	marriage	3.2	3.7	4.3	4.9	5.5	6.1
3000	marriage	2.6	3.1	3.6	4.1	4.6	5.1
3500	marriage	2.3	2.7	3.1	3.5	3.9	4.3
4000	marriage	2.0	2.3	2.7	3.1	3.4	3.8

		Grou	ind Sn	ow: 60	) psf	· · · ·	
Net So	il	·	P	ier Spaci:	ng (ft)		
Pres (p	sf)	4	5	6	7	8	10
1000	ext, int	3.6	4.3	5.0	5.8	6.5	7.9
	marriage	4.2	5.2	6.1	7.0	7.9	9.7
1500	ext, int	2.4	2.9	3.4	3.8	4.3	5.3
	marriage	2.8	3.4	4.1	4.7	5.3	6.5
2000	ext, int	1.8	2.2	2.5	2.9	3.2	4.0
	marriage	2.1	2.6	3.0	3.5	4.0	4.9
2500	ext, int	1.4	1.7	2.0	2.3	2.6	3.2
	marriage	1.7	2.1	2.4	2.8	3.2	3.9
3000	ext, int	1.2	1.4	1.7	1.9	2.2	2.6
	marriage	1.4	1.7	2.0	2.3	2.6	3.2
3500	ext, int	1.0	1.2	1.4	1.6	1.9	2.3
	marriage	1.2	1.5	1.7	2.0	2.3	2.8
4000	ext, int	1.0	1.1	1.3	1.4	1.6	2.0
	marriage	1.1	1.3	1.5	1.7	2.0	2.4
Net So	il ·	N	Aarriage V	Wall Oper	ning Widt	th (ft)	
Pres (p.	sf)	10	12	14	16	18	20
1000	marriage	9.5	11.3	13.1	14.9	16.7	18.5
1500	marriage	6.4	7.5	8.7	9.9	11.1	12.3
2000	marriage	4.8	5.7	6.6	7.4	8.3	9.2
2500	marriage	3.8	4.5	5.2	6.0	6.7	7.4
3000	marriage	3.2	3.8	4.4	5.0	5.6	6.2
3500	marriage	2.7	3.2	3.7	4:3	4.8	5.3
4000	marriage	2.4	2.8	3.3	3.7	4.2	4.6

		Grou	ind Sn	ow: 50	) psf				
Net So	il ·		Pier Spacing (ft)						
Pres (p	<u>sf)</u>	4	5	6	7	8	10		
1000	ext, int	3.4	4.1	4.8	5.5	6.2	7.		
	marriage	3.9	4.8	5.6	6.4	7.3	8.		
1500	ext, int	2.3	2.7	3.2	3.6	4.1	5.		
	marriage	2.6	3.2	3.7	4.3	4.8	5.		
2000	ext, int	1.7	2.1	2.4	2.7	3.1	3.		
	marriage	2.0	2.4	2.8	3.2	3.6	4.		
2500	ext, int	1.4	1.6	1.9	2.2	2.5	3.0		
÷.,	marriage	1.6	1.9	2.2	2.6	2.9	3.6		
3000	ext, int	1.1	1.4	1.6	1.8	2.1	2.:		
	marriage	1.3	1.6	1.9	2.1	2.4	3.0		
3500	ext, int	1.0	1.2	1.4	1.6	1.8	2.1		
	marriage	1.1	1.4	1.6	1.8	2.1	2.5		
4000	ext, int	1.0	1.0	1.2 -	1.4	1.5	1.9		
	marriage	1.0	1.2	1.4	1.6	1.8	. 2.2		
Net Soi	1	N	Aarriage V	Wall Oper	ning Widt	h (ft)			
Pres (ps	sf)	10	12	14	16	18	20		
1000	marriage	8.7	10.3	12.0	13.6	15.2	16.8		
1500	marriage	5.8	6.9	8.0	9.1	. 10.1	11.2		
2000	marriage	4.4	5.2	6.0	6.8	7.6	8.4		
2500	marriage	3.5	4.1	4.8	5.4	6.1	6.7		
3000	marriage	2.9	3.4	4.0	4.5	5.1	5.6		
3500	marriage	2.5	3.0	3.4	3.9	4.3	4.8		
4000	marriage	2.2	2.6	3.0	3.4	3.8	4.2		

		Grou	ind Sn	ow: 7(	) psf		
Net So	il		P	ier Spaci	ng (ft)		
Pres (p	sf)	4	5	÷ 6 ÷	7	8	10
1000	ext, int	3.8	4.5	5.3	6.0	6.8	8.3
	marriage	4.6	5.6	6.6	7.6	8.6	10.6
1500	ext, int	2.5	3.0	3.5	4.0	4.5	5.6
	marriage	3.0	3.7	4.4	5.0	5.7	7.0
2000	ext, int	1.9	2.3	2.6	3.0	3.4	4.2
	marriage	2.3	2.8	3.3	3.8	4.3	5.3
2500	ext, int	1.5	1.8	2.1	2.4	2.7	3.3
	marriage	1.8	2.2	2.6	3.0	3.4	4.2
3000	ext, int	1.3	1.5	1.8	2.0	2.3	2.8
	marriage	1.5	1.9	2.2	2.5	2.9	-3.5
3500	ext, int	1.1	1.3	1.5	1.7	1.9	2.4
	marriage	1.3	1.6	1.9	2.2	2.4	3.0
4000	ext, int	1.0	1.1	1.3	1.5	1.7	2.1
	marriage	1.1	1.4	1.6	1.9	2.1	2.6
Net Soi	1	1	Viarriage V	Vall Ope	ning Widt	h (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	10.4	12.3	14.3	16.2	18.1	20.1
1500	marriage	6.9	8.2	9.5	10.8	12.1	13.4
2000	marriage	5.2	6.2	7.1	8.1	9.1	10:0
2500	marriage	4.1	4.9	5.7	6.5	7.3	8.0
3000	marriage	3.5	4.1	4.8	5.4	6.0	6.7
3500	marriage	3.0	3.5	4.1	4.6	5.2	5.7
4000	marriage	2.6	3.1	3.6	4.0	4.5	5.0

C 12		<b>ulti-S</b> Wi	Section dth				
		Grou	ind Sno	w: 80	) psf		
Net Soi	1		Pi	er Spaci	ng (ft)		
Pres (ps	sf)	4	5	6	7	8	10
1000	ext, int	3.9	4.7	5.5	6.3	7.1	8.7
	marriage	4.9	6.0	7.1	8.1	9.2	11.4
1500	ext, int	2.6	3.1	3.7	4.2	4.8	5.8
·	marriage	3.3	4.0	4.7	5.4	6.1	7.6
2000	ext, int	2.0	2.4	2.8	3.2	3.6	4.4
1. A.	marriage	2.5	3.0	3.5	4.1	4.6	5.7
2500	ext, int	1.6	1.9	2.2	2.5	2.9	3.5
· · ·	marriage	2.0	2.4	2.8	.3.3	3.7	4.5
3000	ext, int	1.3	1.6	1.8	2.I	2.4	2.9
	marriage	1.6	2.0	2.4	2.7	3.1	3.8
3500	ext, int	1.1	1.3	1.6	1.8	2.0	2.5
	marriage	1.4	17	2.0	2.3	2.6	3.2
4000	ext, int	1.0	1.2	1.4	1.6	1.8	2.2
	marriage	1.2	1.5	1.8	2.0	2.3	2.8
Net-Soil		1	Marriage W	all Oper	ning Widt	h (ft)	
Pres (ps	f)	10	12	14	16	18	20
1000	marriage	11.2	13.3	15.4	17.5	19.6	21.7
1500	marriage	7.4	8.9	10,3	11.7	13.1	14.5
2000	marriage	5.6	6.6	7.7	8.8	9.8	10.9
2500	marriage	4.5	5.3	6.2	7.0	7.8	8.7
3000	marriage	3.7	4.4	5.1	5.8	6.5	7.2
3500	marriage	3.2	3.8	4.4	5.0	5.6	6.2
4000	marriage	2.8	3.3	3.8	4.4	4.9	5.4
		Grou	nd Snov	v: 100	) psf		
Net Soil			Pie	r Spacir	ıg (ft)		
Pres (ps	f)	4.	5	6	7	·8· ·	10
1000	ext, int	4.2	5.I	6.0	6.9	7.8	9.6
	marriage	5.6	6.8	8.0	9.3	10.5	13.0

Aftg

# Required Effective Footing Area - Aftg (sqft) \*

		Grou	ind Sn	ow: 90	) psf		
Net So	il			Pier Spaci			
Pres (p	sf)	4	. 5	6	7	8	10
1000	ext, int	4.1	4.9	5.8	6.6	7.5	9.1
	marriage	5.2	6.4	7.5	8.7	9.9	12.2
1500	ext, int	2.7	3:3	3.8	4.4	5.0	6.1
	marriage	. 3.5	4.3	5.0	5.8	6.6	8.1
2000	ext, int	2.0	2.5	2.9	3.3	3.7	4.6
	marriage	2.6	3.2	3.8	4.4	4.9	6.1
2500	ext, int	1.6	2.0	2.3	2.6	3.0	3.7
	marriage	2.1	2.6	3.0	3.5	3.9	4.9
3000	ext, int	1.4	1.6	1.9	2.2	2.5	3.0
	marriage	1.7	2.1	2.5	2.9	3.3	4.1
3500	ext, int	1.2	1.4	1.6	1.9	2.1	2.6
	marriage	1.5	1.8	2.2	2.5	2.8	3.5
4000	ext, int	1.0	1.2	1.4	1.7	1.9	2.3
	marriage	1.3	1.6	1.9	2.2	2.5	3.0
Net Soi	11	P	Marriage V	Wall Oper	ning Wid	th (ft)	
Pres (p:	sf)	10	12	14	16	18	20
1000	marriage	12.0	14.3	16.5	18.8	21.1	23,4
1500	marriage	8.0	9.5	11.0	12.5	14.1	15.6
2000	marriage	6.0	7.1	8.3	9.4	10.5	11.7
2500	marriage	4.8	5.7	6.6	7.5	8.4	9.3
3000	marriage	4.0	4.8	5,5	6.3	7.0	7.8
3500	marriage	3.4	4.1	4.7	5.4	6.0	6.7
4000	marriage	3.0	3.6	4.1	4.7	5.3	5.8

		Grou	nd Sno	w: 10	0 psf		
Net So	il		P	ier Spacis	ng (ft)		
Pres (p	sf)	4.	5	6	7	.8	10
1000	ext, int	4.2	5.I	6.0	6.9	7.8	9.6
	marriage	5.6	6.8	8.0	9.3	10.5	13.0
1500	ext, int	2.8	3.4	4.0	4.6	5.2	6.4
	marriage	3.7	4.5	5.4	6.2	7.0	8.7
2000	ext, int	2.1	2.6	3.0	3.4	3.9	4.8
	marriage	2.8	3.4	4.0	4.6	5.3	6.5
2500	ext, int	1.7	2.1	2.4	2.8	3.1	3.8
	marriage	2.2	2.7	3.2	3.7	4.2	. 5.2
3000	ext, int	1.4	1.7	2.0	2.3	2.6	3.2
1.1	marriage	1.9	2.3	2.7	3.1	3.5	4.3
3500	ext, int	1.2	1.5	17	2.0	2.2	2.7
	marriage	1.6	1.9	2.3	27	3.0	3.7
4000	ext, int	1.1	1.3	15	17	1.9	2.4
	marriage	1.4	1.7	2.0	2.3 %	2.6	3.3
Net Soi	i <b>l</b> .	N	Aarriage V	Wall Oper	ung Wid	th (ft) 🗧	
Pres (pa	sf)	10	12	14	16	18	20
1000 -	marriage	12.8	15.2	177	20.1	22.6	25.0
1500	marriage	8.5	10.2	11.8	13.4	15.0	16.7
2000	marriage	6.4	7.6	8.8	10.1	11.3	12.5
2500	marriage	5.1	6.1	71 -	8.0	9.0	.10.0
3000	marriage	4.3	5.1	59	6.7	7.5	8.3
3500	marriage	3.7	4.4	51	57	6.4	7.1
4000	marriage	3.2	3.8	44	5.0	5.6	6.2

Multi-Section	Aftg C
Width	14'

		Mi	n. Roc	of: 15 p	osf		
Net So	il			ier Spaci			
Pres (p	sf)	4	5	6	7	8	10
1000	ext, int	3.3	4.0	4.6	5.3	5.9	7.
	marriage	3.4	4.1	4.8	5.5	6.3	7.
1500	ext, int	2.2	2.6	3.1	3.5	3.9	4
	marriage	2.3	2.8	3.2	3.7	4.2	5.
2000	ext, int	1.7	2.0	2.3	2.6	3.0	· 3.
	marriage	1.7	2.1	2.4	2.8	3.1	3.
2500	ext, int	1.3	1.6	1.8	2.1	2.4	2
	marriage	1.4	1.7	1.9	2.2	2.5	3.
3000	ext, int	1.1	1.3	1.5	1.8	2.0	2
	marriage	1.1	1.4	1.6	1.8	2.1	2.
3500	ext, int	1.0	1.1	1.3	1:5	1.7	2
	marriage	1.0	1.2	1.4	1.6	1.8	2.
4000	ext, int	1.0	1.0	1.2	1.3	1.5	1.3
	marriage	1.0	1.0	1.2	1.4	1.6	1.9
Net So	il	· N	farriage '	Wall Oper	ning Widt	th (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	7.5	8.8	10.2	11.6	13.0	14
1500	marriage	5.0	5.9	6.8	7.7	8.6	9.:
2000	marriage	3.7	4.4	5.1	5.8	6.5	7.:
2500	marriage	3.0	3.5	4.1	4.6	5.2	5.
3000	marriage	2.5	2.9	3.4	3.9	43	4.8
3500	marriage	2.1	2.5	2.9	3.3	. 3.7	4
4000	marriage	1.9	2.2	2.6	2.9	3.2	3.6

G	round Si	now:	30 psf	& Mir	n. Root	f: 20 p	sf
Net Soi	1		Pi	er Spacin	ng (ft)	<b>_</b>	
Pres (ps	f)	4	5	6	7	8	01
1000	ext, int	3.5	4.2	4.9	5.6	6.2	7.6
-	marriage	3.7	4.5	5.3	6.1	6.9	8.5
1500	ext, int	2.3	2.8	3.2	3.7	4.2	5.1
	marriage	2.5	3.0	3.6	4.1	4.6	5.7
2000	ext, int	1.7	2.1	2.4	2.8	3.1	3.8
	marriage	1.9	2.3	2.7	3.1	3.5	4.2
2500	ext, int	1.4	1.7	1.9	2.2	2.5	3.1
· .	marriage	1.5	1.8	2.1	2.4	2.8	3.4
3000	ext, int	1.2	1.4	1.6	1.9	2.1	2.5
	marriage	1.2	1.5	1.8	2.0	2.3	2.8
3500	ext, int	1.0	1.2	1.4	1.6	1.8	2.2
	marriage	1.1	1.3	1.5	1.7	2.0	2.4
4000	ext, int	1.0	1.0	1.2	1.4	1.6 .	19
4	marriage	1.0	1.1	1.3	1.5	1.7	2.1
Net Soi	1	N	Marriage V	Vall Oper	ning Widt	h (ft)	
Pres (ps	f)	10	12	14	16	18	<sup></sup> 20
1000	marriage	8.3	9.8	11.4	12.9	144	16.0
1500	marriage	5.5	6.6	7.6	8.6	9_6	10.6
2000	marriage	4.1	4.9	5.7	6.4	7.2	8.0
2500	marriage	3.3	3.9	4.5	5.2	5.8	6.4
3000	marriage	2.8	3.3	3.8	4.3	4.8	5.3
3500	marriage	2.4	2.8	3.2	3.7	41	46
4000	marriage	2.1	2.5	2.8	3.2	3.6	4.0

		Grou	ind Sn				
Net So		• • •	_ P	ier Spaci	•••		
Pres (p		4	5	6	7	8	10
1000	ext, int	3.4	4.0	4.7	5.4	6.1	7.
1.500	marriage	3.6	4.3	5.0	5.8	<u> </u>	8.
1500	ext, int	2.3	2.7	3.1	3.6	4.0	4.
0000	marriage	2.4	2.9	3.4	3.9	4.3	5.
2000	ext, int	1.7	2.0	2.4	2.7	3.0	3.
0.500	marriage	1.8	2.1	2.5	2.9	3.3	4.
2500	ext, int	1.4	1.6	1.9	2.2	2.4	3.6
2000	marriage	1.4	1.7	2.0	2.3	2.6	3.2
3000	ext, int	1.1	1.3	1.6	1.8	2.0	2.
2500	marriage	1.2	1.4	1.7	1.9	2.2	2.7
3500	ext, int	1.0	1.2	1.3	1.5	1.7	2.1
1000	marriage	1.0	1.2	1.4	1.7	1.9	2.3
4000	ext, int	1.0	1.0	1.2	1.3	1.5	1.8
	marriage	1.0	1.1	1.3	1.4	1.6	2.0
Net So		N	Marriage V				
Pres (p		10	12	14	16	18	20
1000	marriage	7.8	9.3	10.7	12.1	13.6	15.0
1500	marriage	5.2	6.2	7.1:	8.1	. 9.0	10.0
2000	marriage	3.9	4.6	5.3	6.1	6.8	7.5
2500 3000 -	marriage	3.1	3.7	4.3	4.9	5.4	6.0
			3.1	3.6	4.0	4.5	5.0
	marriage	2.6					
3500	marriage	2.2	2.6	3.1	3.5	3.9	
	•				3.5 3.0	3.9 3.4	4.3 3.8
3500 4000	marriage marriage	2.2	2.6 2.3 nd Sno	3.1 2.7 ow: 40	3.0 .psf		
3500 4000 Net Soi	marriage marriage	2.2	2.6 2.3 nd Sno	3.1 2.7	3.0 .psf		
3500 4000 Net Soi Pres (p:	marriage marriage il sf)	2.2 2.0 Grou	2.6 2.3 nd Sno Pi 5	3.1 2.7 ow: 40 er Spacin 6	3.0 psf g (ft) 7		
3500 4000 Net Soi	marriage marriage	2.2 2.0 Grou 4 3.7	2.6 2.3 nd Snc Pi 5 4.4	3.1 2.7 ow: 40 er Spacin	3.0 psf g (ft)	3.4	3.8 10 8.1
3500 4000 Net Soi Pres (p: 1000	marriage marriage il sf)	2.2 2.0 Grou 4 3.7 4.1	2.6 2.3 nd Sno Pi 5 4.4 5.0	3.1 2.7 <b>ow: 40</b> er Spacin $\frac{6}{5.1}$ 5.9	3.0 psf g (ft) 7	3.4	3.8 10 8.1
3500 4000 Net Soi Pres (p:	marriage marriage il sf) ext, int	2.2 2.0 Grou 4 3.7 4.1 2.4	2.6 2.3 nd Sno Pi 5 4.4 5.0 2.9	3.1 2.7 ow: 40 er Spacin 6 5.1	3.0 psf g (ft) 7 5.9	3.4 	3.8 10 8.1 9.4
3500 4000 Net Soi Pres (p: 1000	marriage marriage il sf) ext, int marriage ext, int marriage	2.2 2.0 Grou 4 3.7 4.1 2.4 2.8	2.6 2.3 nd Sno 5 4.4 5.0 2.9 3.3	3.1 2.7 <b>ow: 40</b> er Spacin 6 5.1 5.9 3.4 3.9	3.0 psf g (ft) 7 5.9 6.8 3.9 4.5	8 6.6 7.7 4.4 5.1	3.8 10 8.1 9.4 5.4 6.3
3500 4000 Net Soi Pres (p: 1000	marriage marriage il sf) ext, int marriage ext, int	2.2 2.0 Grou 4 3.7 4.1 2.4 2.8 1.8	2.6 2.3 nd Sno 5 4.4 5.0 2.9 3.3 2.2	3.1 2.7 <b>ow: 40</b> er Spacin 6 5.1 5.9 3.4 3.9 2.6	3.0 psf g (ft) 7 5.9 6.8 3.9 4.5 2.9	8 6.6 7.7 4.4	3.8 10 8.1 9.4 5.4 6.3 4.1
3500 4000 Net Soi Pres (p: 1000 1500	marriage marriage il sf) ext, int marriage ext, int marriage ext, int marriage	2.2 2.0 Grou 4 3.7 4.1 2.4 2.8 1.8 2.1	2.6 2.3 nd Snc 5 4.4 5.0 2.9 3.3 2.2 2.5	3.1 2.7 ow: 40 er Spacin 6 5.1 5.9 3.4 3.9 2.6 3.0	3.0 psf g (ft) 7 5.9 6.8 3.9 4.5	8 6.6 7.7 4.4 5.1	3.8 10 8.1 9.4 5.4 6.3 4.1 4.7
3500 4000 Net Soi Pres (p: 1000	marriage marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int	2.2 2.0 Grou 4 3.7 4.1 2.4 2.8 1.8 2.1 1.5	2.6 2.3 nd Snc 5 4.4 5.0 2.9 3.3 2.2 2.5 1.8	3.1 2.7 ow: 40 er Spacin 6 5.1 5.9 3.4 3.9 2.6 3.0 2.1	3.0 psf g (ft) 7 5.9 6.8 3.9 4.5 2.9	8 6.6 7.7 4.4 5.1 3.3	3.8 10 8.1 9.4 5.4 6.3 4.1
3500 4000 Pres (p: 1000 1500 2000	marriage marriage il sf) ext, int marriage ext, int marriage ext, int marriage	2.2 2.0 4 3.7 4.1 2.4 2.8 1.8 2.1 1.5 1.7	2.6 2.3 nd Snc 5 4.4 5.0 2.9 3.3 2.2 2.5 1.8 2.0	3.1 2.7 ow: 40 er Spacin 6 5.1 5.9 3.4 3.9 2.6 3.0	3.0 psf g (ft) 7 5.9 6.8 3.9 4.5 2.9 3.4	8 6.6 7.7 4.4 5.1 3.3 3.8	3.8 10 8.1 9.4 6.3 4.1 4.7 3.2 3.8
3500 4000 Net Soi Pres (p: 1000 1500	marriage marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int	2.2 2.0 Grou 4 3.7 4.1 2.4 2.8 1.8 2.1 1.5 1.7 1.2	2.6 2.3 nd Snc 5 4.4 5.0 2.9 3.3 2.2 2.5 1.8	3.1 2.7 ow: 40 er Spacin 6 5.1 5.9 3.4 3.9 2.6 3.0 2.1	3.0 psf g(ft) 7 5.9 6.8 3.9 4.5 2.9 3.4 2.4	3.4 8 6.6 7.7 4.4 5.1 3.3 3.8 2.7	3.8 10 8.1 9.4 6.3 4.1 4.7 3.2
3500 4000 Pres (pr 1000 1500 2000 2500 3000	marriage marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage	2.2 2.0 4 3.7 4.1 2.4 2.8 1.8 2.1 1.5 1.7 1.2 1.4	2.6 2.3 nd Snc 5 4.4 5.0 2.9 3.3 2.2 2.5 1.8 2.0 1.5 1.7	$3.1 \\ 2.7 \\ 0 w: 40 \\ er Spacin \\ 6 \\ 5.1 \\ 5.9 \\ 3.4 \\ 3.9 \\ 2.6 \\ 3.0 \\ 2.1 \\ 2.4 \\ 1.7 \\ 2.0 \\ 1.7 \\ 2.0 \\ 0 \\ 1.7 \\ 2.0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\$	3.0 psf g(ft) 7 5.9 6.8 3.9 4.5 2.9 3.4 2.4 2.7	8 6.6 7.7 4.4 5.1 3.3 3.8 2.7 3.1	3.8 10 8.1 9.4 5.4 6.3 4.1 4.7 3.2 3.8
3500 4000 Pres (p: 1000 1500 2000	marriage marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int	2.2 2.0 Grou 4 3.7 4.1 2.4 2.8 1.8 2.1 1.5 1.7 1.2	2.6 2.3 nd Snc 5 4.4 5.0 2.9 3.3 2.2 2.5 1.8 2.0 1.5	3.1 2.7 0w: 40 er Spacin 6 5.1 5.9 3.4 3.9 2.6 3.0 2.1 2.4 1.7	3.0 psf g(ft) 7 5.9 6.8 3.9 4.5 2.9 3.4 2.4 2.7 2.0	8 6.6 7.7 4.4 5.1 3.3 3.8 2.7 3.1 2.2	3.8 10 8.1 9.4 5.4 6.3 4.1 4.7 3.2 3.8 2.7
3500 4000 Pres (pr 1000 1500 2000 2500 3000	marriage marriage sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	2.2 2.0 4 3.7 4.1 2.4 2.8 1.8 2.1 1.5 1.7 1.2 1.4	2.6 2.3 nd Snc 5 4.4 5.0 2.9 3.3 2.2 2.5 1.8 2.0 1.5 1.7	$3.1 \\ 2.7 \\ 0 w: 40 \\ er Spacin \\ 6 \\ 5.1 \\ 5.9 \\ 3.4 \\ 3.9 \\ 2.6 \\ 3.0 \\ 2.1 \\ 2.4 \\ 1.7 \\ 2.0 \\ 1.7 \\ 2.0 \\ 0 \\ 1.7 \\ 2.0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\$	3.0 psf g(ft) 7 5.9 6.8 3.9 4.5 2.9 3.4 2.4 2.7 2.0 2.3	3.4           8           6.6           7.7           4.4           5.1           3.3           3.8           2.7           3.1           2.2           2.6	3.8 10 8.1 9.4 6.3 4.1 4.7 3.2 3.8 2.7 3.1
3500 4000 Pres (pr 1000 1500 2000 2500 3000	marriage marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.2 2.0 4 3.7 4.1 2.4 2.8 1.8 2.1 1.5 1.7 1.2 1.4 1.0	2.6 2.3 nd Snc 5 4.4 5.0 2.9 3.3 2.2 2.5 1.8 2.0 1.5 1.7 1.3	$\begin{array}{c} 3.1 \\ 2.7 \\ \hline \\ \text{ow: 40} \\ \text{er Spacin} \\ 6 \\ 5.1 \\ 5.9 \\ 3.4 \\ 3.9 \\ 2.6 \\ 3.0 \\ 2.1 \\ 2.4 \\ 1.7 \\ 2.0 \\ 1.5 \\ \end{array}$	3.0 psf g(ft) 7 5.9 6.8 3.9 4.5 2.9 3.4 2.4 2.7 2.0 2.3 1.7	3.4           8           6.6           7.7           4.4           5.1           3.3           3.8           2.7           3.1           2.2           2.6           1.9	3.8 10 8.1 9.4 5.4 6.3 4.1 4.7 3.2 3.8 2.7 3.1 2.3
3500 4000 Net Soi Pres (p) 1000 1500 2500 2500 3500	marriage marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	2.2 2.0 4 3.7 4.1 2.4 2.8 1.8 2.1 1.5 1.7 1.2 1.4 1.0 1.2	2.6 2.3 md Snc 5 4.4 5.0 2.9 3.3 2.2 2.5 1.8 2.0 1.5 1.7 1.3 1.4	3.1 2.7 0w: 40 er Spacin 6 5.1 5.9 3.4 3.9 2.6 3.0 2.1 2.4 1.7 2.0 1.5 1.7	3.0 psf g (ft) 7 5.9 6.8 3.9 4.5 2.9 3.4 2.4 2.7 2.0 2.3 1.7 1.9	3.4 8 6.6 7.7 4.4 5.1 3.3 3.8 2.7 3.1 2.2 2.6 1.9 2.2	3.8 10 8.1 9.4 5.4 6.3 4.1 4.7 3.2 3.8 2.7 3.1 2.3 2.7
3500 4000 Pres (p: 1500 2000 2500 3500	marriage marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	2.2 2.0 4 3.7 4.1 2.4 2.8 1.8 2.1 1.5 1.7 1.2 1.4 1.0 1.2 1.0 1.0	2.6 2.3 Pi 5 4.4 5.0 2.9 3.3 2.2 2.5 1.8 2.0 1.5 1.7 1.3 1.4 1.1 1.3	3.1 2.7 ow: 40 er Spacin 6 5.1 5.9 3.4 3.9 2.6 3.0 2.1 2.4 1.7 2.0 1.5 1.7 1.3 1.5	3.0 psf g (ft) 7 5.9 6.8 3.9 4.5 2.9 3.4 2.4 2.7 2.0 2.3 1.7 1.9 1.5 1.7	3.4           8           6.6           7.7           4.4           5.1           3.3           3.8           2.7           3.1           2.2           2.6           1.9           2.2           1.7           1.9	3.8 10 8.1 9.4 5.4 6.3 4.7 3.2 3.8 2.7 3.1 2.3 2.7 2.0
3500 4000 Net Soi Pres (p) 1000 1500 2500 2500 3500	marriage marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.2 2.0 4 3.7 4.1 2.4 2.8 1.8 2.1 1.5 1.7 1.2 1.4 1.0 1.2 1.0 1.0	2.6 2.3 <b>Ind Sno</b> 5 4.4 5.0 2.9 3.3 2.2 2.5 1.8 2.0 1.5 1.7 1.3 1.4 1.1	3.1 2.7 ow: 40 er Spacin 6 5.1 5.9 3.4 3.9 2.6 3.0 2.1 2.4 1.7 2.0 1.5 1.7 1.3 1.5	3.0 psf g (ft) 7 5.9 6.8 3.9 4.5 2.9 3.4 2.4 2.7 2.0 2.3 1.7 1.9 1.5 1.7	3.4           8           6.6           7.7           4.4           5.1           3.3           3.8           2.7           3.1           2.2           2.6           1.9           2.2           1.7           1.9	3.8 10 8.1 9.4 5.4 6.3 4.7 3.2 3.8 2.7 3.1 2.3 2.7 2.0
3500 4000 Net Soi Pres (p) 1000 1500 2000 2500 3000 3500 4000 Net Soi	marriage marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.2 2.0 4 3.7 4.1 2.4 2.8 1.8 2.1 1.5 1.7 1.2 1.4 1.0 1.2 1.0 1.0 1.0 N	2.6 2.3 Pi 5 4.4 5.0 2.9 3.3 2.2 2.5 1.8 2.0 1.5 1.7 1.3 1.4 1.1 1.3 141113 1arriage W	3.1 2.7 w: 40 er Spacin 6 5.1 5.9 3.4 3.9 2.6 3.0 2.1 2.4 1.7 2.0 1.5 1.7 1.3 1.5 /all Open	3.0 pSf g (ft) 7 5.9 6.8 3.9 4.5 2.9 3.4 2.4 2.7 2.0 2.3 1.7 1.9 1.5 1.7 ing Widt	3.4 8 6.6 7.7 4.4 5.1 3.3 3.8 2.7 3.1 2.2 2.6 1.9 2.2 1.7 1.9 h (ft)	3.8 10 8.1 9.4 5.4 6.3 4.1 4.7 3.2 3.8 2.7 3.1 2.3 2.7 2.0 2.4
3500 4000 Pres (p) 27es (p) 1000 1500 2500 2500 3500 3500 4000 Net Soi Pres (ps	marriage marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.2 2.0 4 3.7 4.1 2.4 2.8 1.8 2.1 1.5 1.7 1.2 1.4 1.0 1.2 1.0 1.0 1.0 M 10	2.6 2.3 Pi 5 4.4 5.0 2.9 3.3 2.2 2.5 1.8 2.0 1.5 1.7 1.3 1.4 1.1 1.3 farriage W	3.1 2.7 ow: 40 er Spacin 6 5.1 5.9 3.4 3.9 2.6 3.0 2.1 2.4 1.7 2.0 1.5 1.7 1.3 1.5 1.7 1.3 1.5 1.7	3.0 psf g (ft) 7 5.9 6.8 3.9 4.5 2.9 3.4 2.4 2.7 2.0 2.3 1.7 1.9 1.5 1.7 1.9 1.5 1.7 1.9	3.4 8 6.6 7.7 4.4 5.1 3.3 3.8 2.7 3.1 2.2 2.6 1.9 2.2 1.7 1.9 h (ft) 18	3.8 10 8.1 9.4 5.4 6.3 4.1 4.7 3.2 3.8 2.7 3.1 2.3 2.7 2.0 2.4 20
3500 4000 Pres (p) Pres (p) 1000 1500 2500 2500 3500 3500 4000 Vet Soi Pres (ps 000	marriage marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	2.2 2.0 4 3.7 4.1 2.4 2.8 1.8 2.1 1.5 1.7 1.2 1.4 1.0 1.0 1.0 1.0 1.0 1.0 9.2	2.6 2.3 Pi 5 4.4 5.0 2.9 3.3 2.2 2.5 1.8 2.0 1.5 1.7 1.3 1.4 1.1 1.3 1.4 1.1 1.3 1arriage W 12 11.0	3.1 2.7 0W: 40 er Spacin 6 5.1 5.9 3.4 3.9 2.6 3.0 2.1 2.4 1.7 2.0 1.5 1.7 1.3 1.5 1.7 1.3 1.5 1.7	3.0 psf g (ft) 7 5.9 6.8 3.9 4.5 2.9 3.4 2.4 2.7 2.0 2.3 1.7 1.5 1.7 1.5 1.7 1.5 1.7 1.5 1.7	3.4 8 6.6 7.7 4.4 5.1 3.3 3.8 2.7 3.1 2.2 2.6 1.9 2.2 1.7 1.9 h (ft) 18 16.2	3.8 10 8.1 9.4 5.4 6.3 4.1 4.7 3.2 3.8 2.7 3.1 2.3 2.7 2.0 2.4 20 17.9
3500 4000 Pres (p) 1000 1500 2500 2500 3500 3500 4000 Net Soi Pres (ps 000 500	marriage marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.2 2.0 4 3.7 4.1 2.4 2.8 1.8 2.1 1.5 1.7 1.2 1.4 1.0 1.0 1.0 M 10 9.2 6.2	2.6 2.3 Pi 5 4.4 5.0 2.9 3.3 2.2 2.5 1.8 2.0 1.5 1.7 1.3 1.4 1.1 1.3 Marriage W 12 11.0 7.3	3.1 2.7 0W: 40 er Spacin 6 5.1 5.9 3.4 3.9 2.6 3.0 2.1 2.4 1.7 2.0 1.5 1.7 1.3 1.5 /all Open 14 12.7 8.5	3.0 psf g(ft) 7 5.9 6.8 3.9 4.5 2.9 3.4 2.4 2.7 2.0 2.3 1.7 1.9 1.5 1.7 ing Widt 16 14.4 9.6 7.2	3.4 8 6.6 7.7 4.4 5.1 3.3 3.8 2.7 3.1 2.2 2.6 1.9 2.2 1.7 1.9 h (ft) 18 16.2 10.8 8.1	3.8 10 8.1 9.4 5.4 6.3 4.1 4.7 3.2 3.8 2.7 2.0 2.4 20 17.9 1.9 8.9
3500 4000 Pres (pr 1000 1500 2500 2500 3500 3500 4000 Net Soi Pres (ps 000 500 2000	marriage marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage f) marriage marriage	2.2 2.0 4 3.7 4.1 2.4 2.8 1.8 2.1 1.5 1.7 1.2 1.4 1.0 1.0 1.0 1.0 N 0 9.2 6.2 4.6	2.6 2.3 Pi 5 4.4 5.0 2.9 3.3 2.2 2.5 1.8 2.0 1.5 1.7 1.3 1.4 1.1 1.3 Marriage W 12 11.0 7.3 5.5	3.1 2.7 0W: 40 er Spacin 6 5.1 5.9 3.4 3.9 2.6 3.0 2.1 2.4 1.7 2.0 1.5 1.7 1.3 1.5 /all Open 14 12.7 8.5 6.3	3.0 psf g(ft) 7 5.9 6.8 3.9 4.5 2.9 3.4 2.4 2.7 2.0 2.3 1.7 1.9 1.5 1.7 ing Widt 16 14.4 9.6	3.4 8 6.6 7.7 4.4 5.1 3.3 3.8 2.7 3.1 2.2 2.6 1.9 2.2 1.7 1.9 h (ft) 18 16.2 10.8	3.8 10 8.1 9.4 6.3 4.1 4.7 3.2 3.8 2.7 2.0 2.4 20 17.9 11.9
3500 4000 Pres (pres (pr	marriage marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage f) marriage marriage marriage marriage	2.2 2.0 4 3.7 4.1 2.4 2.8 1.8 2.1 1.5 1.7 1.2 1.4 1.0 1.0 1.0 1.0 1.0 N 0 9.2 6.2 4.6 3.7	2.6 2.3 Pi 5 4.4 5.0 2.9 3.3 2.2 2.5 1.8 2.0 1.5 1.7 1.3 1.4 1.1 1.3 farriage W 12 11.0 7.3 5.5 4.4	3.1 2.7 0w: 40 er Spacin 6 5.1 5.9 3.4 3.9 2.6 3.0 2.1 2.4 1.7 2.0 1.5 1.7 1.3 1.5 //all Open 14 12.7 8.5 6.3 5.1	3.0 psf g(ft) 7 5.9 6.8 3.9 4.5 2.9 3.4 2.4 2.7 2.0 2.3 1.7 1.9 1.5 1.7 ing Widt 16 14.4 9.6 7.2 5.8	3.4 8 6.6 7.7 4.4 5.1 3.3 3.8 2.7 3.1 2.2 2.6 1.9 2.2 2.6 1.9 2.2 1.7 1.9 h (ft) 18 16.2 10.8 8.1 6.5	3.8 10 8.1 9.4 5.4 6.3 4.1 4.7 3.2 3.8 2.7 2.0 2.4 20 17.9 1.9 8.9 7.2

C 14		ulti-S Wid	ection				
· · ·		Grou	nd Sno	w: 50	psf		
Net Soi	iI			er Spacir			
Pres (pa		4	5	6	7	8	10
1000	ext, int	3.9	4.6	5.4	6.2	7.0	8.6
1	marriage	4.5	5.5	6.5	7.5	8.4	10.4
1500	ext, int	2.6	3.1	3.6	4.1	4.7	5.7
	marriage	3.0	3.7	4.3	5.0	5.6	6.9
2000	ext, int	1.9	2.3	2.7	3.1	. 3.5	4.3
	marriage	2.3	2.7	3.2	3.7	4.2	5.2
2500	ext, int	1.5	1.9	2.2	2.5	2.8	3.4
	marriage	1.8	2.2	2.6	3.0	3.4	4.2
3000	ext, int	1.3	1.5	1.8	2.1	2.3	2.9
	marriage	1.5	1.8	2.2	2.5	2.8	3.5
3500	ext, int	1.1	1.3	1.6	1.8	2.0	2.5
	marriage	1.3	1.6	1.8	2.1	2.4	3.0
4000	ext, int	1.0	1.2	1.4	1.6	1.8	2.1
. <u></u>	marriage	1.1	1.4	1.6	1.9	2.1	2.6
Net Soi			Aarriage W				·
Pres (p		10	12	14	16	18	20
1000	marriage	10.2	12.1	14.0	16.0	17.9	19.8
1500	marriage	6.8	8.1	9.4	10.6	11.9	13.2
2000	marriage	5.1	6.1	7.0	8.0	8.9	9.9
2500	marnage	4.1	4.8	5.6	6.4	7.1	7.9
3000	marriage	3.4	4.0	4.7	5.3	6.0	6.6
3500	marriage	2.9.	3.5	4.0	4.6 4.0	5.1 4.5	5.7 49
<u>4000</u>	тападе	2.9	3.5	4.0 3.5	4.6 4.0	5.1 4.5	4.9
		2.6	3.0	3.5	4.0		
4000	таттаде	2.6	3.0 nd Sno	3.5 w: 70	4.0 psf		
4000	marriage	2.6 Grou	3.0 nd Sno Pie	3.5 w: 70 er Spacir	4.0 psf ng (ft)	4.5	
4000 Net Soi Pres (p	marriage il sf)	2.6 Grou 4	3.0 nd Sno Pic 5	3.5 w: 70 er Spacir 6	4.0 psf ng (ft) 7		4.9
4000	marriage il sf) ext, int	2.6 Grou 4 4.2	3.0 nd Sno Pic 5 5.1	3.5 w: 70 er Spacir 6 6.0	4.0 psf ng (ft) 7 6.9	4.5 8 7.8	4.9
4000 Net Soi Pres (p: 1000	marriage il sf) ext, int marriage	2.6 Grou 4 4.2 5.3	3.0 nd Sno Pic 5 5.1 6.5	3.5 w: 70 er Spacir 6 6.0 7.6	4.0 psf ag (ft) 7 6.9 8.8	4.5	<u>4.9</u> <u>10</u> 9.5
4000 Net Soi Pres (p	marriage il sf) ext, int marriage ext, int	2.6 Grou 4 4.2 5.3 2.8	3.0 nd Sno Pic 5 5.1	3.5 w: 70 er Spacir 6 6.0	4.0 psf rg (ft) 7 6.9 8.8 4.6	4.5 8 7.8 10.0	4.9 10 9.5 12.3
4000 Net Soi Pres (p: 1000	il sf) ext, int marriage ext, int marriage	2.6 Grou 4 4.2 5.3 2.8 3.5	3.0 nd Sno 5 5.1 6.5 3.4	3.5 w: 70 er Spacir 6 6.0 7.6 4.0	4.0 psf ag (ft) 7 6.9 8.8	4.5 8 7.8 10.0 5.2	4.9 10 9.5 12.3 6.4
4000 Net Soi Pres (pr 1000	marriage il sf) ext, int marriage ext, int marriage ext, int	2.6 Grou 4.2 5.3 2.8 3.5 2.1	3.0 nd Sno 5 5.1 6.5 3.4 4.3	3.5 w: 70 r Spacir 6 6.0 7.6 4.0 5.1	4.0 psf g (ft) 7 6.9 8.8 4.6 5.9	4.5 8 7.8 10.0 5.2 6.6	4.9 10 9.5 12.3 6.4 8.2
4000 Net Soi Pres (pr 1000	il sf) ext, int marriage ext, int marriage	2.6 Grou 4 4.2 5.3 2.8 3.5	3.0 nd Sno 5 5.1 6.5 3.4 4.3 2.6	3.5 w: 70 r Spacir 6 6.0 7.6 4.0 5.1 3.0	4.0 psf rg (ft) 7 6.9 8.8 4.6 5.9 3.4	4.5 8 7.8 10.0 5.2 6.6 3.9	4.9 10 9.5 12.3 6.4 8.2 4.8
4000 Net Soi Pres (pr 1000 1500 2000	marriage il sf) ext, int marriage ext, int marriage ext, int marriage	2.6 Grou 4.2 5.3 2.8 3.5 2.1 2.6	3.0 nd Sno 5 5.1 6.5 3.4 4.3 2.6 3.2	3.5 w: 70 rr Spacirr 6 6.0 7.6 4.0 5.1 3.0 3.8	4.0 psf 9 (ft) 7 6.9 8.8 4.6 5.9 3.4 4.4	4.5 8 7.8 10.0 5.2 6.6 3.9 5.0	4.9 10 9.5 12.3 6.4 8.2 4.8 6.2
4000 Net Soi Pres (pr 1000 1500 2000	marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int	2.6 Grou 4.2 5.3 2.8 3.5 2.1 2.6 1.7	3.0 nd Sno 5 5.1 6.5 3.4 4.3 2.6 3.2 2.0	3.5 w: 70 r Spacin 6 6.0 7.6 4.0 5.1 3.0 3.8 2.4 3.0 2.0	4.0 <b>psf</b> 	4.5 8 7.8 10.0 5.2 6.6 3.9 5.0 3.1	4.9 10 9.5 12.3 6.4 8.2 4.8 6.2 3.8
4000 Net Soi Pres (pr 1000 1500 2000 2500	marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage	2.6 Grou 4.2 5.3 2.8 3.5 2.1 2.6 1.7 2.1	3.0 nd Sno 5 5.1 6.5 3.4 4.3 2.6 3.2 2.0 2.6	3.5 w: 70 r Spacin 6 6.0 7.6 4.0 5.1 3.0 3.8 2.4 3.0 2.0	4.0 psf rg (ft) 7 6.9 8.8 4.6 5.9 3.4 4.4 2.8 3.5	4.5 8 7.8 10.0 5.2 6.6 3.9 5.0 3.1 4.0	4.9 10 9.5 12.3 6.4 8.2 4.8 6.2 3.8 4.9 3.2 4.1
4000 Net Soi Pres (pr 1000 1500 2000 2500	marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	2.6 Grou 4.2 5.3 2.8 3.5 2.1 2.6 1.7 2.1 1.4 1.8	3.0 nd Sno Pic 5 5.1 6.5 3.4 4.3 2.6 3.2 2.0 2.6 1.7	3.5 w: 70 or Spacin 6 6.0 7.6 4.0 5.1 3.0 3.8 2.4 3.0	4.0 psf 7 6.9 8.8 4.6 5.9 3.4 4.4 2.8 3.5 2.3 2.9 2.0	4.5 8 7.8 10.0 5.2 6.6 3.9 5.0 3.1 4.0 2.6 3.3 2.2	4.9 10 9.5 12.3 6.4 8.2 4.8 6.2 3.8 4.9 3.2
4000 Net Soi Pres (pt 1000 1500 2000 2500 3000	marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.6 Grou 4.2 5.3 2.8 3.5 2.1 2.6 1.7 2.1 1.4	3.0 nd Sno 5 5.1 6.5 3.4 4.3 2.6 3.2 2.0 2.6 1.7 2.2	3.5 w: 70 r Spacin 6 7.6 4.0 5.1 3.0 3.8 2.4 3.0 2.0 2.5	4.0 psf r 6.9 8.8 4.6 5.9 3.4 4.4 2.8 3.5 2.3 2.9	4.5 8 7.8 10.0 5.2 6.6 3.9 5.0 3.1 4.0 2.6 3.3 2.2	4.9 10 9.5 12.3 6.4 8.2 4.8 6.2 3.8 4.9 3.2 4.1
4000 Net Soi Pres (pt 1000 1500 2000 2500 3000	marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.6 Grou 4.2 5.3 2.8 3.5 2.1 2.6 1.7 2.1 1.4 1.8 1.2	3.0 nd Sno Pic 5 5.1 6.5 3.4 4.3 2.6 3.2 2.0 2.6 1.7 2.2 1.5	3.5 w: 70 r Spacin 6 6.0 7.6 4.0 5.1 3.0 3.8 2.4 3.0 2.0 2.5 1.7	4.0 psf 7 6.9 8.8 4.6 5.9 3.4 4.4 2.8 3.5 2.3 2.9 2.0 2.5 1.7	4.5 8 7.8 10.0 5.2 6.6 3.9 5.0 3.1 4.0 2.6 3.3 2.2	4.9 10 9.5 12.3 6.4 8.2 4.8 6.2 3.8 4.9 3.2 4.1 2.7 3.5 2.4
4000 Net Soi Pres (p) 1000 1500 2000 2500 3000 3500	marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	2.6 Grou 4 4.2 5.3 2.8 3.5 2.1 2.6 1.7 2.1 1.4 1.8 1.2 1.5 1.1 1.3	3.0 nd Sno 5 5.1 6.5 3.4 4.3 2.6 3.2 2.0 2.6 1.7 2.2 1.5 1.8 1.3 1.6	3.5 w: 70 r Spacin 6 6.0 7.6 4.0 5.1 3.0 3.8 2.4 3.0 2.0 2.0 2.5 1.7 2.2 1.5 1.9	4.0 psf 	4.5 8 7.8 10.0 5.2 6.6 3.9 5.0 3.1 4.0 2.6 3.3 2.2 2.8 1.9 2.5	4.9 10 9.5 12.3 6.4 8.2 4.8 6.2 3.8 4.9 3.2 4.1 2.7 3.5
4000 Net Soi Pres (p) 1000 1500 2000 2500 3000 3500	marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.6 Grou 4 4.2 5.3 2.8 3.5 2.1 2.6 1.7 2.1 1.4 1.8 1.2 1.5 1.1 1.3 N	3.0 Pic 5 5.1 6.5 3.4 4.3 2.6 3.2 2.0 2.6 1.7 2.2 1.5 1.8 1.3 1.6 Marriage W	3.5 w: 70 r Spacin 6 6.0 7.6 4.0 5.1 3.0 3.8 2.4 3.0 2.0 2.5 1.7 2.2 1.5 1.9 /all Oper	4.0 psf 6.9 8.8 4.6 5.9 3.4 4.4 2.8 3.5 2.3 2.9 2.0 2.5 1.7 2.2 ning Widt	4.5 8 7.8 10.0 5.2 6.6 3.9 5.0 3.1 4.0 2.6 3.3 2.2 2.8 1.9 2.5 h (ft)	4.9 10 9.5 12.3 6.4 8.2 4.8 6.2 3.8 4.9 3.2 4.1 2.7 3.5 2.4 3.1
4000 Net Soi Pres (p) 1000 2000 2500 3000 3500 4000	marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage il	2.6 Grou 4 4.2 5.3 2.8 3.5 2.1 2.6 1.7 2.1 1.4 1.8 1.2 1.5 1.1 1.3 N 10	3.0 Pic 5 5.1 6.5 3.4 4.3 2.6 3.2 2.0 2.6 1.7 2.2 1.5 1.8 1.3 1.6 Marriage W 12	3.5 w: 70 rr Spacin 6 6.0 7.6 4.0 5.1 3.0 3.8 2.4 3.0 2.0 2.5 1.7 2.2 1.5 1.9 /all Oper 14	4.0 psf 6.9 8.8 4.6 5.9 3.4 4.4 2.8 3.5 2.3 2.9 2.0 2.5 1.7 2.2 ning Widt 16	4.5 8 7.8 10.0 5.2 6.6 3.9 5.0 3.1 4.0 2.6 3.3 2.2 2.8 1.9 2.5 h (ft) 18	4.9 10 9.5 12.3 6.4 8.2 4.8 6.2 3.8 4.9 3.2 4.1 2.7 3.5 2.4 3.1 20
4000 Net Soi Pres (pr 1000 1500 2000 2500 3000 3500 4000 Net Soi Pres (p 1000	marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage il sf) marriage	2.6 Grou 4 4.2 5.3 2.8 3.5 2.1 2.6 1.7 2.1 1.4 1.8 1.2 1.5 1.1 1.3 N 10 12.1	3.0 Pic 5 5.1 6.5 3.4 4.3 2.6 3.2 2.0 2.6 1.7 2.2 1.5 1.8 1.3 1.6 Marriage W 12 14.4	3.5 w: 70 r Spacir 6 6.0 7.6 4.0 5.1 3.0 3.8 2.4 3.0 2.0 2.5 1.7 2.2 1.5 1.9 /all Oper 14 16.7	4.0 psf 	4.5 8 7.8 10.0 5.2 6.6 3.9 5.0 3.1 4.0 2.6 3.3 2.2 2.8 1.9 2.5 h (ft) 18 21.3	4.9 10 9.5 12.3 6.4 8.2 4.8 6.2 3.8 4.9 3.2 4.1 2.7 3.5 2.4 3.1 20 23.6
4000 Net Soi Pres (pr 1000 1500 2000 2500 3000 3500 4000 Net Soi Pres (p 1000 1500	marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.6 Grou 4 4.2 5.3 2.8 3.5 2.1 2.6 1.7 2.1 1.4 1.8 1.2 1.5 1.1 1.3 N 10 12.1 8.1	3.0 Pic 5 5.1 6.5 3.4 4.3 2.6 3.2 2.0 2.6 1.7 2.2 1.5 1.8 1.3 1.6 Marriage W 12 14.4 9.6	3.5 w: 70 cr Spacir 6 6.0 7.6 4.0 5.1 3.0 3.8 2.4 3.0 2.5 1.7 2.2 1.5 1.9 /all Oper 14 16.7 11.1	4.0 psf ig (ft) 7 6.9 8.8 4.6 5.9 3.4 4.4 2.8 3.5 2.3 2.9 2.0 2.5 1.7 2.2 ning Widt 16 19.0 12.7	4.5 8 7.8 10.0 5.2 6.6 3.9 5.0 3.1 4.0 2.6 3.3 2.2 2.8 1.9 2.5 h (ft) 18 21.3 14.2	4.9 10 9.5 12.3 6.4 8.2 4.8 6.2 3.8 4.9 3.2 4.1 2.7 3.5 2.4 3.1 20 23.6 15.7
4000 Net Soi Pres (pr 1000 1500 2000 2500 3000 3500 4000 Net Soi Pres (pr 1000 1500 2000	marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.6 Grou 4 4.2 5.3 2.8 3.5 2.1 2.6 1.7 2.1 1.4 1.8 1.2 1.5 1.1 1.3 N 10 12.1 8.1 6.1	3.0 Pic 5 5.1 6.5 3.4 4.3 2.6 3.2 2.0 2.6 1.7 2.2 1.5 1.8 1.3 1.6 Marriage W 12 14.4 9.6 7.2	3.5 w: 70 cr Spacir 6 6.0 7.6 4.0 5.1 3.0 3.8 2.4 3.0 2.0 2.5 1.7 2.2 1.5 1.9 /all Oper 14 16.7 11.1 8 4	4.0 psf ag (ft) 7 6.9 8.8 4.6 5.9 3.4 4.4 2.8 3.5 2.3 2.9 2.0 2.5 1.7 1.2 2.2 ning Widt 16 19.0 12.7 9.5	4.5 8 7.8 10.0 5.2 6.6 3.9 5.0 3.1 4.0 2.6 3.3 2.2 2.8 1.9 2.5 h (ft) 18 21.3 14.2 10.7	4.9 10 9.5 12.3 6.4 8.2 4.8 6.2 3.8 4.9 3.2 4.1 2.7 3.5 2.4 3.1 20 23.6 15.7 11.8
4000 Net Soi Pres (pr 1000 1500 2000 2500 3000 3500 4000 Net Soi Pres (p 1000 1500 2000 2500	marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage il sf) marriage marriage marriage marriage marriage	2.6 Grou 4 4.2 5.3 2.8 3.5 2.1 2.6 1.7 2.1 1.4 1.8 1.2 1.5 1.1 1.3 N 10 12.1 8.1 6.1 4.8	3.0 Pic 5 5.1 6.5 3.4 4.3 2.6 3.2 2.0 2.6 1.7 2.2 1.5 1.8 1.3 1.6 Marriage W 12 14.4 9.6 7.2 5.8	3.5 w: 70 cr Spacir 6 6.0 7.6 4.0 5.1 3.0 3.8 2.4 3.0 2.5 1.7 2.2 1.5 1.9 /all Oper 14 16.7 11.1	4.0 psf 7 6.9 8.8 4.6 5.9 3.4 4.4 2.8 3.5 2.3 2.9 2.0 2.5 1.7 2.2 ning Widt 16 19.0 12.7 9.5 7.6	4.5 8 7.8 10.0 5.2 6.6 3.9 5.0 3.1 4.0 2.6 3.3 2.2 2.8 1.9 2.5 h (ft) 18 21.3 14.2 10.7 8 5	4.9 10 9.5 12.3 6.4 8.2 4.8 6.2 3.8 4.9 3.2 4.1 2.7 3.5 2.4 3.1 20 23.6 15.7 11.8 9.4
4000 Net Soi Pres (pr 1000 1500 2000 2500 3000 3500 4000 Net Soi Pres (p 1000 1500 2500 3000 2500 2500 3000 2500 2500 3000 2500 2000	marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage sf) marriage marriage marriage marriage	2.6 Grou 4 4.2 5.3 2.8 3.5 2.1 2.6 1.7 2.1 1.4 1.8 1.2 1.5 1.1 1.3 N 10 12.1 8.1 6.1 4.8 4.0	3.0 Pic 5 5.1 6.5 3.4 4.3 2.6 3.2 2.0 2.6 1.7 2.2 1.5 1.8 1.3 1.6 Marriage W 12 14.4 9.6 7.2 5.8 4.8	3.5 w: 70 r Spacin 6 6.0 7.6 4.0 5.1 3.0 3.8 2.4 3.0 2.0 2.5 1.7 2.2 1.5 1.9 /all Oper 14 16.7 11.1 8 4	4.0 psf (ft) 7 6.9 8.8 4.6 5.9 3.4 4.4 2.8 3.5 2.3 2.9 2.0 2.5 1.7 2.2 1.7 2.2 1.7 2.2 1.7 2.2 1.7 2.5 1.7 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	4.5 8 7.8 10.0 5.2 6.6 3.9 5.0 3.1 4.0 2.6 3.3 2.2 2.8 1.9 2.5 h (ft) 18 21.3 14.2 10.7 8.5 .1	4.9 10 9.5 12.3 6.4 8.2 4.8 6.2 3.8 4.9 3.2 4.1 2.7 3.5 2.4 3.1 20 23.6 15.7 11.8 9.4 7.9
4000 Net Soi Pres (pr 1000 1500 2000 2500 3000 3500 4000 Net Soi Pres (p 1000 1500 2000 2500	marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage il sf) marriage marriage marriage marriage marriage	2.6 Grou 4 4.2 5.3 2.8 3.5 2.1 2.6 1.7 2.1 1.4 1.8 1.2 1.5 1.1 1.3 N 10 12.1 8.1 6.1 4.8	3.0 Pic 5 5.1 6.5 3.4 4.3 2.6 3.2 2.0 2.6 1.7 2.2 1.5 1.8 1.3 1.6 Marriage W 12 14.4 9.6 7.2 5.8	3.5 w: 70 cr Spacir 6 6.0 7.6 4.0 5.1 3.0 3.8 2.4 3.0 2.0 2.5 1.7 2.2 1.5 1.9 /all Oper 14 16.7 11.1 8 4	4.0 psf 7 6.9 8.8 4.6 5.9 3.4 4.4 2.8 3.5 2.3 2.9 2.0 2.5 1.7 2.2 ning Widt 16 19.0 12.7 9.5 7.6	4.5 8 7.8 10.0 5.2 6.6 3.9 5.0 3.1 4.0 2.6 3.3 2.2 2.8 1.9 2.5 h (ft) 18 21.3 14.2 10.7 8 5	4.9 10 9.5 12.3 6.4 8.2 4.8 6.2 3.8 4.9 3.2 4.1 2.7 3.5 2.4 3.1 20 23.6 15.7 11.8 9.4

### Required Effective Footing Area - Aftg (sqft) \*

		Grou	ind Sn	<u>ow: 6</u> 0	) psf		
Net Soi	1 .		P	ier Spaci	ng (ft)		
Pres (ps	sf)	4	5	6	7	8	10
1000	ext, int	4.0	4.9	5.7	6.6	7.4	9.1
	marriage	4.9	6.0	7.0	. 8.1	9.2	11.4
1500	ext, int	2.7	3.3	3.8	4.4	4.9	6.0
	marriage	3.3	4.0	4.7	5.4	6.1	7.6
2000	ext, int	2.0	2.4	2.9	3.3	3.7	4.5
	marriage	2.4	3.0	3.5	4.1	4.6	5.7
2500	ext, int	1.6	2.0	2.3	2.6	3.0	3.6
	marriage	2.0	2.4	2.8	3.3	3.7.	4.5
3000	ext, int	1.3	1.6	1.9	2.2	2.5	3.0
	marriage	1.6	2.0	2.3	2.7	3.1	3.8
3500	ext, int	1.2	1.4	1.6	1.9	2.1	2.6
:	marriage	1.4	1.7	2.0	2:3	2.6	3.2
4000	ext, int	1.0	1.2	1.4	1.6	1.8	2.3
	marriage	1.2	· 1.5 ·	1.8	2.0	2.3	2.8
Net Soi	1	- 1	Marriage V	Wall Oper	ning Wid	th (ft)	
Pres (ps	sf) i i i	10	12	14	16	18	20
1000	marriage	11.2	13.3	15.4	17.5	19.6	21.7
1500	marriage	7.4	8.8	10.3	11.7	13.1	14.5
2000	marriage	5.6	6.6	7.7	8.7	9.8	10.9
2500	marriage	4.5	5.3	6.2	7.0	7.8	8.7
3000	marriage	3.7	4.4	5.1	5:8	6.5	7.2
3500	marriage	3.2	3.8	4.4	5.0	5.6	6.2
4000	marriage	2.8	3.3	3.8	4.4	4.9	5.4
	4. A 1				100 A.		
÷ .	1997) 1997 - 1997	Grou	nd Sn	ow: 80	psf		-
Net Soi		Grou					
		Grou 4		ow: 80 ier Spacir 6		8	10
			Р	ier Spacir	ıg (ft)	<u>8</u> 8.2	<u>10</u> 10.0
Pres (ps	sf)	4	P 5	ier Spacir 6	ng (ft) 7		
Pres (ps 1000	sf) ext, int	4	5 5.4	ier Spacir 6 6.3	ng (ft) 7 7.2	8.2	10.0
Pres (ps	sf) ext, int marriage ext, int	4 4.4 5.7	P 5 5.4 6.9	ier Spacir 6 6.3 8.2	ng (ft) 7 7.2 9.5	8.2 10.7	10.0 13.3
Pres (ps 1000 1500	sf) ext, int marriage	4 4.4 5.7 3.0	P 5 5.4 6.9 3.6	ier Spacir 6 6.3 8.2 4.2	ng (ft) 7 7.2 9.5 4.8	8.2 10.7 5.4	10.0 13.3 6.7
	sf) ext, int marriage ext, int marriage	4 4.4 5.7 3.0 3.8	P 5.4 6.9 3.6 4.6	ier Spacir 6 6.3 8.2 4.2 5.5	ng (ft) 7 7.2 9.5 4.8 6.3	8.2 10.7 5.4 7.2	10.0 13.3 6.7 8.8
Pres (ps 1000 1500	sf) ext, int marriage ext, int marriage ext, int marriage	4 4.4 5.7 3.0 3.8 2.2	P 5 5.4 6.9 3.6 4.6 2.7	ier Spacir 6 6.3 8.2 4.2 5.5 3.1	ng (ft) 7 7.2 9.5 4.8 6.3 3.6	8.2 10.7 5.4 7.2 4.1	10.0 13.3 6.7 8.8 5.0
Pres (ps 1000 1500 2000	sf) ext, int marriage ext, int marriage ext, int	4 4.4 5.7 3.0 3.8 2.2 2.8	P 5.4 6.9 3.6 4.6 2.7 3.5	ier Spacir 6 6.3 8.2 4.2 5.5 3.1 4.1	ng (ft) 7 7.2 9.5 4.8 6.3 3.6 4.7	8.2 10.7 5.4 7.2 4.1 5.4	10.0 13.3 6.7 8.8 5.0 6.6
Pres (ps 1000 1500 2000 2500	sf) ext, int marriage ext, int marriage ext, int marriage ext, int	4 4.4 5.7 3.0 3.8 2.2 2.8 1.8	P 5.4 6.9 3.6 4.6 2.7 3.5 2.1	ier Spacir 6 6.3 8.2 4.2 5.5 3.1 4.1 2.5 3.3	ng (ft) 7 7.2 9.5 4.8 6.3 3.6 4.7 2.9	8.2 10.7 5.4 7.2 4.1 5.4 3.3	10.0 13.3 6.7 8.8 5.0 6.6 4.0
Pres (ps 1000 1500 2000 2500	ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	4 4.4 5.7 3.0 3.8 2.2 2.8 1.8 2.3	P 5 5.4 6.9 3.6 4.6 2.7 3.5 2.1 2.8	ier Spacir 6 6.3 8.2 4.2 5.5 3.1 4.1 2.5	ng (ft) 7 7.2 9.5 4.8 6.3 3.6 4.7 2.9 3.8	8.2 10.7 5.4 7.2 4.1 5.4 3.3 4.3	10.0 13.3 6.7 8.8 5.0 6.6 4.0 5.3
Pres (ps 1000 1500 2000 2500 3000	ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	4 4.4 5.7 3.0 3.8 2.2 2.8 1.8 2.3 1.5 1.9	P 5.4 6.9 3.6 4.6 2.7 3.5 2.1 2.8 1.8 2.3	ier Spacir 6 6.3 8.2 4.2 5.5 3.1 4.1 2.5 3.3 2.1	ng (ft) 7 7.2 9.5 4.8 6.3 3.6 4.7 2.9 3.8 2.4	8.2 10.7 5.4 7.2 4.1 5.4 3.3 4.3 2.7	10.0 13.3 6.7 8.8 5.0 6.6 4.0 5.3 3.3
Pres (ps 1000 1500 2000	ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	4 4.4 5.7 3.0 3.8 2.2 2.8 1.8 2.3 1.5 1.9 1.3	P 5 5.4 6.9 3.6 4.6 2.7 3.5 2.1 2.8 1.8 2.3 1.5	ier Spacin 6 6.3 8.2 4.2 5.5 3.1 4.1 2.5 3.3 2.1 2.7 1.8	rg (ft) 7 7.2 9.5 4.8 6.3 3.6 4.7 2.9 3.8 2.4 3.2 2.1	8.2 10.7 5.4 7.2 4.1 5.4 3.3 4.3 2.7 3.6	10.0 13.3 6.7 8.8 5.0 6.6 4.0 5.3 3.3 4.4
Pres (ps 1000 1500 2000 2500 3000	ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	4 4.4 5.7 3.0 3.8 2.2 2.8 1.8 2.3 1.5 1.9	P 5.4 6.9 3.6 4.6 2.7 3.5 2.1 2.8 1.8 2.3	ier Spacin 6 6.3 8.2 4.2 5.5 3.1 4.1 2.5 3.3 2.1 2.7	rg (ft) 7 7.2 9.5 4.8 6.3 3.6 4.7 2.9 3.8 2.4 3.2	8.2 10.7 5.4 7.2 4.1 5.4 3.3 4.3 2.7 3.6 2.3	10.0 13.3 6.7 8.8 5.0 6.6 4.0 5.3 3.3 4.4 2.9
Pres (ps 1000 1500 2000 2500 3000 3500	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	4 4.4 5.7 3.0 3.8 2.2 2.8 1.8 2.3 1.5 1.9 1.3 1.6	P 5 5.4 6.9 3.6 4.6 2.7 3.5 2.1 2.8 1.8 2.3 1.5 2.0 1.3	ier Spacir 6 6.3 8.2 4.2 5.5 3.1 4.1 2.5 3.3 2.1 2.7 1.8 2.3 1.6	rg (ft) 7 7.2 9.5 4.8 6.3 3.6 4.7 2.9 3.8 2.4 3.2 2.1 2.7 1.8	8.2 10.7 5.4 7.2 4.1 5.4 3.3 4.3 2.7 3.6 2.3 3.1	10.0 13.3 6.7 8.8 5.0 6.6 4.0 5.3 3.3 4.4 2.9 3.8 2.5
Pres (ps 1000 1500 2000 2500 3000 3500 4000	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	4 4.4 5.7 3.0 3.8 2.2 2.8 1.8 2.3 1.5 1.9 1.3 1.6 1.1 1.4	P 5 5.4 6.9 3.6 4.6 2.7 3.5 2.1 2.8 1.8 2.3 1.5 2.0 1.3 1.7	ier Spacir 6 6.3 8.2 4.2 5.5 3.1 4.1 2.5 3.3 2.1 2.7 1.8 2.3 1.6 2.0	rg (ft) 7 9.5 4.8 6.3 3.6 4.7 2.9 3.8 2.4 3.2 2.1 2.7 1.8 2.4	8.2 10.7 5.4 7.2 4.1 5.4 3.3 4.3 2.7 3.6 2.3 3.1 2.0 2.7	10.0 13.3 6.7 8.8 5.0 6.6 4.0 5.3 3.3 4.4 2.9 3.8
Pres (ps           1000           1500           2000           2500           3000           3500           4000           Net Soi	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	4 4.4 5.7 3.0 3.8 2.2 2.8 1.8 2.3 1.5 1.9 1.3 1.6 1.1 1.4	P 5 5.4 6.9 3.6 4.6 2.7 3.5 2.1 2.8 1.8 2.3 1.5 2.0 1.3	ier Spacir 6 6.3 8.2 4.2 5.5 3.1 4.1 2.5 3.3 2.1 2.7 1.8 2.3 1.6 2.0	rg (ft) 7 9.5 4.8 6.3 3.6 4.7 2.9 3.8 2.4 3.2 2.1 2.7 1.8 2.4	8.2 10.7 5.4 7.2 4.1 5.4 3.3 4.3 2.7 3.6 2.3 3.1 2.0 2.7	10.0 13.3 6.7 8.8 5.0 6.6 4.0 5.3 3.3 4.4 2.9 3.8 2.5
Pres (ps           1000           1500           2000           2500           3000           3500           4000           Net Soi           Pres (ps	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	4 4.4 5.7 3.0 3.8 2.2 2.8 1.8 2.3 1.5 1.9 1.3 1.6 1.1 1.4 1.0	P 5 5.4 6.9 3.6 4.6 2.7 3.5 2.1 2.8 1.8 2.3 1.5 2.0 1.3 1.7 Marriage 12	ier Spacir 6 6.3 8.2 4.2 5.5 3.1 4.1 2.5 3.3 2.1 2.7 1.8 2.3 1.6 2.0 Wall Oper 14	rg (ft) 7 7.2 9.5 4.8 6.3 3.6 4.7 2.9 3.8 2.4 3.2 2.1 2.7 1.8 2.4 ming Widt 16	8.2 10.7 5.4 7.2 4.1 5.4 3.3 4.3 2.7 3.6 2.3 3.1 2.0 2.7 th (ft) 18	10.0 13.3 6.7 8.8 5.0 6.6 4.0 5.3 3.3 4.4 2.9 3.8 2.5 3.3
Pres (ps           1000           1500           2000           2500           3000           3500           4000           Net Soi           1000	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage sf) marriage	4 4.4 5.7 3.0 3.8 2.2 2.8 1.8 2.3 1.5 1.9 1.3 1.6 1.1 1.4 10 13.1	P 5 5.4 6.9 3.6 4.6 2.7 3.5 2.1 2.8 1.8 2.3 1.5 2.0 1.3 1.7 Varriage V 12 15.6	ier Spacir 6 6.3 8.2 4.2 5.5 3.1 4.1 2.5 3.3 2.1 2.7 1.8 2.3 1.6 2.0 Wall Oper	rg (ft) 7 7.2 9.5 4.8 6.3 3.6 4.7 2.9 3.8 2.4 2.1 2.7 1.8 2.4 ning Widt 16 20.5	8.2 10.7 5.4 7.2 4.1 5.4 3.3 4.3 2.7 3.6 2.3 3.1 2.0 2.7 th (ft)	10.0 13.3 6.7 8.8 5.0 6.6 4.0 5.3 3.3 4.4 2.9 3.8 2.5 3.3 20
Pres (ps           1000           1500           2000           2500           3000           3500           4000           Pres (ps           1000           1500	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage sf) marriage	4 4.4 5.7 3.0 3.8 2.2 2.8 1.8 2.3 1.5 1.9 1.3 1.6 1.1 1.4 1.4 10 13.1 8.7	P 5 5.4 6.9 3.6 4.6 2.7 3.5 2.1 2.8 1.8 2.3 1.5 2.0 1.3 1.7 Marriage 7 12 15.6 10.4	ier Spacir 6 6.3 8.2 4.2 5.5 3.1 4.1 2.5 3.3 2.1 2.7 1.8 2.3 1.6 2.0 Wall Oper 14 18.1 12.0	rg (ft) 7 7.2 9.5 4.8 6.3 3.6 4.7 2.9 3.8 2.4 3.2 2.1 1.8 2.4 1.8 2.4 ning Widt 16 20.5 13.7	8.2 10.7 5.4 7.2 4.1 5.4 3.3 4.3 2.7 3.6 2.3 3.1 2.0 2.7 th (ft) 18 23.0	10.0 13.3 6.7 8.8 5.0 6.6 4.0 5.3 3.3 4.4 2.9 3.8 2.5 3.3 20 25.5
Pres (ps           1000           1500           2000           2500           3000           3500           4000           Pres (ps           1000           1500	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage sf) marriage marriage	4 4.4 5.7 3.0 3.8 2.2 2.8 1.8 2.3 1.5 1.9 1.3 1.6 1.1 1.4 10 13.1	P 5 5.4 6.9 3.6 4.6 2.7 3.5 2.1 2.8 1.8 2.3 1.5 2.0 1.3 1.7 Varriage V 12 15.6	ier Spacir 6 6.3 8.2 4.2 5.5 3.1 4.1 2.5 3.3 2.1 2.7 1.8 2.3 1.6 2.0 Wall Oper 14 18.1	rg (ft) 7 7.2 9.5 4.8 6.3 3.6 4.7 2.9 3.8 2.4 2.1 2.7 1.8 2.4 ning Widt 16 20.5	8.2 10.7 5.4 7.2 4.1 5.4 3.3 4.3 2.7 3.6 2.3 3.1 2.0 2.7 th (ft) 18 23.0 15.4	10.0 13.3 6.7 8.8 5.0 6.6 4.0 5.3 3.3 4.4 2.9 3.3 4.4 2.5 2.5 3.3 20 25.5 17.0
Pres (ps 1000 2000 2500 3000 3500 4000 Net Soi Pres (ps 1000 1500 2000	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage f) marriage marriage marriage	4 4.4 5.7 3.0 3.8 2.2 2.8 1.8 2.3 1.5 1.9 1.3 1.6 1.1 1.4 10 13.1 8.7 6.5	P 5 5.4 6.9 3.6 4.6 2.7 3.5 2.1 2.8 1.8 2.3 1.5 2.0 1.3 1.7 Marriage 7 12 15.6 10.4 7.8	ier Spacir 6 6.3 8.2 4.2 5.5 3.1 4.1 2.5 3.3 2.1 2.7 1.8 2.3 1.6 2.0 Wall Opeu 14 18.1 12.0 9.0	rg (ft) 7 7.2 9.5 4.8 6.3 3.6 4.7 2.9 3.8 2.4 3.2 2.1 2.7 1.8 2.4 hing Widt 16 20.5 13.7 10.3	8.2 10.7 5.4 7.2 4.1 5.4 3.3 4.3 2.7 3.6 2.3 3.1 2.0 2.7 th (ft) 18 23.0 15.4 11.5	10.0 13.3 6.7 8.8 5.0 6.6 4.0 5.3 3.3 4.4 2.9 3.8 2.5 3.3 20 25.5 17.0 12.8
Pres (ps 1000 2000 2500 3000 3500 4000 Net Soi Pres (ps 1000 1500 2000 2500	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage sf) marriage marriage	4 4.4 5.7 3.0 3.8 2.2 2.8 1.8 2.3 1.5 1.9 1.3 1.6 1.1 1.4 1.4 13.1 8.7 6.5 5.2	P 5 5.4 6.9 3.6 4.6 2.7 3.5 2.1 2.8 1.8 2.3 1.5 2.0 1.3 1.7 Marriage 7 15.6 10.4 7.8 6.2	ier Spacir 6 6.3 8.2 4.2 5.5 3.1 4.1 2.5 3.3 2.1 2.7 1.8 2.3 1.6 2.0 Wall Opeu 14 18.1 12.0 9.0 7.2	rg (ft) 7 7.2 9.5 4.8 6.3 3.6 4.7 2.9 3.8 2.4 3.2 2.1 2.7 1.8 2.4 3.2 2.1 2.7 1.8 2.4 3.2 1.3 1.2 1.3 3.6 4.7 1.2 3.8 2.4 3.2 2.1 2.7 1.8 3.6 4.7 1.2 3.8 2.4 3.2 1.2 1.2 1.2 1.2 1.2 1.2 1.2 1	8.2 10.7 5.4 7.2 4.1 5.4 3.3 4.3 2.7 3.6 2.3 3.1 2.0 2.7 th (ft) 18 23.0 15.4 11.5 9.2	10.0 13.3 6.7 8.8 5.0 6.6 4.0 5.3 3.3 4.4 2.9 3.8 2.5 3.3 20 25.5 17.0 12.8 10.2

<u>\_</u>

Multi-Section	Aftg
Width	14'

	· ·	Grou	ind Sn	ow: 90	) psf		
Net So	il	1.00	F	ier Spaci	ng (ft)		
Pres (p	osf)	4	5	6	7	8.	10
1000	ext, int	4.6	5.6	6.6	7.6	8.5	10.5
	marriage	6.0	7.4	8.8	10.1	11.5	14.2
1500	ext, int	3.1	3.7	4.4	5.0	5.7	7.0
	marriage	4.0	4.9	5.8	6.8	7.7	9.5
2000	ext, int	2.3	2.8	3.3	3.8	4.3	5.3
	marriage	3.0	3.7	4.4	5.1	5.7	7.1
2500	ext, int	1.8	2.2	2.6	3.0	3.4	4.2
	marriage	2.4	3.0	3.5	4.1	4.6	5.7
3000	ext, int	1.5	1.9	2.2	2.5	2.8	3.5
	marriage	2.0	2.5	2.9	3.4	3.8	4.7
3500	ext, int	1.3	1.6	1.9	2.2	2.4	3.0
	marriage	1.7	2.1	2.5	2.9	3.3	4.1
4000	ext, int	1.2	1.4	1.6	1.9	2.1	2.6
	marriage	1.5	1.9	2.2	2.5	2.9	3.6
Net Soi	1	Ν	Aarriage V	Wall Oper	ning Widt	th (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	14.0	16.7	19.4	22.1	24.8	27.4
1500	marriage	9.4	11.1	12.9	14.7	16.5	18.3
2000	marriage	7.0	8.4	9.7	11.0	12.4	13.7
2500	marriage	5.6	6.7	7.8	8.8	9.9	11.0
3000	marriage	4.7	5.6	6.5	7.4	8.3	9.1
3500	marriage	4.0	4.8	5.5	6.3	. 7.1	7.8
4000	marriage	3.5	4.2	4.8	5.5	6.2	6.9

				· · · · ·		· · · · · · · · · · · · · · · · · · ·	
		Grou	nd Sno	ow: 10	0 psf		
Net So	oil	÷ .	I	Pier Spaci	ing (ft)		
Pres (p	osf)	4	5	6	7	8	10
1000	ext, int	4.8	-5.8	6.9	7.9	8.9	11.0
	marriage	6.4	7.9	9.3	10.8	12.3	15.2
1500	ext, int	3.2	3.9	4.6	5.3	6.0	7.3
	marriage	4.3	5.3	6.2	7.2	8.2	10.1
2000	ext, int	2.4	2.9	3.4	3.9	4.5	5.5
·.	marriage	3.2	3.9	4.7	5.4	6.1	7.6
2500	ext, int	1.9	2.3	2.7	3.2	3.6	4.4
	marriage	2.6	3.2	3.7	4.3	4.9	6.1
3000	ext, int	1.6	19	2.3	2.6	3.0	3.7
	marriage	2.1	2.6	3.1	3.6	4.1	5.1
3500	ext, int	1.4	1.7	2.0	2.3	2.6	3.1
	marriage	1.8	2.3	2.7	3.1	3.5	4.3
4000	ext, int	1.2	1.5	1.7	2.0	2.2	2.7
	marriage	1.6	2.0	2.3	2.7	3.1	3.8
Net Soi	U sa s	N	Marriage V	Wall Ope	ning Wid	th (ft)	
Pres (p	sf)	10	12-	14	16	18	20
1000	marriage	15.0	17.9	20.7	23.6	26.5	29.4
1500	marriage	10.0	11.9	13.8	15.7	17.7	19.6
2000	marriage	7.5	8.9	10.4	11.8	13.2	14.7
2500	marriage	6.0	7.1	8.3	9.4	10.6	11.7
3000	marriage	5.0	6.0	6.9	7.9	8.8	9.8
3500	marriage	4.3	5.1	5.9	6.7	7.6	8.4
4000	marriage	3.7	4.5	5.2	5.9	6.6	7.3

\* Minimum exterior and interior pier area is 1.0 sqft.

B-13

Af	ta						
Ĉ	and and the set	ىلىتى] Q_iti_0	ection				
Serie march	223						
16		Wic	ith 				
		Mi	n. Rooi	f: 15 p	sf		
Net So	il			er Spacin			
Pres (p	sf)	4	5	6	7	8	
1000	ext, int	3.6	44	5.1	5.8	6.6	8.0
	marriage	3.7	4.5	5.3	6.1	6.9	8.5
1500	ext, int	2.4	2.9	3.4	3.9	4.4 4.6	5.4
2000	marriage	2.5	3.0	<u>3.6</u> 2.5	<u>4.1</u> 2.9	3.3	<u> </u>
2000	ext, int marriage	1.8	2.2	2.7	3.1	3.5 ·	4.0
2500	ext, int	1.5	1.7	2.0	2.3	2.6	3.2
2000	marriage	1.5	1.8	2.1	2.4	2.8	3.4
3000	ext, int	1.2	1.5	1.7	1.9	2.2	2.7
	marriage	1.2	1.5	1.8	2.0	2.3	2.8
3500	ext, int	1.0	1.2	1.5	1.7	1.9	2.3
	marriage	1.1	1.3	1.5	1.7	2.0	2.4
4000	ext, int	1.0	1.1	1.3	1.5	1.6	2.0
<u> </u>	marriage	1.0	1.1	1.3	1.5	1.7	2.1
Net So	il	N	Aarriage V			h (ft)	
Pres (p	sf)	10	12	14	16	18	. 20
1000	marriage	8.3	9.8	11.4	12.9	14.4	16.0
1500	marriage	5.5	6.6	7.6	8.6	9.6	. 10.6
2000	marriage	4.1	4.9	5.7	6.5	7.2	8.0
2500	marriage	3.3	3.9	4.5	5.2	5.8	6.4
3000	marriage	2.8	3.3	3.8	4.3 3.7	4.8	5.3 4.6
3500	marriage	2.4 2.1	2.8 2.5	3.2 2.8	3.2	4.1 3.6	4.0 4.0
4000	marriage	4.1	2.5	2.0	2.2	5.0	4.0
			20	0 1/:-	. D	c. 00 -	
<u> </u>	round Si	10W:				<u>1. 20 p</u>	SI .
Net So				er Spacir			10
Pres (p		4	. 5	6	7	8	10
1000	ext, int	3.8	4.6	5.4 5.9	6.2	6.9	8.5
1500	таттаде	4.1	5.0		6.8	7.7	9.4
1500	ext, int	2.5	31	3.6 3.9	4.1	4.6 5.1	5.7 6.3
0000	marriage	2.7	<u>3.3</u> 2.3	2.7	4.5	3.5	4.2
2000	ext, int marriage	1.9 2.1	2.5	2.9	3.4	3.8	.4.7
2500	ext, int	1.5	1.8	2.9	2.5	2.8	3.4
00,02	marriage	1.5	2.0	2.4	2.7	3.1	3.8
3000	ext, int	1.3	1.5	1.8	2.1	2.3	2.8
2000	marriage	1.4	1.7	2.0	2.3	2.6	3.1
3500	ext, int	1.1	1.3	1.5	1.8	2.0	2.4
5500	marriage	1.2	1.4	1.7		2.2	2.7
4000	ext, int	1.0	1.1	1.3	1.5	1.7	2.1
	marriage	1.0	1.3	1.5	1.7	1.9	2.4
Net So			Aarriage V				
Pres (p		10	12	14	<u> </u>	18	20
1000	marriage	9.2	10.9	12.7	14.4	16.1	17.8
1500	marriage	6.2	7.3	8.4	9.6	10.7	11.9
2000	marriage	4.6	5.5	6.3	7.2	8.1	8.9
2500	marriage	3.7	4.4	5.1	5.8	6.4	7.1
3000	marriage	3.1	3.6	4.2	4.8	5.4	5.9
3500	marriage	2.6	3.1	3.6	4.1	4.6	5.1
4000_	maniage	2.3	2.7	3.2	3.6	4.0	4.5

F

#### Required Effective Footing Area - Aftg (sqft) \*

		Grou	ind Sn	ow: 25	psf		
Net So	il		F	ier Spaci	ng (ft)	· .	
Pres (p	sf)	4	5	6	7	8	10
1000	ext, int	3.7	4.5	5.2	6.0	6.7	8.2
	marriage	3.9	4.7	5.6	6.4	7.2	8.9
1500	ext, int	2.5	3.0	3.5	4.0	4.5	5.5
	marriage	2.6	3.2	3.7	4.3	4.8	5.9
2000	ext, int	1.9	2.2	2.6	3.0	3.4	4.1
-	marriage	2.0	2.4	2.8	3.2	3.6	4.4
2500	ext, int	1.5	1.8	2.1	2.4	2.7	3.3
14 A	marriage	1.6	1.9	2.2	2.6	2.9	3.6
3000	ext, int	1.2	1.5	1.7	2.0	2.2	2.7
	marriage	1.3	1.6	1.9	2.1	2.4	3.0
3500	ext, int	1.1	1.3	1.5	1.7	1.9	2.3
	marriage	1.1	1.4	1.6	1.8	2.1	2.5
4000	ext, int	1.0	1.1	1.3	1.5	- 1.7	2.1
	marriage	1.0	1.2	1.4	1.6	1.8	2.2
Net So				Wall Oper			
Pres (p		10	12	14	16	18	20
1000	marriage	8.7	10.3	11.9	13.5	15.1	16.7
1500	marriage	5.8	6.9	7.9	9.0	10.1	11.2
2000	marriage	4.3	5.1	6.0	6.8	7.6	8.4
2500	marriage	3.5	4.1	4.8	5.4	6.1	6.7
3000	marriage	2.9	3.4	4.0	4.5	5.0	5.6
3500	marriage	2.5	2.9	3.4	3.9	4.3	4.8
4000	marriage	2.2	2.6	3.0	3.4	3.8	4.2
		Grou	nd Sn	ow: 40	DSf		
Net So	1	Grou		ow: 40			
			P	ier Spacir	ıg (ft)	. 8	10
Pres (p	sf)	4	- P 5	ier Spacir 6	ıg (ft) 7	8	10
Pres (p	sf) ext, int	4 4.0	5 4.9	ier Spacir 6 5.7	ng (ft) 7 6.5	7.4	9.0
Pres (p 1000	sf) ext, int marriage	4 4.0 4.6	P 5 4.9 5.5	ier Spacir 6 5.7 6.5	ng (ft) 7 6.5 7.5	7.4 8.5	9.0 10.5
Pres (p 1000	sf) ext, int marriage ext, int	4 4.0 4.6 2.7	P 5 4.9 5.5 3.2	ier Spacir 6 5.7 6.5 3.8	ng (ft) 7 6.5 7.5 4_4	7.4 8.5 4.9	9.0 10.5 6.0
Pres (p 1000 1500	sf) ext, int marriage ext, int marriage	4 4.0 4.6 2.7 3.0	P 5 4.9 5.5 3.2 3.7	ier Spacir 6 5.7 6.5 3.8 4.4	rg (ft) 7 6.5 7.5 4.4 5.0	7.4 8.5 4.9 5.7	9.0 10.5 6.0 7.0
Pres (p 1000 1500	sf) ext, int marriage ext, int marriage ext, int	4 4.0 4.6 2.7 3.0 2.0	P 5 4.9 5.5 3.2 3.7 2.4	ier Spacir 6 5.7 6.5 3.8 4.4 2.9	ng (ft) 7 6.5 7.5 4.4 5.0 3.3	7.4 8.5 4.9 5.7 3.7	9.0 10.5 6.0 7.0 4.5
Pres (p 1000 1500 2000	sf) ext, int marriage ext, int marriage ext, int marriage	4 4.0 4.6 2.7 3.0 2.0 2.3	P 5 4.9 5.5 3.2 3.7 2.4 2.8	ier Spacir 6 5.7 6.5 3.8 4.4 2.9 3.3	ng (ft) 7 6.5 7.5 4.4 5.0 3.3 3.8	7.4 8.5 4.9 5.7 3.7 4.3	9.0 10.5 6.0 7.0 4.5 5.3
Pres (p 1000 1500 2000	sf) ext, int marriage ext, int marriage ext, int marriage ext, int	4 4.0 4.6 2.7 3.0 2.0 2.3 1.6	P 5 4.9 5.5 3.2 3.7 2.4 2.8 1.9	ier Spacir 6 5.7 6.5 3.8 4.4 2.9 3.3 2.3	ng (ft) 7 6.5 7.5 4.4 5.0 3.3 3.8 2.6	7.4 8.5 4.9 5.7 3.7 4.3 2.9	9.0 10.5 6.0 7.0 4.5 5.3 3.6
Pres (p 1000 1500 2000 2500	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage	4 4.0 4.6 2.7 3.0 2.0 2.3 1.6 1.8	P 5 4.9 5.5 3.2 3.7 2.4 2.8 1.9 2.2	ier Spacir 6 5.7 6.5 3.8 4.4 2.9 3.3 2.3 2.6	ng (ft) 7 6.5 7.5 4.4 5.0 3.3 3.8 2.6 3.0	7.4 8.5 4.9 5.7 3.7 4.3 2.9 3.4	9.0 10.5 6.0 7.0 4.5 5.3 3.6 4.2
Pres (p 1000 1500 2000 2500	st) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	4 4.0 4.6 2.7 3.0 2.0 2.3 1.6 1.8 1.3	P 5 4.9 5.5 3.2 3.7 2.4 2.8 1.9 2.2 1.6	ier Spacir 6 5.7 6.5 3.8 4.4 2.9 3.3 2.3 2.6 1.9	ng (ft) 7 6.5 7.5 4.4 5.0 3.3 3.8 2.6 3.0 2.2	7.4 8.5 4.9 5.7 3.7 4.3 2.9 3.4 2.5	9.0 10.5 6.0 7.0 4.5 5.3 3.6 4.2 3.0
Pres (p 1000 1500 2000 2500 3000	st) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	4 4.0 4.6 2.7 3.0 2.0 2.3 1.6 1.8 1.3 1.5	P 5 3.2 3.7 2.4 2.8 1.9 2.2 1.6 1.8	ier Spacir 6 5.7 6.5 3.8 4.4 2.9 3.3 2.3 2.6 1.9 2.2	ng (ft) 7 6.5 7.5 4.4 5.0 3.3 3.8 2.6 3.0 2.2 2.5	7.4 8.5 4.9 5.7 3.7 4.3 2.9 3.4 2.5 2.8	9.0 10.5 6.0 7.0 4.5 5.3 3.6 4.2 3.0 3.5
Pres (p 1000 1500 2000 2500 3000	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	4 4.0 4.6 2.7 3.0 2.0 2.3 1.6 1.8 1.3 1.5 1.2	P 5 4.9 5.5 3.2 3.7 2.4 2.8 1.9 2.2 1.6 1.8 1.4	ier Spacir 6 5.7 6.5 3.8 4.4 2.9 3.3 2.3 2.6 1.9 2.2 1.6	g (ft) 7 6.5 7.5 4.4 5.0 3.3 3.8 2.6 3.0 2.2 2.5 1.9	7.4 8.5 4.9 5.7 3.7 4.3 2.9 3.4 2.5 2.8 2.1	9.0 10.5 6.0 7.0 4.5 5.3 3.6 4.2 3.0 3.5 2.6
1500 2000 2500 3000 3500	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	4 4.0 4.6 2.7 3.0 2.0 2.3 1.6 1.8 1.3 1.5 1.2 1.3	P 5 4.9 5.5 3.2 3.7 2.4 2.8 1.9 2.2 1.6 1.8 1.4 1.6	ier Spacir 6 5.7 6.5 3.8 4.4 2.9 3.3 2.3 2.6 1.9 2.2 1.6 1.9	g (ft) 7 6.5 7.5 4.4 5.0 3.3 3.8 2.6 3.0 2.2 2.5 1.9 2.2	7.4 8.5 4.9 5.7 3.7 4.3 2.9 3.4 2.5 2.8 2.1 2.4	9.0 10.5 6.0 7.0 4.5 5.3 3.6 4.2 3.0 3.5 2.6 3.0
Pres (p 1000 1500 2000 2500 3000	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	4 4.0 4.6 2.7 3.0 2.0 2.3 1.6 1.8 1.3 1.5 1.2 1.3 1.0	P 5 4.9 5.5 3.2 3.7 2.4 2.8 1.9 2.2 1.6 1.8 1.4 1.6 1.2	ier Spacir 6 5.7 6.5 3.8 4.4 2.9 3.3 2.3 2.3 2.6 1.9 2.2 1.6 1.9 1.4	g (ft) 7 6.5 7.5 4.4 5.0 3.3 3.8 2.6 3.0 2.2 2.5 1.9 2.2 1.6	7.4 8.5 4.9 5.7 3.7 4.3 2.9 3.4 2.5 2.8 2.1 2.4 1.8	9.0 10.5 6.0 7.0 4.5 5.3 3.6 4.2 3.0 3.5 2.6 3.0 2.3
Pres (p 1000 1500 2000 2500 3000 3500 4000	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	4 4.0 4.6 2.7 3.0 2.0 2.3 1.6 1.8 1.3 1.5 1.2 1.3 1.0 1.1	P 5 4.9 5.5 3.2 3.7 2.4 2.8 1.9 2.2 1.6 1.8 1.4 1.6 1.2 1.4	ier Spacir 6 5.7 6.5 3.8 4.4 2.9 3.3 2.6 1.9 2.2 1.6 1.9 1.4 1.6	g (ft) 7 6.5 7.5 4.4 5.0 3.3 3.8 2.6 3.0 2.2 2.5 1.9 2.2 1.6 1.9	7.4 8.5 4.9 5.7 3.7 4.3 2.9 3.4 2.5 2.8 2.1 2.4 1.8 2.1	9.0 10.5 6.0 7.0 4.5 5.3 3.6 4.2 3.0 3.5 2.6 3.0
Pres (p           1000           1500           2000           2500           3000           3500           4000           Net So	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage il	4 4.0 4.6 2.7 3.0 2.0 2.3 1.6 1.8 1.3 1.5 1.2 1.3 1.0 1.1	P 5 4.9 5.5 3.2 3.7 2.4 2.8 1.9 2.2 1.6 1.8 1.4 1.6 1.2 1.4 4arriage V	ier Spacir 6 5.7 6.5 3.8 4.4 2.9 3.3 2.6 1.9 2.2 1.6 1.9 1.4 1.6 Wall Oper	g (ft) 7 6.5 7.5 4.4 5.0 3.3 3.8 2.6 3.0 2.2 2.5 1.9 2.2 1.6 1.9 2.2 1.6	7.4 8.5 4.9 5.7 3.7 4.3 2.9 3.4 2.5 2.8 2.1 2.4 1.8 2.1 h (ft)	9.0 10.5 6.0 7.0 4.5 5.3 3.6 4.2 3.0 3.5 2.6 3.0 2.3 2.6
Pres (p           1000           1500           2000           2500           3000           3500           4000           Net So           Pres (p	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage il sf)	4 4.0 4.6 2.7 3.0 2.0 2.3 1.6 1.8 1.3 1.5 1.2 1.3 1.0 1.1 1.0 1.1	P 5 4.9 5.5 3.2 3.7 2.4 2.8 1.9 2.2 1.6 1.8 1.4 1.6 1.2 1.4 4 Arriage V 12	ier Spacir 6 5.7 6.5 3.8 4.4 2.9 3.3 2.3 2.3 2.6 1.9 2.2 1.6 1.9 1.4 1.6 Wall Oper 14	g (ft) 7 6.5 7.5 4.4 5.0 3.3 3.8 2.6 3.0 2.2 2.5 1.9 2.2 1.6 1.9 2.2 1.6 1.9 1.9 1.6	7.4 8.5 4.9 5.7 3.7 4.3 2.9 3.4 2.5 2.8 2.1 2.4 1.8 2.1 h (ft) 18	90 10.5 6.0 7.0 4.5 5.3 3.6 4.2 3.0 3.5 2.6 3.0 2.3 2.6 2.3 2.6
Pres (p           1000           1500           2000           2500           3000           3500           4000           Net So           Pres (p           1000	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage il sf) marriage	4 4.0 4.6 2.7 3.0 2.0 2.3 1.6 1.8 1.3 1.5 1.2 1.3 1.0 1.1 1.1 10 10.3	P 5 4.9 5.5 3.2 3.7 2.4 2.8 1.9 2.2 1.6 1.8 1.4 1.6 1.2 1.4 Varriage V 12 12.2	ier Spacir 6 5.7 6.5 3.8 4.4 2.9 3.3 2.3 2.6 1.9 1.6 1.9 1.4 1.6 Wall Oper 14 14.2	g (ft) 7 6.5 7.5 4.4 5.0 3.3 3.8 2.6 3.0 2.2 2.5 1.9 2.2 1.6 1.9 1.6 1.9 16 16.1	7.4 8.5 4.9 5.7 3.7 4.3 2.9 3.4 2.5 2.8 2.1 2.4 1.8 2.1 h (ft) 18 18.1	9.0 10.5 6.0 7.0 4.5 5.3 3.6 4.2 3.0 3.5 2.6 3.0 2.3 2.6 2.3 2.6 2.0 20.0
Pres (p           1000           1500           2000           2500           3000           3500           4000           Net So           Pres (p           1000           1500	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage il sf) marriage	4 4.0 4.6 2.7 3.0 2.0 2.3 1.6 1.8 1.3 1.5 1.2 1.3 1.0 1.1 1.1 10 10.3 6.9	P 5 4.9 5.5 3.2 3.7 2.4 2.8 1.9 2.2 1.6 1.8 1.4 1.6 1.2 1.4 Varriage V 12 12.2 8.2	ier Spacir 6 5.7 6.5 3.8 4.4 2.9 3.3 2.3 2.6 1.9 2.2 1.6 1.9 1.4 1.6 Wall Oper 14 14.2 9.5	g (ft) 7 6.5 7.5 4.4 5.0 3.3 3.8 2.6 3.0 2.2 2.5 1.9 2.2 1.6 1.9 1.6 1.9 1.6 1.9 1.6 1.9 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	7.4 8.5 4.9 5.7 3.7 4.3 2.9 3.4 2.5 2.8 2.1 2.4 2.1 1.8 2.1 h (ft) 18 18.1 12.0	9.0 10.5 6.0 7.0 4.5 5.3 3.6 4.2 3.0 3.5 2.6 3.0 2.3 2.3 2.6 2.0 2.3 2.3 2.3 2.3 2.3 2.3 2.3 2.3 2.3 2.3
Pres (p 1000 1500 2000 2500 3000 3500 4000 Net So Pres (p 1000 1500 2000	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage il sf) marriage marriage marriage	4 4.0 4.6 2.7 3.0 2.0 2.3 1.6 1.8 1.3 1.5 1.2 1.3 1.0 1.1 1.1 10 10.3 6.9 5.2	P 5 4.9 5.5 3.2 3.7 2.4 2.8 1.9 2.2 1.6 1.8 1.4 1.6 1.2 1.4 Marriage V 12 12.2 8.2 6.1	ier Spacir 6 5.7 6.5 3.8 4.4 2.9 3.3 2.3 2.6 1.9 2.2 1.6 1.9 1.4 1.6 Wall Oper 14 14.2 9.5 7.1	g (ft) 7 6.5 7.5 4.4 5.0 3.3 3.8 2.6 3.0 2.2 2.5 1.9 2.2 1.6 1.9 1.6 1.9 1.0.7 8.1	7.4 8.5 4.9 5.7 3.7 4.3 2.9 3.4 2.5 2.8 2.1 2.4 1.8 2.1 h (ft) 18 18.1 12.0 9.0	900 10.5 6.0 7.0 4.5 5.3 3.6 4.2 3.0 3.5 2.6 3.0 2.3 2.6 2.0 2.0 20.0 13.3 10.0
Pres (p 1000 1500 2500 3000 3500 4000 Net So Pres (p 1000 1500 2000 2500	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage il sf) marriage marriage marriage	4 4.0 4.6 2.7 3.0 2.0 2.3 1.6 1.8 1.3 1.5 1.2 1.3 1.0 1.1 1.1 10 10.3 6.9 5.2 4.1	P 5 4.9 5.5 3.2 3.7 2.4 2.8 1.9 2.2 1.6 1.8 1.4 1.6 1.2 1.4 Marriage V 12 12.2 8.2 6.1 4.9	ier Spacir 6 5.7 6.5 3.8 4.4 2.9 3.3 2.3 2.6 1.9 2.2 1.6 1.9 2.2 1.6 1.9 1.4 1.4 1.4 1.4 1.4 1.4 1.5 7.1 5.7 5.7 5.7 5.7 5.7 5.7 5.7 5.7	g (ft) 7 6.5 7.5 4.4 5.0 3.3 3.8 2.6 3.0 2.2 2.5 1.9 2.2 1.9 2.2 1.9 1.9 1.9 1.9 1.0 16.1 10.7 8.1 6.4	7.4 8.5 4.9 5.7 3.7 4.3 2.9 3.4 2.5 2.8 2.1 2.4 1.8 2.1 h (ft) 18 18.1 12.0 9.0 7.2	9.0 10.5 6.0 7.0 4.5 5.3 3.6 4.2 3.0 3.5 2.6 3.0 2.3 2.6 2.0 20.0 13.3 10.0 8.0
Pres (p 1000 1500 2000 2500 3000 3500 3500 4000 1500 2000 2500 3000	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage il sf) marriage marriage marriage marriage marriage	4 4.0 4.6 2.7 3.0 2.0 2.3 1.6 1.8 1.3 1.5 1.2 1.3 1.0 1.1 1.1 10 10.3 6.9 5.2 4.1 3.4	P 5 4.9 5.5 3.2 3.7 2.4 2.8 1.9 2.2 1.6 1.8 1.4 1.6 1.2 1.4 4 Aarriage V 12 12.2 8.2 6.1 4.9 4.1	ier Spacir 6 5.7 6.5 3.8 4.4 2.9 3.3 2.3 2.3 2.6 1.9 2.2 1.6 1.9 1.4 1.6 1.9 1.4 1.4 1.4 1.4 1.5 7.1 5.7 4.7	g (ft) 7 6.5 7.5 4.4 5.0 3.3 3.8 2.6 3.0 2.2 2.5 1.9 2.2 1.6 1.9 2.2 1.6 1.9 1.6 1.9 3.3 4.4 5.0 3.3 3.8 3.8 3.8 3.0 3.0 2.2 5.5 1.9 2.2 1.9 2.2 1.9 2.2 1.6 1.9 3.3 3.8 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0	7.4 8.5 4.9 5.7 3.7 4.3 2.9 3.4 2.5 2.8 2.1 2.4 1.8 2.1 1.8 2.1 h (ft) 18 18.1 12.0 9.0 7.2 6.0	900 10.5 6.0 7.0 4.5 5.3 3.6 4.2 3.0 3.5 2.6 3.0 2.3 2.6 2.0 20.0 13.3 10.0 8.0 6.7
Pres (p 1000 1500 2500 3000 3500 4000 Net So Pres (p 1000 1500 2000 2500	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage il sf) marriage marriage marriage	4 4.0 4.6 2.7 3.0 2.0 2.3 1.6 1.8 1.3 1.5 1.2 1.3 1.0 1.1 1.1 10 10.3 6.9 5.2 4.1	P 5 4.9 5.5 3.2 3.7 2.4 2.8 1.9 2.2 1.6 1.8 1.4 1.6 1.2 1.4 Marriage V 12 12.2 8.2 6.1 4.9	ier Spacir 6 5.7 6.5 3.8 4.4 2.9 3.3 2.3 2.6 1.9 2.2 1.6 1.9 2.2 1.6 1.9 1.4 1.4 1.4 1.4 1.4 1.4 1.5 7.1 5.7 5.7 5.7 5.7 5.7 5.7 5.7 5.7	g (ft) 7 6.5 7.5 4.4 5.0 3.3 3.8 2.6 3.0 2.2 2.5 1.9 2.2 1.9 2.2 1.9 1.9 1.9 1.9 1.0 16.1 10.7 8.1 6.4	7.4 8.5 4.9 5.7 3.7 4.3 2.9 3.4 2.5 2.8 2.1 2.4 1.8 2.1 h (ft) 18 18.1 12.0 9.0 7.2	9.0 10.5 6.0 7.0 4.5 5.3 3.6 4.2 3.0 3.5 2.6 3.0 2.3 2.6 2.0 20.0 13.3 10.0 8.0

		_Grou	ind Sn	ow: 50	) psf		
Net So	il		I	Pier Spaci	ng (ft)		
Pres (p	sf)	4	5	<u>6</u>	7	8	10
1000	ext, int	4.3	5.1	6.0	6.9	7.8	9.6
	marriage	5.0	6.1	7.2	8.3	9.4	11.6
1500	ext, int	2.8	3.4	4.0	4.6	5.2	6.4
	marriage	3.3	4.1	4.8	5.5	6.3	7.7
2000	ext, int	2.1	2.6	3.0	3.5	3.9	4.8
	marriage	2.5	3.0	3.6	4.1	4.7	5.8
2500	ext, int	1.7	2.1	2.4	2.8	3.1	3.8
	marriage	2.0	2.4	2.9	3.3	3.8	4.6
3000	ext, int	1.4	1.7	2.0	2.3	2.6	3.2
	marriage	1.7	2.0	2.4	2.8	. 3.1	3.9
3500	ext, int	1.2	1.5	1.7	2.0	2.2	2.7
	marriage	1.4	1.7	2.1	2.4	2.7	3.3
4000	ext, int	1.1	1.3	1.5	1.7	2.0	2.4
	marriage	1.2	1.5	1.8	2.1	2.3	2.9
Net Soi		N	Marriage '	Wall Ope	ning Widt	h (ft)	:
Pres (p:		10	12	14	16	18	20
1000	marriage	11.4	13.6	15.7	17.9	20.0	22.2
1500	marriage	7.6	9.0	10,5	11.9	13.3	14.8
2000	marriage	5.7	6.8	7.9	8.9	10.0	11.1
2500	marriage	4.6	5.4	6.3	7.1	8.0	8.9
3000	marriage	3.8	4.5	5.2	6.0	6.7	· 7.4
3500	marriage	3.3	3.9	4.5	5.1	5.7	6.3
4000	marriage	2.8	3.4	3.9	4.5	5.0	5.5
		Grou	nd Sn	ow: 70	psf		
Net Soi	İ			ier Spacin			ابى

	marriage	5.4	0.6	7.8	9.0	10.3	12.7
1500	ext, int	3.0	3.6	4.2	4.9	5.5	6.7
	marriage	3.6	4.4	5.2	6.0	6.8	8.5
2000	ext, int	2.2	2.7	3.2	3.6	4.1	5.1
	marriage	2.7	3.3	3.9	4.5	5.1	6.3
2500	ext, int	1.8	2.2	2.5	2.9	3.3	4.0
	marriage	2.2	2.7	3.1	3.6	4.1	5.1
3000	ext, int	1.5	1.8	2.1	2.4	2.7	3.4
	marriage	1.8	2.2	2.6	3.0	3.4	4.2
3500	ext, int	1.3	1.5	1.8	2.1	2.4	2.9
1.1	marriage	1.5	1.9	2.2	2.6	2.9	3.6
4000	ext, int	1.1	1.4	1.6	1.8	2.1	2.5
	marriage	1.4	1.7	2.0	2.3	2.6	3.2
Net So		1	Marriage		ning Widt	th (ft)	
Pres (p		10	12	14	16	18	20
1000	marriage	12.5	14.9	17.2	19.6	22.0	24.3
1500	marriage	8.3	9.9	11.5	13.1	14.6	16.2
2000	marriage	6.2	7.4	8.6	9.8	11.0	12.2
2500	marriage	5.0	5.9	6.9	7.8	8.8	9.7
3000	marriage	4.2	5.0	5.7	6.5	7.3	8.1
3500	marriage	3.6	4.2	4.9	5.6	6.3	7.0
4000	marriage	3.1	3.7	4.3	4.9	5.5	6.1
		Grou	nd Sno				л. Т
Net So		,	· P	ier Spacir			
Pres (p		4	5	6	7	8	10
1000	ext, int	4.9	6.0	7.0	8.1	9.1	11.2
	marriage	6.3	7.7	9.1	10.6	12.0	14.8
1500	ext, int	3.3	4.0	4.7	5.4	6.1	7.5
	marriage	4.2	5.1	6.1	7.0	8.0	9.9
2000	ext, int	2.5	3.0	3.5	4.0	4.6	5.6
	marriage	3.1	3.9	4.6	5.3	6.0	7.4
2500	ext, int	2.0	2.4	2.8	3.2	3.6	4.5
	marriage	2.5	3.1	3.7	4.2	4.8	5.9
3000	ext, int	1.6	2.0	2.3	2.7	3.0	3.7
	marriage	2.1	2.6	3.0	3.5	4.0	4.9
3500	ext, int	1.4	1.7	2.0	2.3	2.6	3.2
	marriage	1.8	2.2	2.6	3.0	3.4	4.2
4000	ext, int	1.2	1.5	1.8	2.0	2.3	2.8
	marriage	_ 1.6	1.9	2.3	2.6	3.0	3.7
Net Soi			farriage V	Vall Oper	ung Widtl	1 (ft)	
Pres (p		10	12	14	16	18	20
1000	marriage	14.7	17.5	20.3	23.1	25.9	28.7
1500	marriage	9.8	11.6	13.5	15.4	17.2	19.1
2000	marriage	7.3	8.7	10.1	11.5	12.9	14.3
2500	marriage	5.9	7.0	8.1	9.2	10.3	11.5
3000	marriage	4.9	5.8	6.8	7.7	8.6	9.6
3500	marriage	4.2	5.0	5.8	6.6	7.4	8.2
4000	marriage	3.7	4.4	5.1	5.8	6.5	7.2

٦

7

7.3

9.0

**Multi-Section** 

Width

Pier Spacing (ft)

6

6.4

7.8

Ground Snow: 60 psf

5

5.4

6.6

4

4.5

5.4

Net Soil

Pres (psf)

ext, int

marriage

1000

Aftg

С

16'

10

10.1

12.7

8

10.3

8.2

* Minimum exterior and interior pier	area is 1.0 sqft.
--------------------------------------	-------------------

4

4.7

5.9

3.1

3.9

2.3

2.9

1.9

2.3

1.6

2.0

1.3

1.7

1.2

1.5

10

13.6

9.0

6.8

5.4

4.5

3.9

3.4

5

5.7

7.2

3.8

4.8

2.8

3.6

2.3

2.9

1.9

2.4

1.6

2.0

1.4

1.8

12

16.2

10.8

8.1

6.5

5.4

4.6

4.0

6

6.7

8.5

4.5

5.7

3.3

4.2

2.7

3.4

2.2

2.8

1.9

2.4

1.7

2.1

14

18.7

12.5

9:4

7.5

6.2

5.4

4.7

Marriage Wall Opening Width (ft)

7

7.7

9.8

5.1

6.5

3.8

4.9

3.1

3.9

2.6

3.3

2.2

2.8

1.9

2.5

16

21.3

14.2

10.7

8.5

7.1

6.1

5.3

8

8.7

5.8

7.4

4.3

5.6

3.5

4.5

2.9

3.7

2.5

3.2

2.2

2.8

18

23.9

15.9

12.0

9.6

8.0

6.8

6.0

11.1

10

10.7

13.8

7.1

9.2

5.3

6.9

4.3

<u>5.5</u>

3.6

4.6

3.0

3.9

2.7

3.4

20

26.5

17.7

13.3

10.6

8.8

7.6

6.6

Pres (psf)

ext, int

ext, int

ext, int

marriage

marriage

marriage

ext, int

ext, int

ext, int

marriage

marriage

marriage

marriage

marriage

marriage

marriage

marriage

marriage

ext, int

marriage

marriage

1000

1500

2000

2500

3000

3500

4000

1000

1500

2000

2500

3000

3500

4000

Net Soil

Pres (psf)

Aftg C 16'	Multi-Section Width

E

]		Grou	ind Sn	ow: 90	) psf		
Net So	il		F	Pier Spaci:	ng (ft)		d
Pres (p	sf)	4	5	6	7	8	10
1000	ext, int	5.1	6.2	7.3	8.4	9.5	11.7
	marriage	6.7	8.3	9.8	11.3	12.9	15.9
1500	ext, int	. 3.4	4.1	4.9	5.6	6.4	7.8
	marriage	4.5	5.5	6.5	7.6	8. <del>6</del>	10.6
2000	ext, int	2.6	3.1	3.7	4.2	4.8	5.9
	marriage	3.4	4.1	4.9	5.7	6.4	8.0
2500	ext, int	2.0	2.5	2.9	3.4	3.8	4.7
	marriage	2.7	3.3	3.9	4.5	5.1	6.4
3000	ext, int	1.7	2.1	2.4	2.8	3.2	3.9
	marriage	2.2	2.8	3.3	3.8	4.3	5.3
3500	ext, int	1.5	1.8	2.1	2.4	2.7	3.4
	marriage	1.9	2.4	2.8	3.2	3.7	4.6
4000	ext, int	1.3	1.6	1.8	2.1	2.4	2.9
	marriage	1.7	2.1	2.4	2.8	3.2	4.0
Net Soi	1	1	Marriage V	Wall Oper	ning Widt	th (ft)	
Pres (ps	sť)	10	12	14	16	18	20
1000	marriage	15.7	18.8	21.8	24.8	27.8	30.9
1500	marriage	10.5	12.5	14.5	16.5	18.6	20.6
2000	marriage	7.9	9.4	10.9	12.4	13.9	15.4
2500	marriage	6.3	7.5	8.7.	9.9	11.1	12.3
3000	marriage	5.2	6.3	7.3	8.3	9.3	10.3
3500	marriage	4.5	5.4	6.2	7.1	8.0	8.8
4000	marriage	3.9	4.7	5.4	6.2	7.0	7.7

## Required Effective Footing Area - Aftg (sqft) \*

		0	1.0	10	·		
		Grou	nd Sno	<u>)w: 10</u>	0 pst		
Net So	il ·		- 1 - F	Pier Spaci	ng (ft)		
Pres (p	osf)	. 4	5	6	. 7	8	10
1000	ext, int	5.3	6.5	7.7	8.8	10.0	12.3
	marriage	7.2	8.8	10.4	12.1	13.7	17.0
1500	ext, int	3.6	4.3	5.1	5.9	6.6	8.2
	marriage	4.8	5.9	7.0	8.1	9.2	11.3
2000	ext, int	2.7	3.2	3.8	4.4	5.0	6.1
i.	marriage	3.6	4.4	5.2	6.0	6.9	. 8.5
2500	ext, int	2.1	2.6	3.1	3.5	4.0	4.9
	marriage	2.9	3.5	4.2	4.8	5.5	6.8
3000	ext, int	1.8	2.2	2.6	2.9	3.3	4.1
	marriage	2.4	2.9	3.5	4.0	4.6	5.7
3500	ext, int	1.5	1.9	2.2	2.5	2.8	3.5
	marriage	2.0	2.5	3.0	3.5	3.9	4.9
4000	ext, int	1.3	1.6	1.9	2.2	2.5	3.1
1	marriage	1.8	2.2	2.6	3.0	3.4	4.3
Net So	il	1	Marriage V	Wall Oper	ning Widt	th (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	16.8	20.1	23.3	26.5	29.8	33.0
1500	marriage	11.2	13.4	15.5	17.7	19.9	22.0
2000	marriage	8.4	10.0	11.7	13.3	14.9	16.5
2500	marriage	6.7	8.0	9.3	10.6	11.9	13.2
3000	marriage	5.6	6.7	7.8	8.8	9.9	11.0
3500	marriage	4.8	5.7	6.7	7.6	8.5	9.4
4000	marriage	4.2	5.0	5.8	6.6	7.4	8.3

# **Multi-Section Cnw**

Required Effective Footing Area - Aftg (sqft) \*

Min. Roof: 15 psf										
Net Soil Pres (psf)			Pier Spacing (ft)							
		4	5	.6	7	8	10			
1000	pier	3.0	3.5	4.1	4.7	5.2	6:3			
1500	pier	2.0	2.3	2.7	3.1	3.5	4.2			
2000	pier	1.5	1.8	2.0	2.3	2.6	3.2			
2500	pier	1.2	1.4	1.6	1.9	2.1	2.5			
3000	pier	1.0	1.2	1.4	1.6	1.7	2.1			
3500	pier	1.0	1.0	1.2	1.3	1.5	1.8			
4000	pier	1.0	1.0	1.0	1.2	1.3	1.6			





Ground Snow: 25 psf											
Net Soi	1	Pier Spacing (ft)									
Pres (ps	sf)	4	5	6	7	8	10				
1000	pier	3.0	3.6	4.2	4.8	5.3	6.5				
1500	pier	2.0	2.4	2.8	3.2	3.6	4.3				
2000	pier	1.5	1.8	2.1	2.4	2.7	3.2				
2500	pier	1.2	1.4	1.7	1.9	2.1	2.6				
3000	pier	1.0	1.2	1.4	1.6	1.8	2.2				
3500	pier	1.0	1.0	1.2	1.4	1.5	1.9				
4000	pier	1.0	1.0	1.0	1.2	1.3	1.6				

Ground Snow: 40 psf											
Net Soi	I	Pier Spacing (ft)									
Pres (ps	sf)	4	5	6	7	8	10				
1000	pier	. 3.3	3.9	4.5	5.2	5.8	-7.1				
1500	pier	2.2	2.6	3.0	3.5	3.9	4.7				
2000	pier	1.6	2.0	2.3	2.6	2,9	3.6				
2500	pier	1.3	1.6	1.8	2.1	2.3	2.8				
3000	pier	1.1	1.3	1.5	1.7	1.9	2.4				
3500	pier	1.0	1.1	1.3	1.5	1.7	2.0				
4000	pier	1.0	1.0	1.1	1.3	1.5	1.8				

Ground Snow: 60 psf											
Net Soi	1		Pier Spacing (ft)								
Pres (ps	sf)	4	5	6	7	8	10				
1000	pier	3.6	4.3	5.0	5.8	6.5	7.9				
1500	pier	2.4	2.9	3.4	3.8	4.3	5.3				
2000	pier	1.8	2.2	2.5	2.9	3.2	4:0				
2500	pier	1.4	1.7	2.0	2.3	2.6	3.2				
3000	pier	1.2	1.4	1.7	1.9	2.2	2.6				
3500	pier	1.0	1.2	1.4	1.6	1.9	2.3				
4000	pier	1.0	1.1	1.3	1.4	1.6	2.0				

Ground Snow: 30 psf & Min. Roof: 20 psf Pier Spacing (ft) 6 7 Net Soil Pres (psf) 5 4 10 8 1000 3.1 3.7 5.5 3.7 pier 4.9 4.3 6:7 1500 pier 2.1 2.5 2.9 3.3 4.5 2000 1.5 2.7 2.2 1.8 3.3 2.7 pier 1.8 2.1 2.4 2500 pier 1.2 1.5 1.7 2.0 3000 pier 1.0 1.2 1.4 1.6 2.2 3500 pier 1.0 1.1 1.2 1.4 1.9 1.6 4000 pier 1.0 1.0 1.11.2 1.4 1.7

Ground Snow: 50 psf											
Net Soi	1	Pier Spacing (ft)									
Pres (psf)		4	.5	6	7	8	10				
1000	pier	3.4	4.1	4.8	5.5	6.2	7.5				
1500	pier	2.3	2.7	3.2	3.6	4.1	5.0				
2000	pier	1.7	2.1	2.4	2.7	3.1	3.8				
2500	pier	1.4	1.6	1.9	2.2	2.5	3.0				
3000	pier	1.1	1.4	1.6	1.8	2.1	2.5				
3500	pier	1.0	1.2	1.4	1.6	1.8	2.1				
4000	pier	1.0	1.0	1.2	1.4	1.5	1.9				

Ground Snow: 70 psf											
Net Soi			Pier Spacing (ft)								
Pres (ps	sf)	4	5	6	7	8	10				
1000	pier	3.8	4:5	5.3	6.0	6.8	8.3				
1500	pier	2.5	3.0	3.5	4.0	4.5	5.6				
2000	pier	1.9	2.3	2.6	3.0	3.4	4.2				
2500	pier	1.5	1.8	2.1	2.4	2.7	3.3				
3000	pier	1.3	1.5	1.8	2.0	2.3	2.8				
3500	pier	1.1	1.3	1.5	1.7	1.9	2.4				
4000	pier	1.0	1.1	1.3	1.5	1.7	2.1				

Aftg	
Cnw	<b>Multi-Section</b>
12'	Width

Ground Snow: 80 psf											
Net Soi	1	1.	Pi	ier Spacir	g (ft)						
Pres (ps	sf)	4	5	6	7	8	- 10				
1000	pier	3.9	4.7	5.5	6.3	7.1	8.7				
1500	pier	2.6	3.1	3.7	4.2	4.8	5.8				
2000	pier	2.0	2.4	2.8	3.2	3.6	4.4				
2500	pier	1.6	1.9	2.2	2,5	2.9	3.5				
3000	pier	1:3	1.6	1.8	2.1	2.4	2.9				
3500	pier	1.1	1.3	1.6	1.8	2.0	2.5				
4000	pier	1.0	1.2	1.4	1.6	1.8	2.2				

	Ground Snow: 100 psf											
Net Soi	1	Pier Spacing (ft)										
Pres (p.	sf)	4	- 5	6	7	8	10					
1000	pier	4.2	5.1	6.0	6.9	7.8	. 9.6					
1500	pier	2.8	3.4	4.0	4.6	5.2	6.4					
2000	pier	2.1	2.6	3.0	3.4	3.9	4.8					
2500	pier	1.7 :	2.1	2.4	2.8	3.1	3.8					
3000	pier	1.4	1.7	2.0	2.3	2.6	3.2					
3500	pier	1.2	1.5	1.7	2.0	2.2	2.7					
4000	pier	1.1	1.3	1.5	1.7	1.9	2.4					

Ground Snow: 90 psf											
Net Soi	1	Pier Spacing (ft)									
Pres (psf)		. 4	5	6	7	. 8	10				
1000	pier	4.1	4.9	5.8	6.6	7.5	9.1				
1500	pier	2.7	3.3	3.8	4.4	5.0	6.1				
2000	pier	2.0	2.5	2.9	3.3	3.7	4.6				
2500	pier	1.6	2.0	2.3	2.6	3.0	3.7				
3000	pier	1.4	1.6	1.9	2.2	2.5	3.0				
3500	pier	1.2	1.4	1.6	1.9	2.1	2.6				
4000	pier	1.0	1.2	1.4	1.7	1.9	2.3				

Required Effective Footing Area - Aftg (sqft) \*

Cnw	<b>Multi-Section</b>	
14'	Width	
	and the second	
	Min. Roof:	15 psf
t Soil	Pier	Spacing (f

Aftg

Net Soi	I · _	Pier Spacing (ft)						
Pres (ps		4	5	6	7	8	10	
1000	pier	3.3	4.0	4.6	5.3	5.9	7.2	
1500	pier	2.2	2.6	3.1	3.5	3.9	4.8	
2000	pier	1.7	2.0	2.3	2.6	3.0	. 3.6	
2500	pier	1.3	1.6	1.8	2.1	2.4	2.9	
3000	pier	1.1	1.3	1.5	1.8	2.0	2.4	
3500	pier	1.0	1.1	1.3	1.5	1.7	2.1	
4000	pier	1.0	1.0	1.2	1.3	1.5	1.8	
1.14								

G	Ground Snow: 30 psf & Min. Roof: 20 psf											
Net Soi	1	Pier Spacing (ft)										
Pres (ps	sf).	4	5	6	7.	. 8	10					
1000	pier	3.5	4.2	4.9	5.6	62	7.6					
1500	pier	2.3	2.8	3.2	3.7	4.2	5.1					
2000	pier	1.7	2.1	2.4	2.8	3.1	.3.8					
2500	pier	1.4	1.7	1.9	2.2	2.5	3.1					
3000	pier	1.2	1.4	1.6	1.9	2.1	2.5					
3500	pier	1.0	1.2	1.4	1.6	1.8	2.2					
4000	Dier	1.0	1.0	1.2	1.4	1.6	1.9					

Ground Snow: 25 psf Pier Spacing (ft) 4 5 6 7 Net Soil Pres (psf) 10 8 6.1 4.0 1000 pier 3.4 4.0 2.7 2.0 1.6 1.3 4.7 5.4 7.4 4.9 3.7 3.0 2.5 2.1 1500 2000 2.3 1.7 pier 3.1 3.6 2.4 1.9 2.7 2.2 3.0 2.4 pier 2500 3000 1.4 pier 1.6 1.3 1.2 1.8 1.5 1.3 2.0 1.7 pier İ.1 1.2 1.0 3500 1.0 pier 4000 pier 1.0 1.5 1.8

Ground Snow: 40 psf											
Net Soil Pres (psf)		Pier Spacing (ft)									
		4	5	6	7	8	10				
1000	pier	3.7	4.4	5.1	5.9	6.6	8.1				
1500	pier	2.4	2.9	3.4	3.9	4.4	5.4				
2000	pier	1.8	2.2	2.6	2.9	3.3	4.1				
2500	pier	1.5	1.8	2.1	2.4	2.7	3.2				
3000	pier	1.2	1.5	1.7	2.0	2.2	2.7				
3500	pier	1.0	1.3	1.5	1.7	1.9	2.3				
4000	pier	1.0	1.1	1.3	1.5	1.7	2.0				

Ground Snow: 50 psf										
Net Soi	1	ng (ft)								
Pres (ps	<u>sf)</u>	4	5	6	7	8	10			
1000	pier	3.9	4.6	5.4	6.2	7.0	8.6			
1500	pier	2.6	3.1	3.6	4.1	4.7	5.7			
2000	pier	1.9	2.3.	2.7	3.1	3.5	4.3			
2500	pier	1.5	1.9	2.2	2.5	2.8	3.4			
3000	pier	1.3	1.5	1.8	2.1	2.3	2.9			
3500	pier	1.1	1.3	1.6	1.8	2.0	2.5			
4000	pier	1.0	1.2	1.4	1.6	1.8	2.1			

Ground Snow: 70 psf									
Net Soi	1		Pi	er Spacin	g (ft)	-			
Pres (psf)		4	5	6	7	8	10		
1000	pier	4.2	5.1	6.0	6.9	7.8	9.5		
1500	pier	2.8	3.4	4.0	4.6	5.2	6.4		
2000	pier	2.1	2.6	3.0	3.4	3.9	4.8		
2500	pier	1.7	2.0	2.4	2.8	3.1	3.8		
3000	pier	1.4	1.7	2.0	2.3	2.6	3.2		
3500	pier	1.2	1.5	1.7	2.0	2.2	2.7		
4000	pier	1.1	1.3	1.5	1.7	1.9	24		

Ground Snow: 90 psf								
Net Soil		Pi	er Spacin	ig (ft)				
Pres (psf)	4	5	6	7	8 10			
1000 pier	4.6	5.6	6.6	7.6	8.5 10.5			
1500 pier	3.1	3.7	4.4	5.0	5.7 7.0			
2000 pier	2.3	2.8	3.3	3.8	4.3 5.3			
2500 pier	1.8	2.2	2.6	3.0	3.4 4.2			
3000 pier	1.5	1.9	2.2	2.5	2.8 3.5			
3500 pier	1.3	1.6	1.9	2.2	2.4 3.0			
4000 pier	1.2	1.4	1.6	1.9	2.1 2.6			

## Required Effective Footing Area - Aftg (sqft) \*

		Min	n. Roo	f: 15 p	sf	-	
Net Soi	1		Р	ier Spacir	ng (ft)		
Pres (ps	sf)	4	5	6	7	8	10
1000	pier	3.6	4.4	5.1	5.8	6.6	. 8.0
1500	pier	2.4	2.9	3.4	3.9	4.4	5.4
2000	pier	1.8	2.2	2.5	2.9	3.3	4.0
2500	pier	1.5	1.7	2.0	2.3	2.6	3.2
3000	pier	1.2	1.5	1.7	1.9	2.2	2.7
3500	pier	1.0	1.2	1.5	1.7	1.9	2.3
4000	pier	1.0	1.1	1.3	1.5	1.6	2.0

Multi-Section	Aftg Cnw
Width	14

Ground Snow: 60 psf									
Net Soi	1		Р	ier Spacir	ıg (ft)				
Pres (p:	sf)	4	. 5	6	7		10		
1000	pier	4.0	4.9	5.7	6.6	7.4	9.1		
1500	pier	2.7	3.3	3.8	4.4	4.9	6.0		
2000	pier	2.0	2.4	2.9	3.3	3.7	4.5		
2500	pier	1.6	2.0	2.3	2.6	3.0	3.6		
3000	pier	1.3	1.6	1.9	2.2	2.5	3.0		
3500	pier	1.2	1.4	1.6	1.9	2.1	2.6		
4000	pier	1.0	1.2	1.4	1.6	1.8	2.3		

Ground Snow: 80 psf									
Net Soi	1		P	ier Spacin	1g (ft)				
Pres (ps	sf)	4	5	6	7	8	10		
1000	pier	4.4	5.4	6.3	7.2	8.2	10.0		
1500	pier	3.0	3.6	4.2	4.8	5.4	6.7		
2000	pier	2.2	2.7	3.1	3.6	4.1	5.0		
2500	pier	1.8	2.1	2.5	2.9	3.3	4.0		
3000	pier	1.5	1.8	2.1	2.4	2.7	3.3		
3500	pier	1.3	1.5	1.8	2.1	2.3	2.9		
4000	pier	1.1	1.3	1.6	1.8	2.0	2.5		
	·						:		

		Grour	id Sno	w: 100	) psf	1 :	
Net Soil		1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	P	ier Spacir	g (ft)		
Pres (psf)	Pres (psf)		. 5 .	6.	7	8	10
1000	pier	4.8	5.8	6.9	7.9	8.9	11.0
1500	pier	3.2	3.9	4.6	5.3	6.0	7.3
2000	pier	2.4	2.9	3.4	3.9	4.5	5.5
2500	pier	1.9	2.3	2.7	3.2	3.6	4.4
3000	pier	1.6	1.9	2,3	2.6	3.0	3.7
3500	pier	1.4	1.7	2.0	2.3	2.6	3.1
4000	pier	1.2	1.5	1.7	2.0	2.2	2.7

	Multi-Section	Aftg
*	Width	16'

Ground Snow: 25 psf									
Net Soi	1		P	ier Spacir	ng (ft)	÷	· · ·		
Pres (pa	sf)	4	. 5 [	6	7	8 .	10		
1000	pier	3.7	4.5	5.2	6.0	6.7	8.2		
1500	pier	2.5	3.0	3.5	4.0	4.5	5.5		
2000	pier	1.9	2.2	2.6	3.0	3.4	4.1		
2500	pier	1.5	1.8	2.1	2.4	2.7	3.3		
3000	pier	1.2	1.5	1.7	2.0	2.2	2.7		
3500	pier	1.1	1.3	1.5	1.7	1.9	2.3		
4000	pier	1.0	1.1	1.3	1.5	1.7	2.1		

Aftg Cnw	Multi-Section
16'	Width

G	Ground Snow: 30 psf & Min. Roof: 20 psf										
Net Soi	1		P	ier Spacin	ıg (ft)						
Pres (ps	sf)	• 4	5	6	7	8 10					
1000	pier	3.8	4.6	5.4	6.2	6.9	8.5				
1500	pier	2.5	3.1	3.6	4.1	4.6	5.7				
2000	pier	1.9	2.3	2.7	3.1	3.5	4.2				
2500	pier	1.5	1.8	2.2	2.5	2.8	3.4				
3000	pier	1.3	1.5	1.8	2.1	2.3	2.8				
3500	pier	1.1	1.3	1.5	1.8	2.0	2.4				
4000	pier	1.0	1.1	1.3	1.5	1.7	2.1				

Ground Snow: 50 psf										
Net Soi	I		Pier Spacing (ft)							
Pres (ps	sf)	4	5	6	7	8	10			
1000	pier	4.3	5.1	6.0	6.9	7.8	9.6			
1500	pier	2.8	3.4	4.0	4.6	5.2	6.4			
2000	pier	2.1	2.6	3.0	3.5	3.9	4.8			
2500	pier	1.7	2.1	2.4	2.8	3.1	3.8			
3000	pier	1.4	1.7	2.0	2.3	2.6	3.2			
3500	pier	1.2	1.5	1.7	2.0	2.2	2.7			
4000	pier	1.1	1.3	1.5	1.7	2.0	2.4			

Ground Snow: 70 psf										
Net Soil Pres (psf)			. P	ier Spacir	ig (ft)					
		4	5.	6	7	8	10			
1000	pier	4.7	5.7	6.7	7.7	8.7	10.7			
1500	pier	3.I	3.8	4.5	5.1	5.8	. 7.1			
2000	pier	2.3	2.8	3.3	3.8	4.3	5.3			
2500	pier	1.9	2.3	2.7	3.1	3.5	4.3			
3000	pier	1.6	1.9	2.2	2.6	2.9	3.6			
3500	pier	1.3	1.6	1.9	2.2	2.5	3.0			
4000	pier	1.2	1.4	1.7	1.9	2.2	2.7			

Ground Snow: 90 psf									
Net Soi	1	Pier Spacing (ft)							
Pres (pa	sf)	4	5	6	7	8	10		
1000	pier	5.1	6.2	7.3	8.4	9.5	11.7		
1500	pier	3.4	4.1	4.9	5.6	6.4	7.8		
2000	pier	2.6	3.1	3.7	4.2	4.8	.5.9		
2500	pier	2.0	2.5	2.9	3.4	3.8	4.7		
3000	pier	1.7	2.1	2.4	2.8	3.2	3.9		
3500	pier	1.5	1.8	2.1	2.4	2.7	3.4		
4000	pier	1.3	1.6	1.8	2.1	2.4	2.9		

#### \* Minimum exterior and interior pier area is 1.0 sqft.

## Required Effective Footing Area - Aftg (sqft) \*

Ground Snow: 40 psf										
Net Soi	1	Pier Spacing (ft)								
Pres (ps	sf)	4	5	6	7	8	10			
1000	pier	4.0	4.9	5.7	6.5	7.4	9.0			
1500	pier	2.7	3.2	3.8	4.4	4.9	6.0			
2000	pier	2.0	2.4	2.9	3.3	3.7	4.5			
2500	pier	1.6	1.9	2.3	2.6	2.9	3.6			
3000	pier	1.3	1.6	1.9	2.2	2.5	3.0			
3500	pier	1.2	1.4	1.6	1.9	2.1	2.6			
4000	pier	1.0	1.2	1.4	1.6	1.8	2.3			

	· . ·	Grou	nd Sno	w: 60	psf		
Net Soil			Pi	er Spacin	g (ft)		
Pres (ps	f)	4	<u>5</u>	6	7	8	10
1000	pier	4.5	5.4	6.4	7.3	8.2	10.1
1500	pier	3.0	3.6	4.2	4.9	5.5	6.7
2000	pier	2.2	2.7	3.2	3.6	4.1	5.1
2500	pier	1.8	2.2	2.5	2.9	3.3	4.0
3000	pier	1.5	1.8	2.1	2.4	2.7	3.4
3500	pier	1.3	1.5	1.8	2.1	2.4	2.9
4000	pier	1.1	1.4	1.6	1.8	2:1	

Ground Snow: 80 psf									
Net Soi	1	1.1	P	ier Spacir	1 - C.				
Pres (psf)		4	5	Ĝ	7	8	10		
1000	pier	4.9	6.0	7.0	8.1	9.1	11.2		
1500	pier	3.3	4.0	4.7	5.4	6.1	7.5		
2000	pier	2.5	3.0	3.5	4.0	4.6	5.6		
2500	pier	2.0	2.4	2.8	3.2	3.6	4.5		
3000 :	pier	1.6	2.0	2.3	2.7	3.0	3.7		
3500	pier	1.4	1.7	2.0	2.3	2.6	3.2		
4000	pier	1.2	1.5	1.8	2.0	2.3	2.8		

Ground Snow: 100 psf									
Net Soi	1		ıg (ft)						
Pres (psf)		- 4	5	6	7 -	8	10		
1000	pier	5.3	6.5	7.7	8.8	10.0	12.3		
1500	pier	- 3.6	4.3	5.1	5.9	6.6	8.2		
2000	pier	2.7	3.2	3.8	4.4	5.0	6.1		
2500	pier	2.1	2.6	3.1	3.5	4.0	4.9		
3000	pier	1.8	2.2	2.6	2.9	3.3	4.1		
3500	pier	1.5	1.9	2.2	2.5	2.8	3.5		
4000	pier	1.3	1.6	1.9	2.2	2.5	3.1		

•	Multi-Section E,

Ι

Required Effective Footing Area - Aftg (sqft) \* Min. Roof: 15 psf Net Soil

•

Net Sc	oil		Pier Spacing (ft)											
Pres (p	osf)	4	5	6	ĩ ź	8	10							
1000	ext, int	1.7	1.9	2.2	2.4	2.7	3.2							
	marriage	3.0	3.6	4.2	4.8	5.4	6.6							
1500	ext, int	1.1	1.3	1.5	1.6	1.8	2.1							
	marriage	2.0	2.4	2.8	3.2	3.6	4.4							
2000	ext, int	1.0	1.0	1.1	1.2	1.3	1.6							
	marriage	1.5	1.8	2.1	2.4	2.7	3.3							
2500	ext, int	1.0	1.0	1.0	1.0	1.1	1.3							
	marriage	1.2	1.4	1.7	1.9	2.2	2.6							
3000	ext, int	1.0	1.0	1.0	1.0	1.0	1.1							
	marriage	1.0	1.2	1.4	1.6	1.8	2.2							
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.0							
	marriage	1.0	1.0	1.2	1.4	1.5	1.9							
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0							
	marriage	1.0	1.0	1.0	1.2	1.3	1.6							
Net So			Marriage V											
Pres (p		10	12	14	16	18	20							
1000	marriage	6.4	7.5	8.7	9.9	11.0	12.2							
1500	marriage	4.3	5.0	5.8	6.6	7.3	8.1							
2000	marriage	3.2	3.8	4.3	4.9	5.5	6.1							
2500	marriage	2.6	3.0	3.5	3.9	4.4	4.9							
3000	marriage	2.1	2.5	2.9	3.3	3.7	4.1							
3500	marriage	1.8	2.2	2.5	2.8	3.1	3.5							
4000	marriage	1.6	1.9	2.2	2.5	2.8	3.0							
1 1		Car	- 1 0		<b>F</b>									
		Giou	nd Sno		-									
Net So		· · ·		er Spacin										
Pres (p		4	5	6	7	8	10							
1000	ext, int	1.7	1.9	2.2	2.4	2.7	3.2							
	marriage	3.1	3.7	4.4	5.0	5.6	6.9							
1500	ext, int	1.1	1.3	1.5	1.6	1.8	2.1							
	marriage	_2.1	2.5	2.9	3.3	3.7	4.6							
2000	ext, int	1.0	1.0	1.1	1.2	1.3	1.6							
	marriage	1.6	1.9	2.2	2.5	2.8	3.4							
2500	ext, int	1.0	1.0	1.0	1.0	1.1	1.3							
	marriage	1.2	1.5	1.7	2.0	2.2	2.8							
3000	ext, int	1.0	1.0	1.0	1.0	1.0	1.1							
	marriage	1.0	1.2	1.5	1.7	1.9	2.3							
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.0							
	marriage	1.0	1.1	1.2	1.4	1.6	2.0							
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0							
	morringo	1.0	1:0	1.1	1.2	1.4	1.7							
	marriage					Net Soil Marriage Wall Opening Width (ft)								
Net Soi	il	N			•									
Pres (p	il sf)	N 10	12	14	16	18	20							
Pres (p: 1000	il sf) marriage	N 10 6.7	12 7.9	<u>14</u> 9.1	16 10.3	18 11.5	12.7							
Pres (p: 1000 1500	il sf) marriage marriage	N 10 6.7 4.5	<u>12</u> 7.9 5.3	14 9.1 6.1	16 10.3 6.9	18 11.5 7.7	12.7 8.5							
Pres (p 1000 1500 2000	il sf) marriage marriage marriage	N 10 6.7 4.5 3.3	12 7.9 5.3 3.9	14 9.1 6.1 4.6	16 10.3 6.9 5.2	18 11.5 7.7 5.8	12.7 8.5 6.4							
Pres (p: 1000 1500 2000 2500	il sf) marriage marriage marriage marriage	N 10 6.7 4.5 3.3 2.7	12 7.9 5.3 3.9 3.2	9.1 6.1 4.6 3.6	16 10.3 6.9 5.2 4.1	18 11.5 7.7 5.8 4.6	12.7 8.5 6.4 5.1							
Pres (p 1000 1500 2000 2500 3000	il sf) marriage marriage marriage marriage marriage	N 10 6.7 4.5 3.3 2.7 2.2	12 7.9 5.3 3.9 3.2 2.6	14 9.1 6.1 4.6 3.6 3.0	16 10.3 6.9 5.2 4.1 3.4	18 11.5 7.7 5.8 4.6 3.8	12.7 8.5 6.4 5.1 4.2							
Pres (p 1000 1500 2000 2500	il sf) marriage marriage marriage marriage	N 10 6.7 4.5 3.3 2.7	12 7.9 5.3 3.9 3.2	9.1 6.1 4.6 3.6	16 10.3 6.9 5.2 4.1	18 11.5 7.7 5.8 4.6	12.7 8.5 6.4 5.1							



	<u> </u>		· ·		<u> </u>			
G	round Si	now:	30 psf	& Mii	n. Roo	f: 20 p	sf	
Net Sc	oil		Pi	ier Spaci	ng (ft)		1	
Pres (p	osf)	4	5	6	7	8	10	
1000	ext, int	1.7	1.9	2.2	2.4	2.7	3.2	
	marriage	3.3	3.9	4.6	5.3	5.9	7.3	
1500	ext, int	1.1	1.3	1.5	1.6	1.8	2.1	
	marriage	2.2	2.6	3.1	3.5	4.0	4.9	
2000	ext, int	1.0	1.0	1.1	1.2	1.3	1.6	
	marriage	1.6	2.0	2.3	2.6	3.0	3.6	
2500	ext, int	1.0	1.0	1.0	1.0	1.1	1.3	
	marriage	1.3	1.6	1.8	2.1	2.4	2.9	
3000	ext, int	1.0	1.0	1.0	1.0	1.0	1.1	
	marriage	1.1	1.3	1.5	1.8	2.0	2.4	
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.0	
•	marriage	1.0	1.1	1.3	1.5	1.7	2.1	
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0	
· ·	marriage	1.0	1.0	1.2	1.3	1.5	1.8	
Net So	il ·	Ň	Aarriage V	ge Wall Opening Width (ft)				
Pres (p	sf)	10	12	14	16	18	20	
1000	marriage	7.1	8.4	9.7	11.0	12.3	13.6	
1500	marriage	4.7	5.6	6.5	7.3	8.2	9.0	
2000	marriage	3.5	4.2	4.8	5.5	6.1	6.8	
2500	marriage	2.8	3.4	3.9	4.4	4.9	5.4	
3000	marriage	2.4	2.8	3.2	3.7	4.1	4.5	
3500	marriage	2.0	2.4	2.8	3.1	3.5	3.9	
4000	marriage	1.8	2.1	2.4	2.7	3.1	3.4	

\* Minimum interior pier area is 1.0 sqft. Minimum exterior foundation wall footing width is 1'-0"; except for a 16' wide unit when the snow load is 100 psf and the allowable soil pressure is 1000 psf, use 1'-2".

Aftg	
<b>E,I</b>	<b>Multi-Section</b>
12'	Width

		Grou	ind Sn	ow: 40	) psf		
Net Sc	oil 🗌	1.1	P	ier Spaci	ng (ft)		
Pres (p	osf)	4	5	6	7	8	10
1000	ext, int	1.7	1.9	2.2	2.4	. 2.7	3.2
	marriage	3.6	4.3	5.1	5.8	6.6	8.1
1500	ext, int	1.1	1.3	1.5	1.6	1.8	2.1
	marriage	2.4	2.9	3.4	3.9	4.4	5.4
2000	ext, int	1.0	1.0	1.1	1.2	1.3	1.6
	marriage	1.8	2.2	2.5	2.9	3.3	4.1
2500	ext, int	1.0	1.0	1.0	1.0	1.1	1.3
	marriage	1.4	1.7	2.0	2.3	2.6	3.2
3000	ext, int	1.0	1.0	1.0	1.0	1.0	1.1
<u></u>	marriage	1.2	1.4	1.7	1.9	2.2	2.7
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.0	1.2	1.5	1.7	1.9	2.3
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.0	1.1	1.3	1.5	1.6	2.0
Net So	il	N	farriage V	Vall Oper	ning Widt	h (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	7.9	9.4	10.8	12.3	13.7	15.2
1500	marriage	5.3	6.2	7.2	8.2	9.2	10.1
2000	marriage	4.0	4.7	5.4	6.1	6.9	7.6
2500	marriage	3.2	3.7	4.3	4.9	5.5	6.1
3000	marriage	2.6	3.1	3.6	4.1	4.6	5.1
3500	marriage	2.3	2.7	3.1	3.5	3.9	4.3
4000	marriage	2.0	2.3	2.7	3.1	3.4	3.8

		~	10			·	
		GIOU	ind Sn				
Net So				ier Spacii	1g (ft)		
Pres (p	sf)	4	5	6	. 7	8 🤺	10
1000	ext, int	1.7	1.9	2.2	2.4	2.7	3.2
	marriage	4.2	5.2	6.1	7.0	7.9	9.7
1500	ext, int	1.1	1.3	1.5	1.6	1.8	2.1
<u></u>	marriage	2.8	3.4	41	4.7	5.3	6.5
2000	ext, int	1.0	1.0	1.1	1.2	1.3	1.6
	marriage	2.1	2.6	3.0	3.5	4.0	4.9
2500	ext, int	1.0	1.0	1.0	1.0	1.1	1.3
	marriage	1.7	2.1	2.4	2.8	3.2	3.9
3000	ext, int	1.0	1.0	1.0	1.0	1.0	1.1
	marriage	1.4	1.7	2.0	2.3	2.6	3.2
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.2	1.5	1.7	2.0	2.3	2.8
4000	ext, int	1.0	1.0	1.0	1.0	1.0	. 1.0
	marriage	1.1	1.3	1.5	1.7	2.0	2.4
Net Soi	1	N	Aarriage V	Vall Oper	uing Widt	h (ft)	
Pres (p.	sf)	10	12	14	16	18	20
1000	marriage	9.5	11.3	13.1	14.9	16.7	18.5
1500	marriage	6.4	7.5	8.7	9.9	11.1	12.3
2000	marriage	4.8	5.7	6.6	7.4	8.3	9.2
2500	marriage	3.8	4.5	5.2	6.0	6.7	7.4
3000	marriage	3.2	3.8	4.4	5.0	5.6	6.2
3500	marriage	2.7	3.2	3.7	4.3	4.8	5.3
4000	marriage	2.4	2.8	3.3	3.7	4.2	4.6

### Required Effective Footing Area - Aftg (sqft) \*

.

		Grou	ind Sn	ow: 50	0 psf		
Net So	oil		.]	Pier Spaci	ing (ft)		
Pres (	osf)	4	5	6	7	8	10
1000	ext, int	1.7	1.9	2.2	2.4	2.7	3.2
	marriage	3.9	4.8	5.6	6.4	7.3	8.9
1500	ext, int	1.1	1.3	1.5	1.6	1.8	2.1
	marriage	2.6	3.2	3.7	4.3	4.8	5.9
2000	ext, int	1.0	1.0	1.1	1.2	1.3	1.6
	marriage	2.0	2.4	2.8	3.2	3.6	4.5
2500	ext, int	1.0	1.0	1.0	1.0	1.1	1.3
	marriage	1.6	1.9	2.2	2.6	2.9	3.6
3000	ext, int	1.0	-1.0	1.0	1.0	1.0	1.1
5000	marriage	1.3	1.6	1.9	2.1		
3500		1.0				2.4	3.0
5500	ext, int		1.0	1.0	1.0	1.0	1.0
4000	marriage	11	1.4	1.6	1.8	2.1	2.5
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.0	1.2	1.4	1.6	1.8	2.2
Net So					ning Wid		
Pres (p		10	12	14	16	18	20
1000	marriage	8.7	10.3	12.0	13.6	15.2	16.8
1500	marriage	5.8	6:9	8.0	9.1	10.1	11.2
2000	marriage	4.4	5.2	6.0	6.8	7.6	8.4
2500	marriage	3.5	4.1	4.8	5.4	6.1	6.7
3000	marriage	2.9	3.4	4.0	4.5	5.1	5.6
3500	marriage	2.5	3.0	3.4	3.9	4.3	4.8
4000	marriage	2.2	2.6	3.0	3.4	3.8	4.2
		Grou	nd Sno				
Net So				ier Spacir	ıg (ft)	· · ·	
Pres (p		4	5	6	7	8	10
1000	ext, int	1.7	1.9	2.2	2.4	2.7	3.2
	marriage	4.6	5.6	6.6	7.6	8.6	10.6
1500	ext, int	1.1	1.3	1.5	1.6	1.8	2.1
	marriage	3.0	3.7	4.4	5.0	5.7	7.0
2000	ext, int	1.0	1.0	1.1	1.2	1.3	1.6
	marriage	2.3	2.8	3.3	3.8	4.3	5.3
2500	ext. int	1.0	1.0	1.0	1.0	1.1	1.3
	marriage	1.8	2.2	2.6	3.0	3.4	4.2
3000	ext, int	1.0	1.0	1.0	1.0	1.0	1.1
	marriage	1.5	1.9	2.2	2.5	2.9	3.5
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.3	1.6	1.9	2.2	2.4	3.0
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.0	1.4	1.6	1.9	2.1	2.6
Net Soi							2.0
Pres (ps		10	12 12	14	ung Widtl		20
1000		10.4			16	18	20
1000	marriage		12.3	14.3	16.2	18.1	20.1
2000	marriage	6:9	8.2	9.5	10.8	12.1	13.4
2000	marriage	5.2	6.2	7.1	8.1	9.1	10.0
3000	marriage	4.1	4.9	5.7	6.5	7.3	8.0
3500	marriage	3.5	4.1	4.8	5.4	6.0	6.7
5000 1000	marriage	3.0	3.5	4.1	4.6	5.2	5.7

\* Minimum interior pier area is 1.0 sqft. Minimum exterior foundation wall footing width is 1'-0"; except for a 16' wide unit when the snow load is 100 psf and the allowable soil pressure is 1000 psf, use 1'-2".

4000

marriage

2.6

3.1

3.6

4.0

4.5

5.0

Multi-Section	Aftg E, I
Width	12'

		Grou	und Sn	ow: 8	0 psf		
Net Sc	oil			Pier Spac			
Pres (p	psf)	4	5	6	7	8	10
1000	ext, int	1.7	1.9	2.2	2.4	2.7	3.2
	marriage	4.9	6.0	7.1	8.1	9.2	11.4
1500	ext, int	1.1	1.3	1.5	1.6	1.8	2.1
	marriage	3.3	4.0	4.7	5.4	6.1	7.6
2000	ext, int	1.0	1.0	1.1	1.2	1.3	1.6
	marriage	2.5	3.0	3.5	. 4.1	4.6	5:7
2500	ext, int	1.0	1.0	1.0	1.0	1.1	1.3
· .	marriage	2.0	2.4	2.8	3.3	3.7	4.5
3000	ext, int	1.0	1.0	1.0	1.0	1.0	1.1
	marriage	1.6	2.0	2.4	2.7	3.1	3.8
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.4	1.7	2.0	2.3	2.6	3.2
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.2	1.5	1.8	2.0	2.3	2.8
Net So	il	1	Marriage '	Wall Ope	ning Wid	th (ft)	
Pres (p	sf) – –	10	12	14	16	18	20
1000	marriage	11.2	13.3	15.4	17.5	19.6	21.7
1500	marriage	7.4	8.9	10.3	11.7	13.1	14.5
2000	marriage	5.6	6.6	7.7	8.8	9.8	10.9
2500.	marriage	4.5	5.3	6.2	7.0	7.8	8.7
3000	marriage	3.7	4.4	5.1	5.8	6.5	. 7.2
3500	marriage	3.2	3.8	4.4	5.0	5.6	6.2
4000	marriage	2.8	3.3	3.8	4.4	4.9	5.4
						<u> </u>	
		Grou	nd Sno				
Net Soi		1		ier Spacin	ng (ft)		1
Pres (p		4	5	6	7	8	10
1000	ext, int	1.7	1.9	2.2	2.4	2.7	3.2
	marriage	5.6	6.8	8.0	9.3	10.5	13.0
1500	ext, int	1.1	1.3	1.5	1.6	1.8	2.1
	marriage	3.7	4:5	5.4	6.2	7.0	8.7
2000	ext, int	1.0	1.0	1.1	1.2	1.3	1.6
	marriage	2.8	3.4	4.0	4.6	5.3	6.5
2500	ext, int	10	1.0	1.0	1.0	1.1	1.3
2000	marriage	2.2	2.7	3.2	3.7	4.2	5.2
3000	ext, int	1.0	1.0	1.0	1.0	1.0	1.1
3500	marriage	1.9	2.3	2.7	3.1	3.5	4.3
	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
0000							
	marriage	1.6	1.9	2.3	2.7	3.0	3.7
4000	marriage ext, int	1.6 1.0	1.9 1.0	2.3	2.7	3.0	1.0
4000	marriage ext, int marriage	1.6 1.0 1.4	<u>1.9</u> 1.0 1.7	2.3 1.0 2.0	2.7 1.0 2.3	3.0 1.0 2.6	
4000 Net Soi	marriage ext, int marriage l	1.6 1.0 1.4	1.9 1.0 1.7 Marriage V	2.3 1.0 2.0 Vall Oper	2.7 1.0 2.3	3.0 1.0 2.6	1.0
4000 Net Soi Pres (ps	marriage ext, int marriage l sf)	1.6 1.0 1.4 N 10	1.9 1.0 1.7 Marriage W 12	2.3 1.0 2.0 Vall Oper 14	2.7 1.0 2.3 ning Widt 16	3.0 1.0 2.6 h (ft) 18	1.0 3.3 20
1000 Net Soi Pres (ps	marriage ext, int marriage l sf) marriage	1.6 1.0 1.4 N 10 12.8	1.9 1.0 1.7 Marriage V 12 15.2	2.3 1.0 2.0 Vall Oper 14 17.7	2.7 1.0 2.3 ning Widt 16 20.1	3.0 1.0 2.6 h (ft) 18 22.6	1.0 3.3 20 25.0
1000 Net Soi Pres (ps 1000 1500	marriage ext, int marriage l sf) marriage marriage	1.6 1.0 1.4 N 10 12.8 8.5	1.9 1.0 1.7 Marriage V 12 15.2 10.2	2.3 1.0 2.0 Vall Oper 14 17.7 11.8	2.7 1.0 2.3 ning Widt 16 20.1 13.4	3.0 1.0 2.6 h (ft) 18 22.6 15.0	1.0 3.3 20 25.0 16.7
1000 Net Soi Pres (ps 1000 1500 2000	marriage ext, int marriage l sf) marriage marriage marriage	1.6 1.0 1.4 N 10 12.8 8.5 6.4	1.9 1.0 1.7 Marriage V 12 15.2 10.2 7.6	2.3 1.0 2.0 Vall Oper 14 17.7 11.8 8.8	2.7 1.0 2.3 ning Widti 16 20.1 13.4 10.1	3.0 1.0 2.6 h (ft) 18 22.6 15.0 11.3	1.0 3.3 20 25.0 16.7 12.5
Net Soi Pres (ps 1000 1500 2000 2500	marriage ext, int marriage l sf) marriage marriage marriage marriage	1.6 1.0 1.4 N 10 12.8 8.5 6.4 5.1	1.9 1.0 1.7 Marriage V 12 15.2 10.2 7.6 6.1	2.3 1.0 2.0 Vall Oper 14 17.7 11.8 8.8 7.1	2.7 1.0 2.3 ning Widti 16 20.1 13.4 10.1 8.0	3.0 1.0 2.6 h (ft) 18 22.6 15.0 11.3 9.0	1.0 3.3 20 25.0 16.7 12.5 10.0
4000 Vet Soi Pres (ps 1000 1500 2000 2500 8000	marriage ext, int marriage l sf) marriage marriage marriage marriage marriage	1.6 1.0 1.4 N 10 12.8 8.5 6.4 5.1 4.3	1.9 1.0 1.7 Marriage V 12 15.2 10.2 7.6 6.1 5.1	2.3 1.0 2.0 Vall Oper 14 17.7 11.8 8.8 7.1 5.9	2.7 1.0 2.3 ning Widt 16 20.1 13.4 10.1 8.0 6.7	3.0 1.0 2.6 h (ft) 18 22.6 15.0 11.3 9.0 7.5	1.0 3.3 20 25.0 16.7 12.5 10.0 8.3
4000	marriage ext, int marriage l sf) marriage marriage marriage marriage	1.6 1.0 1.4 N 10 12.8 8.5 6.4 5.1	1.9 1.0 1.7 Marriage V 12 15.2 10.2 7.6 6.1	2.3 1.0 2.0 Vall Oper 14 17.7 11.8 8.8 7.1	2.7 1.0 2.3 ning Widti 16 20.1 13.4 10.1 8.0	3.0 1.0 2.6 h (ft) 18 22.6 15.0 11.3 9.0	1.0 3.3 20 25.0 16.7 12.5 10.0

			1				6 A 2. 1 A 1.4
		Grou	ind Sn	ow: 90	) psf		
Net Sc	oil			ier Spaci			
Pres (p	osf)	. 4	5	-6	7	8	10
1000	ext, int	1.7	1.9	2.2	2.4	2.7	3.2
	marriage	5.2	6.4	7.5	8.7	9.9	12.2
1500	ext, int	1.1	1.3	1.5	1.6	1.8	2.1
	marriage	3.5	4.3	5.0	5.8	6.6	8.1
2000	ext, int	1.0	1.0	1.1	1.2	1.3	1.6
<u> </u>	marriage	2.6	3.2	3.8	4.4	4.9	6.1
2500	ext, int	1.0	1.0	1.0	1.0	1.1	1.3
	marriage	2.1	2.6	3.0	3.5	3.9	4.9
3000	ext, int	1.0	1.0	1.0	1.0	1.0	1.1
	marriage	1.7	2.1	2.5	2.9	3.3	4.1
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.5	1.8	2.2	2.5	2.8	3.5
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.3	1.6	1.9	2.2	2.5	3.0
Net So	il	Ν	Aarriage V	Vall Oper	ning Widt		
Pres (p.	sf)	10	12	14	16.	18	20
1000	marriage	12.0	14.3	16.5	18.8	21.1	23.4
1500	marriage	8.0	9.5	11.0	12.5	14.1	15.6
2000	marriage	6.0	7.1	8.3	9.4	10.5	11.7
2500	marriage	4.8	5.7	6.6	7.5	8.4	9.3
3000	marriage	4.0	4.8	5.5	6.3	7.0	7.8
3500	marriage	3.4	4.1	4.7	5.4	6.0	6.7
4000	marriage	3.0	3.6	4.1	47	5.3	5.8

\* Minimum interior pier area is 1.0 sqft. Minimum exterior foundation wall footing width is 1'-0"; except for a 16' wide unit when the snow load is 100 psf and the allowable soil pressure is 1000 psf, use 1'-2".

Ľ	ttg ,I M 4'	<b>Iulti-S</b> Wie	Section dth	n				Req	uired Ef	fectiv	e Foot	ing Aı	rea - A	.ftg (sq	[ft) *
		Mi	n. Roc	of: 15	psf			· [		Grou	ind Sn	0112. 24	5 nef	<u> </u>	
Net So	oil			Pier Spac				Net So		0100					
Pres (		4	5	6	7	8	10	Pres (		.4	5	Pier Spaci			10
1000	ext, int	1.8	2.1	2.4	2.7	2.9	3.5	1000	ext, int	1.8	2.1	2.4	2.7	<u>8</u> 2.9	10
	marriage	3.4	4.1	4.8	5.5	6.3	7.7	1000	maniage	3.6	4.3	5.0	5.8	6.5	3.5 8.0
1500	ext, int	1.2	1.4	1.6	1.8	2.0	2.3	1500	ext, int	1.2	1.4	1.6	1.8	2.0	2.3
	marriage	2.3	2.8	3.2	3.7	4.2	5.1		marriage	2.4	2.9	3.4	3:9	4.3	5.3
2000	ext, int	1.0	1.1	1.2	-1.3	1.5	1.8	2000	ext, int	1.0	1.1	1.2	1.3	1.5	1.8
	marriage	1.7	2.1	2.4	2.8	3.1	3.8	·	marriage	1.8	2.1	2.5	2.9	3.3	4.0
2500	ext, int	1.0	1.0	1.0	1.1	1.2	1.4	2500	ext, int	1.0	1.0	1.0	1.1	1.2	1.4
	marriage	1.4	1.7	1.9	2.2	2.5	3.1		marriage	1.4	1.7	2.0	2.3	2.6	3.2
3000	ext, int	1.0	1.0	1.0	1.0	1.0	1.2	3000	ext, int	1.0	1.0	1.0	1.0	1.0	1.2
0.000	marriage	1.1	1.4	1.6	1.8	2.1	2.6		marriage	1.2	1.4	1.7	1.9	2.2	2.7
3500	ext. int	1.0	1.0	1.0	1.0	1.0	1.0	3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
4000	marriage	1.0	1.2	1.4	1.6	1.8	2.2	·	marriage	1.0	1.2	1.4	-1.7	1.9	2.3
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0	4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
Net So	marriage	1.0	1.0	1.2	1.4	1.6	1.9	·	marriage	1.0	1.1	1.3	1.4	1.6	2.0
Pres (p		10	Лаптіаде 12				20	Net So		· N	Marriage V			th (ft)	
1000	marriage	7.5	8.8	14	16	18	20	Pres (p		10	12	14	16	18	20
1500	marriage	5.0	5.9	6.8	11.6 7.7	13.0 8.6	14.3 9.5	1000	marriage	7.8	9.3	10.7	12.1	13.6	15.0
2000	marriage	3.7	4.4	5.1	5.8	6.5	7.2	.1500 2000	marriage	5.2	6.2	7.1	8.1	9.0	10.0
2500	marriage	3.0	3.5	4.1	4.6	5.2	5.7	2000	marriage	3.9	4.6	5.3	6.1	6.8	7.5
3000	marriage	2.5	2.9	3.4	3.9	4.3	4.8	3000	marriage marriage	3.1 2.6	3.7	4.3	4.9	5.4	6.0
3500	marriage	2.1	2.5	2.9	3.3	3.7	4.1	3500	marriage	2.0	3.1 2.6	3.6 3.1	4.0 3.5	4.5 3.9	5.0
4000	marriage	1.9	2.2	2.6				0000		<i></i>			2.2		
				2.0	2.9	3.2	3.6	4000							. 4.3
							3.6	4000	marriage	2.0	2.3	2.7	3.0	3.4	4.3 3.8
G	round Sr	now: 3						4000		2.0	2.3	2.7	3.0		
G Net Soi	round Si	now: 3	30 psf	& Mir	1. Roo				marriage	2.0	2.3 nd Sno	2.7 ow: 40	3.0 psf		
G Net Soi Pres (p	il	now: 3	30 psf		1. Roo	f: 20 p	sf	Net Soi	marriage	2.0 Grou	2.3 nd Sno Pi	2.7 ow: 40	3.0 psf ng (ft)	3.4	3.8
Net So	il	4	30 psf P	& Mit ier Spacin	1. Roo 1g (ft)			Net Soi Pres (p:	marriage il sf)	2.0 Grou 4	2.3 nd Sno Pi 5	2.7 ow: 40 ier Spacin 6	3.0 psf ng (ft) 7	3.4	3.8
Net Soi Pres (p 1000	il sf)	4 1.8 3.7	30 psf P	& Min ier Spacir 6	1. Roo 1g (ft) 7	f: 20 p 8	sf 10	Net Soi	marriage il sf) ext, int	2.0 Grou 4 1.8	2.3 nd Sno 5 2.1	2.7 ow: 40 er Spacin 6 2.4	3.0 psf ng (ft) 7 2.7	<u>3.4</u> <u>8</u> 2.9	3.8 10 3.5
Net Soi Pres (p	il sf) ext, int	4 1.8 3.7 1.2	30 psf 5 2.1 4.5 1.4	& Min ier Spacin 6 2.4	1. Roo ng (ft) 7 2.7	f: 20 p 8 2.9	sf 10 3.5	Net Soi Pres (p: 1000	marriage il sf) ext, int marriage	2.0 Grou 4 1.8 4.1	2.3 nd Sno 5 2.1 5.0	2.7 DW: 40 ier Spacin 6 2.4 5.9	3.0 psf og (ft) 7 2.7 6.8	3.4 8 2.9 7.7	3.8 10 3.5 9.4
Net So Pres (p 1000 1500	il sf) ext, int marriage	4 1.8 3.7 1.2 2.5	30 psf P 5 2.1 4.5 1.4 3.0	& Min ier Spacir 6 2.4 5.3 1.6 3.6	1. Roo ng (ft) 7 2.7 6.1	f: 20 p 8 2.9 6.9	sf 10 3.5 8.5	Net Soi Pres (p:	marriage il sf) ext, int	2.0 Grou 4 1.8 4.1 1.2	2.3 nd Sno 5 2.1 5.0 1.4	2.7 <b>DW: 40</b> ter Spacin 6 2.4 5.9 1.6	3.0 9 psf 10 pg (ft) 7 2.7 6.8 1.8	3.4 8 2.9 7.7 2.0	3.8 10 3.5 9.4 2.3
Net Soi Pres (p 1000	il ext, int marriage ext, int marriage ext, int	4 1.8 3.7 1.2 2.5 1.0	30 psf 5 2.1 4.5 1.4 3.0 1.1	& Min ier Spacin 6 2.4 5.3 1.6 3.6 1.2	n. Roo ng (ft) 7 2.7 6.1 1.8 4.1 1.3	f: 20 p 8 2.9 6.9 2.0	<u>10</u> <u>3.5</u> <u>8.5</u> 2.3	Net Soi Pres (p: 1000	marriage il sf) ext, int marriage ext, int	2.0 Grou 4 1.8 4.1 1.2 2.8	2.3 nd Sno 5 2.1 5.0 1.4 3.3	2.7 <b>DW: 40</b> ter Spacin 6 2.4 5.9 1.6 3.9	3.0 psf pg (ft) 7 2.7 6.8 1.8 4.5	3.4 8 2.9 7.7 2.0 5.1	3.8 10 3.5 9.4 2.3 6.3
Net So Pres (p 1000 1500 2000	il ext, int marriage ext, int marriage ext, int marriage	4 1.8 3.7 1.2 2.5 1.0 1.9	30 psf 5 2.1 4.5 1.4 3.0 1.1 2.3	& Min ier Spacin 2.4 5.3 1.6 3.6 1.2 2.7	n. Roo ng (ft) 7 2.7 6.1 1.8 4.1 1.3 3.1	f: 20 p 8 2.9 6.9 2.0 4.6 1.5 3.5	sf 10 3.5 8.5 2.3 5.7	Net Soi Pres (p. 1000	marriage il sf) ext, int marriage ext, int marriage	2.0 Grou 4 1.8 4.1 1.2	2.3 nd Sno 5 2.1 5.0 1.4 3.3 1.1	2.7 <b>DW: 40</b> ter Spacin 6 2.4 5.9 1.6	3.0 psf 7 2.7 6.8 1.8 4.5 1.3	3.4 8 2.9 7.7 2.0 5.1 1.5	3.8 10 3.5 9.4 2.3 6.3 1.8
Net So Pres (p 1000 1500	il sf) ext, int marriage ext, int marriage ext, int marriage ext, int	4 1.8 3.7 1.2 2.5 1.0 1.9 1.0	30 psf P 5 2.1 4.5 1.4 3.0 1.1 2.3 1.0	& Mir ier Spacir 2.4 5.3 1.6 3.6 1.2 2.7 1.0	1. Roo ng (ft) 7 2.7 6.1 1.8 4.1 1.3 3.1 1.1	f: 20 p 8 2.9 6.9 2.0 4.6 1.5 3.5 1.2	10 3.5 8.5 2.3 5.7 1.8 4.2 1.4	Net Soi Pres (p. 1000	marriage il sf) ext, int marriage ext, int marriage ext, int	2.0 Grou 4 1.8 4.1 1.2 2.8 1.0	2.3 nd Sno 5 2.1 5.0 1.4 3.3	2.7 2.7 2.7 6 2.4 5.9 1.6 3.9 1.2	3.0 psf pg (ft) 7 2.7 6.8 1.8 4.5	3.4 8 2.9 7.7 2.0 5.1 1.5 3.8	3.8 10 3.5 9.4 2.3 6.3 1.8 4.7
Net Soi Pres (p) 1000 1500 2000 2500	il ext, int marriage ext, int marriage ext, int marriage ext, int marriage	4 1.8 3.7 1.2 2.5 1.0 1.9 1.0 1.5	30 psf P: 5 2.1 4.5 1.4 3.0 1.1 2.3 1.0 1.8	& Min ier Spacir 2.4 5.3 1.6 3.6 1.2 2.7 1.0 2.1	n. Roo ng (ft) 7 2.7 6.1 1.8 4.1 1.3 3.1 1.1 2.4	f: 20 p 8 2.9 6.9 2.0 4.6 1.5 3.5 1.2 2.8	10           3.5           8.5           2.3           5.7           1.8           4.2           1.4           3.4	Net Soj Pres (p: 1000 1500 2000	marriage il sf) ext, int marriage ext, int marriage ext, int marriage	2.0 Grou 4 1.8 4.1 1.2 2.8 1.0 2.1	2.3 nd Sno 5 2.1 5.0 1.4 3.3 1.1 2.5	2.7 <b>DW: 40</b> ter Spacin 6 2.4 5.9 1.6 3.9 1.2 3.0	3.0 psf pg (ft) 7 2.7 6.8 1.8 4.5 1.3 3.4	3.4 8 2.9 7.7 2.0 5.1 1.5 3.8 1.2	3.8 10 3.5 9.4 2.3 6.3 1.8 4.7 1.4
Net So Pres (p 1000 1500 2000	il ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	4 1.8 3.7 1.2 2.5 1.0 1.9 1.0 1.5 1.0	30 psf P: 5 2.1 4.5 1.4 3.0 1.1 2.3 1.0 1.8 1.0	& Min ier Spacin 6 2.4 5.3 1.6 3.6 1.2 2.7 1.0 2.1 1.0	1. Roo 1. Roo	f: 20 p 8 2.9 6.9 2.0 4.6 1.5 3.5 1.2 2.8 1.0	10 3.5 8.5 2.3 5.7 1.8 4.2 1.4	Net Soj Pres (p: 1000 1500 2000	marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int	2.0 Grou 4 1.8 4.1 1.2 2.8 1.0 2.1 1.0	2.3 nd Sne 5 2.1 5.0 1.4 3.3 1.1 2.5 1.0	2.7 pw: 40 er Spacin 6 2.4 5.9 1.6 3.9 1.2 3.0 1.0	3.0 psf ng (ft) 7 2.7 6.8 1.8 4.5 1.3 3.4 1.1 2.7	3.4 8 2.9 7.7 2.0 5.1 1.5 3.8 1.2 3.1	3.8 10 3.5 9.4 2.3 6.3 1.8 4.7 1.4 3.8
Net Soi Pres (p) 1000 1500 2000 2500 3000	il ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	4 1.8 3.7 1.2 2.5 1.0 1.9 1.0 1.5 1.0 1.2	30 psf P 5 2.1 4.5 1.4 3.0 1.1 2.3 1.0 1.8 1.0 1.5	& Min ier Spacin 6 2.4 5.3 1.6 3.6 1.2 2.7 1.0 2.1 1.0 1.8	1.         Roo           ng (ft)         7           2.7         6.1           1.8         4.1           1.3         3.1           1.1         2.4           1.0         2.0	f: 20 p 8 2.9 6.9 2.0 4.6 1.5 3.5 1.2 2.8 1.0 2.3	10           3.5           8.5           2.3           5.7           1.8           4.2           1.4           3.4	Net Soi Pres (p: 1000 1500 2000 2500	marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage	2.0 Grou 4 1.8 4.1 1.2 2.8 1.0 2.1 1.0 1.7	2.3 nd Sno 5 2.1 5.0 1.4 3.3 1.1 2.5 1.0 2.0	2.7 pw: 40 ter Spacin 6 2.4 5.9 1.6 3.9 1.2 3.0 1.0 2.4	3.0 psf g (ft) 7 2.7 6.8 1.8 4.5 1.3 3.4 1.1 2.7 1.0	3.4 8 2.9 7.7 2.0 5.1 1.5 3.8 1.2 3.1 1.0	3.8 10 3.5 9.4 2.3 6.3 1.8 4.7 1.4 3.8 1.2
Net Soi Pres (p) 1000 1500 2000 2500	il ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	4 1.8 3.7 1.2 2.5 1.0 1.9 1.0 1.5 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.9 1.0 1.5 1.0 1.2 1.0 1.5 1.0 1.0 1.5 1.0 1.2 1.0 1.5 1.0 1.0 1.2 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	30 psf P 5 2.1 4.5 1.4 3.0 1.1 2.3 1.0 1.8 1.0 1.5 1.0	& Min ier Spacin 6 2.4 5.3 1.6 3.6 1.2 2.7 1.0 2.1 1.0 1.8 1.0	1.         Roo           ng (ft)         7           2.7         6.1           1.8         4.1           1.3         3.1           1.1         2.4           1.0         2.0           1.0         1.0	f: 20 p 8 2.9 6.9 2.0 4.6 1.5 3.5 1.2 2.8 1.0 2.3 1.0	10           3.5           2.3           5.7           1.8           4.2           1.4           3.4           1.2           2.8           1.0	Net Soi Pres (p: 1000 1500 2000 2500	marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.0 Grou 4 1.8 4.1 1.2 2.8 1.0 2.1 1.0 1.7 1.0	2.3 nd Sne 5 2.1 5.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0	2.7 pw: 40 ier Spacin 6 2.4 5.9 1.6 3.9 1.2 3.0 1.0 2.4 1.0	3.0 psf ng (ft) 7 2.7 6.8 1.8 4.5 1.3 3.4 1.1 2.7	3.4 8 2.9 7.7 2.0 5.1 1.5 3.8 1.2 3.1	3.8 10 3.5 9.4 2.3 6.3 1.8 4.7 1.4 3.8 1.2 3.1
Net Soi Pres (p 1000 1500 2000 2500 3500	il ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	4 1.8 3.7 1.2 2.5 1.0 1.9 1.0 1.5 1.0 1.2 1.0 1.2 1.0 1.1	30 psf P 5 2.1 4.5 1.4 3.0 1.1 2.3 1.0 1.8 1.0 1.5 1.0 1.3	& Min ier Spacin 6 2.4 5.3 1.6 3.6 1.2 2.7 1.0 2.1 1.0 1.8 1.0 1.5	A.         Roo           ng (ft)         7           2.7         6.1           1.8         4.1           1.3         3.1           1.1         2.4           1.0         2.0           1.0         1.7	f: 20 p 8 2.9 6.9 2.0 4.6 1.5 3.5 1.2 2.8 1.0 2.3 1.0 2.0	10           3.5           8.5           2.3           5.7           1.8           4.2           1.4           3.4           1.2           2.8           1.0           2.4	Net Soi Pres (p: 1000 1500 2000 2500 3000	marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	2.0 Grou 4 1.8 4.1 1.2 2.8 1.0 2.1 1.0 1.7 1.0 1.4	2.3 nd Sne 5 2.1 5.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.0 1.7	2.7 pw: 40 ter Spacin 6 2.4 5.9 1.6 3.9 1.2 3.0 1.0 2.4 1.0 2.4	3.0 psf g (ft) 7 2.7 6.8 1.8 4.5 1.3 3.4 1.1 2.7 1.0 2.3	3.4           8           2.9           7.7           2.0           5.1           1.5           3.8           1.2           3.1           1.0           2.6           1.0	3.8 10 3.5 9.4 2.3 6.3 1.8 4.7 1.4 3.8 1.2 3.1 1.0
Net Soi Pres (p) 1000 1500 2000 2500 3000	il ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	4 1.8 3.7 1.2 2.5 1.0 1.9 1.0 1.5 1.0 1.2 1.0 1.2 1.0 1.1 1.0 1.1 1.0	30 psf P 5 2.1 4.5 1.4 3.0 1.1 2.3 1.0 1.8 1.0 1.5 1.0 1.3 1.0	& Min ier Spacir 6 2.4 5.3 1.6 3.6 1.2 2.7 1.0 2.1 1.0 1.8 1.0 1.5 1.0	A. Roo           ng (ft)           7           2.7           6.1           1.8           4.1           1.3           3.1           1.1           2.4           1.0           1.7           1.0	f: 20 p 8 2.9 6.9 2.0 4.6 1.5 3.5 1.2 2.8 1.0 2.3 1.0 2.0 1.0 2.0	10         3.5         8.5         2.3         5.7         1.8         4.2         1.4         3.4         1.2         2.8         1.0         2.4         1.0	Net Soi Pres (p: 1000 1500 2000 2500 3000	marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.0 Grou 4 1.8 4.1 1.2 2.8 1.0 2.1 1.0 1.7 1.0 1.4 1.0	2.3 nd Sne 5 2.1 5.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.0 1.7 1.0	2.7 pw: 40 ter Spacin 6 2.4 5.9 1.6 3.9 1.2 3.0 1.0 2.4 1.0 2.0 1.0	3.0 psf g (ft) 7 2.7 6.8 1.8 4.5 1.3 3.4 1.1 2.7 1.0 2.3 1.0	3.4 8 2.9 7.7 2.0 5.1 1.5 3.8 1.2 3.1 - 1.0 2.6	3.8 10 3.5 9.4 2.3 6.3 1.8 4.7 1.4 3.8 1.2 3.1 1.0 2.7
Net Soi Pres (p 1000 2000 2500 3000 3500	il ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	4 1.8 3.7 1.2 2.5 1.0 1.9 1.0 1.5 1.0 1.2 1.0 1.2 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.2 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.0 1.9 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	30 psf P: 5 2.1 4.5 1.4 3.0 1.1 2.3 1.0 1.5 1.0 1.5 1.0 1.3 1.0 1.1	& Min ier Spacir 6 2.4 5.3 1.6 3.6 1.2 2.7 1.0 2.1 1.0 1.8 1.0 1.5 1.0 1.3	1. Roo 1. Roo	f: 20 p 8 2.9 6.9 2.0 4.6 1.5 3.5 1.2 2.8 1.0 2.3 1.0 2.0 1.0 1.7	10         3.5         8.5         2.3         5.7         1.8         4.2         1.4         3.4         1.2         2.8         1.0         2.4         1.0	Net Soi Pres (p: 1000 1500 2000 2500 3000 3500 4000	marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	2.0 4 1.8 4.1 1.2 2.8 1.0 2.1 1.0 1.7 1.0 1.4 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.1 1.0 1.7 1.0 1.2 1.0 1.7 1.0 1.2 1.0 1.7 1.0 1.2 1.0 1.0 1.7 1.0 1.2 1.0 1.0 1.7 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	2.3 nd Sne 5 2.1 5.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.0 1.7 1.0 1.4 1.0 1.3	2.7 2.7 2.7 2.7 2.7 2.7 2.7 2.7	3.0 psf ng (ft) 7 2.7 6.8 1.8 4.5 1.3 3.4 1.1 2.7 1.0 2.3 1.0 1.0 1.9 1.0 1.7	3.4           8           2.9           7.7           2.0           5.1           1.5           3.8           1.2           3.1           1.0           2.6           1.0           2.2           1.0           1.9	3.8 10 3.5 9.4 2.3 6.3 1.8 4.7 1.4 3.8 1.2 3.1 1.0
Net Soi Pres (p 1000 1500 2000 2500 3000 3500 3500 4000 Vet Soi	il ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	4 1.8 3.7 1.2 2.5 1.0 1.9 1.0 1.5 1.0 1.2 1.0 1.2 1.0 1.5 1.0 1.2 M	30 psf P: 5 2.1 4.5 1.4 3.0 1.1 2.3 1.0 1.8 1.0 1.5 1.0 1.3 1.0 1.3 1.0 1.1 1.4 1.0 1.5 1.0 1.3 1.0 1.1 1.4 1.4 1.5 1.0 1.3 1.0 1.1 1.4 1.5 1.0 1.3 1.0 1.1 1.4 1.5 1.0 1.3 1.0 1.1 1.0 1.3 1.0 1.1 1.0 1.3 1.0 1.1 1.0 1.3 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.0	& Min ier Spacir 6 2.4 5.3 1.6 3.6 1.2 2.7 1.0 2.1 1.0 1.8 1.0 1.5 1.0 1.3 Vall Oper	A.         Roo           ng (ft)         7           2.7         6.1           1.8         4.1           1.3         3.1           1.1         2.4           1.0         2.0           1.0         1.5           ning Widt         2.0	f: 20 p 8 2.9 6.9 2.0 4.6 1.5 3.5 1.2 2.8 1.0 2.3 1.0 2.0 1.0 1.7 th (ft)	10         3.5         8.5         2.3         5.7         1.8         4.2         1.4         3.4         1.2         2.8         1.0         2.4         1.0         2.1	Net Soi           Pres (p)           1000           1500           2000           2500           3000           3500           4000           Net Soi	marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.0 Grou 4 1.8 4.1 1.2 2.8 1.0 2.1 1.0 1.7 1.0 1.4 1.0 1.2 1.0 1.4 M	2.3 nd Sne 5 2.1 5.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.0 1.7 1.0 1.4 1.0 1.3 karriage W	2.7 2.7 2.7 2.7 2.7 2.7 2.7 2.7	3.0 psf rg (ft) 7 2.7 6.8 1.8 4.5 1.3 3.4 1.1 2.7 1.0 2.3 1.0 1.9 1.0 1.7 ing Widd	3.4 8 2.9 7.7 2.0 5.1 1.5 3.8 1.2 3.1 1.0 2.6 1.0 2.2 1.0 1.9 h (ft)	3.8 10 3.5 9.4 2.3 6.3 1.8 4.7 1.4 3.8 1.2 3.1 1.0 2.7 1.0 2.4
Net Soi Pres (pr 1000 1500 2000 2500 3500 3500 3500 3500 3500 3	il ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage int sf)	4 1.8 3.7 1.2 2.5 1.0 1.9 1.0 1.5 1.0 1.2 1.0 1.5 1.0 1.2 1.0 1.5 M 10 1.0 1.2 M 10 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.0 1.9 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	30 psf P 5 2.1 4.5 1.4 3.0 1.1 2.3 1.0 1.8 1.0 1.5 1.0 1.3 1.0 1.1 Larriage V 12	& Min ier Spacin 2.4 5.3 1.6 3.6 1.2 2.7 1.0 2.1 1.0 1.3 1.0 1.5 1.0 1.3 Vall Oper 14	1. Roo 1. Roo	f: 20 p 8 2.9 6.9 2.0 4.6 1.5 3.5 1.2 2.8 1.0 2.3 1.0 2.0 1.0 1.7 h (ft) 18	10         3.5         8.5         2.3         5.7         1.8         4.2         1.4         3.4         1.2         2.8         1.0         2.4         1.0         2.1         20	Net Soi           Pres (p:           1000           1500           2000           2500           3000           3500           4000           Net Soi           Pres (p:	marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage if	2.0 Grou 4 1.8 4.1 1.2 2.8 1.0 2.1 1.0 1.7 1.0 1.4 1.0 1.2 1.0 1.2 1.0 1.0 1.2 1.0 1.2 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.0 1.7 1.0 1.0 1.7 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	2.3 nd Sne Pi 5 2.1 5.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.4 1.0 1.7 1.0 1.4 3.3 1.1 2.5 1.0 2.0 1.4 3.3 1.1 2.5 1.0 2.0 1.4 3.3 1.1 2.5 1.0 2.0 1.4 3.3 1.1 2.5 1.0 2.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.4 3.3 1.1 2.5 1.0 1.0 1.7 1.0 1.4 1.0 1.7 1.0 1.4 1.0 1.7 1.0 1.4 1.0 1.7 1.0 1.4 1.0 1.7 1.0 1.4 1.0 1.7 1.0 1.4 1.0 1.7 1.0 1.4 1.0 1.7 1.0 1.4 1.0 1.2 1.0 1.4 1.0 1.7 1.0 1.4 1.0 1.2 1.0 1.4 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.2 1.2 1.2 1.2 1.2 1.2 1.2	2.7 2.7 2.7 2.7 2.7 2.7 2.7 2.7	3.0 psf ng (ft) 7 2.7 6.8 1.8 4.5 1.3 3.4 1.1 2.7 1.0 2.3 1.0 1.0 1.9 1.0 1.7 ing Widtl 16	3.4 8 2.9 7.7 2.0 5.1 1.5 3.8 1.2 3.1 1.0 2.6 1.0 2.2 1.0 1.9 h (ft) 18	3.8 10 3.5 9.4 2.3 6.3 1.8 4.7 1.4 3.8 1.2 3.1 1.0 2.7 1.0 2.4 20
Net Soi Pres (pr 1000 1500 2000 2500 3500 3500 3500 3500 3500 3	il ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage il if) marriage	4 1.8 3.7 1.2 2.5 1.0 1.9 1.0 1.5 1.0 1.5 1.0 1.2 1.0 1.5 1.0 1.2 M 10 8.3	30 psf P 5 2.1 4.5 1.4 3.0 1.1 2.3 1.0 1.8 1.0 1.5 1.0 1.3 1.0 1.1 1.1 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.1 2.3 1.0 1.1 2.3 1.0 1.3 1.0 1.1 2.3 1.0 1.3 1.0 1.1 2.3 1.0 1.3 1.0 1.1 2.3 1.0 1.3 1.0 1.1 2.3 1.0 1.3 1.0 1.1 2.3 1.0 1.3 1.0 1.1 2.3 1.0 1.5 1.0 1.5 1.0 1.1 2.3 1.0 1.5 1.0 1.1 1.5 1.0 1.5 1.0 1.1 1.5 1.0 1.0 1.5 1.0 1.1 1.5 1.0 1.5 1.5 1.0 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	& Min ier Spacin 2.4 5.3 1.6 3.6 1.2 2.7 1.0 2.1 1.0 1.8 1.0 1.5 1.0 1.5 1.0 1.3 Vall Oper 14 11.4	1.         Roo           10         7           2.7         6.1           1.8         4.1           1.3         3.1           1.1         2.4           1.0         2.0           1.7         1.7           1.5         sing Widt           16         12.9	f: 20 p 8 2.9 6.9 2.0 4.6 1.5 3.5 1.2 2.8 1.0 2.3 1.0 2.0 1.0 1.7 th (ft) 18 14.4	sf 10 3.5 8.5 2.3 5.7 1.8 4.2 1.4 3.4 1.2 2.8 1.0 2.1 20 16.0	Net Soi           Pres (p:           1000           1500           2000           2500           3000           3500           4000           Net Soi           Pres (ps)           1000	marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage inf) marriage	2.0 Grou 4 1.8 4.1 1.2 2.8 1.0 2.1 1.0 1.7 1.0 1.7 1.0 1.4 1.0 1.2 1.0 1.7 1.0 1.4 1.0 1.2 M 1.0 1.7 1.0 1.7 1.0 1.2 1.0 1.7 1.0 1.7 1.0 1.2 1.0 1.7 1.0 1.7 1.0 1.2 1.0 1.7 1.0 1.7 1.0 1.2 1.0 1.7 1.0 1.7 1.0 1.2 1.0 1.7 1.0 1.7 1.0 1.2 1.0 1.7 1.0 1.2 1.0 1.7 1.0 1.2 1.0 1.7 1.0 1.2 1.0 1.0 1.7 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	2.3 nd Sne Pi 5 2.1 5.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.4 1.0 1.3 Marriage W 12 11.0	2.7 2.7 2.7 2.7 2.7 2.7 2.4 5.9 1.6 3.9 1.2 3.0 1.0 2.4 1.0 2.0 1.0 2.0 1.0 1.7 1.0 1.5 /all Open 14 12.7	3.0 psf ng (ft) 7 2.7 6.8 1.8 4.5 1.3 3.4 1.1 2.7 1.0 2.3 1.0 1.9 1.0 1.7 ing Widtl 16 14.4	3.4 8 2.9 7.7 2.0 5.1 1.5 3.8 1.2 3.1 1.0 2.6 1.0 2.6 1.0 2.2 1.0 1.9 h (ft) 18 16.2	3.8 10 3.5 9.4 2.3 6.3 1.8 4.7 1.4 3.8 1.2 3.1 1.0 2.7 1.0 2.4 20 17.9
Net Soi Pres (p) 1000 5500 5500 5500 5500 1000 1000 100	il ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage f) marriage	4 1.8 3.7 1.2 2.5 1.0 1.9 1.0 1.5 1.0 1.5 1.0 1.2 1.0 1.5 1.0 1.2 M 1.0 1.1 1.0 1.2 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.9 1.0 1.5 1.0 1.9 1.0 1.5 1.0 1.0 1.5 1.0 1.5 1.0 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.0 1.5 1.0 1.5 1.0 1.0 1.5 1.0 1.0 1.0 1.5 1.0 1.0 1.5 1.0 1.0 1.0 1.5 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	30 psf P 5 2.1 4.5 1.4 3.0 1.1 2.3 1.0 1.8 1.0 1.5 1.0 1.3 1.0 1.1 1.1 1.0 1.3 1.0 1.1 1.1 2.3 1.0 1.5 1.0 1.3 1.0 1.1 2.3 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.0 1.5 1.0 1.5 1.0 1.0 1.5 1.0 1.1 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.1 1.5 1.0 1.1 1.5 1.0 1.1 1.5 1.0 1.1 1.5 1.0 1.1 1.5 1.0 1.1 1.5 1.0 1.1 1.5 1.0 1.1 1.5 1.0 1.1 1.5 1.0 1.1 1.5 1.0 1.1 1.5 1.0 1.0 1.1 1.5 1.0 1.0 1.5 1.0 1.1 1.5 1.0 1.0 1.1 1.5 1.0 1.0 1.5 1.0 1.0 1.5 1.0 1.0 1.5 1.0 1.0 1.5 1.0 1.0 1.5 1.0 1.0 1.5 1.0 1.5 1.0 1.0 1.5 1.0 1.0 1.5 1.0 1.0 1.5 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	& Min ier Spacin 6 2.4 5.3 1.6 3.6 1.2 2.7 1.0 2.1 1.0 1.3 Vall Oper 14 11.4 7.6	1.         Roo           19         7           2.7         6.1           1.8         4.1           1.3         3.1           1.1         2.4           1.0         2.0           1.0         1.7           1.0         1.5           ning Width         16           12.9         8.6	f: 20 p 8 2.9 6.9 2.0 4.6 1.5 3.5 1.2 2.8 1.0 2.3 1.0 2.0 1.0 1.0 1.7 th (ft) 18 14.4 9.6	10         3.5         8.5         2.3         5.7         1.8         4.2         1.4         3.4         1.2         2.8         1.0         2.4         1.0         2.1         20         16.0         10.6	Net Soi           Pres (p:           1000           1500           2000           2500           3000           3500           4000           Net Soi           Pres (ps)           1000	marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	2.0 Grou 4 1.8 4.1 1.2 2.8 1.0 2.1 1.0 1.7 1.0 1.7 1.0 1.4 1.0 1.2 0 1.7 1.0 1.7 1.0 1.2 0 1.7 1.0 1.2 0 1.7 1.0 1.2 0 1.7 1.0 1.2 0 1.7 1.0 1.2 0 1.7 1.0 1.2 0 1.7 1.0 1.2 0 1.7 1.0 1.2 0 1.7 1.0 1.2 1.0 1.7 1.0 1.2 1.0 1.7 1.0 1.2 1.0 1.2 1.0 1.7 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	2.3 nd Sne 5 2.1 5.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.0 1.3 Iarriage W 12 11.0 7.3	2.7 pw: 40 ter Spacin 6 2.4 5.9 1.6 3.9 1.2 3.0 1.0 2.4 1.0 2.0 1.0 1.7 1.0 1.5 /all Open 14 12.7 8.5	3.0 psf ng (ff) 7 2.7 6.8 1.8 4.5 1.3 3.4 1.1 2.7 1.0 2.3 1.0 1.9 1.0 1.7 ing Widtl 16 14.4 9.6	3.4 8 2.9 7.7 2.0 5.1 1.5 3.8 1.2 3.1 1.0 2.6 1.0 2.2 1.0 1.9 h (ft) 18 16.2 10.8	3.8 10 3.5 9.4 2.3 6.3 1.8 4.7 1.4 3.8 1.2 3.1 1.0 2.7 1.0 2.4 20 17.9 11.9
Net Soi Pres (pr 1000 1500 2000 2000 2000 2000 2000 2000	il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage sf) marriage marriage	4 1.8 3.7 1.2 2.5 1.0 1.9 1.0 1.5 1.0 1.2 1.0 1.5 1.0 1.2 1.0 1.2 M 1.0 1.1 1.0 1.2 1.0 1.9 1.0 1.5 1.0 1.9 1.0 1.5 1.0 1.9 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.1 1.0 1.5 1.0 1.1 1.0 1.5 1.0 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.0	30 psf P 5 2.1 4.5 1.4 3.0 1.1 2.3 1.0 1.8 1.0 1.5 1.0 1.5 1.0 1.3 1.0 1.1 1.1 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.1 2.9 8 6.6 4.9	& Min ier Spacir 2.4 5.3 1.6 3.6 1.2 2.7 1.0 2.1 1.0 1.8 1.0 1.5 1.0 1.5 1.0 1.3 Vall Oper 14 11.4 7.6 5.7	1. Roo 19 (ft) 7 2.7 6.1 1.8 4.1 1.3 3.1 1.1 2.4 1.0 2.0 1.0 1.7 1.0 1.5 1.5 12.9 8.6 6.4	f: 20 p 8 2.9 6.9 2.0 4.6 1.5 3.5 1.2 2.8 1.0 2.3 1.0 2.0 1.0 1.0 1.7 th (ft) 18 14.4 9.6 7.2	10         3.5         8.5         2.3         5.7         1.8         4.2         1.4         3.4         1.2         2.8         1.0         2.4         1.0         2.1         20         16.0         10.6         8.0	Net Soi           Pres (pr           1000           1500           2000           2500           3000           3500           4000           Net Soi           Pres (ps           1000           3500           4000           Net Soi           Pres (ps           1000           1500           2000	marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage f) marriage marriage marriage	2.0 Grou 4 1.8 4.1 1.2 2.8 1.0 2.1 1.0 1.7 1.0 1.7 1.0 1.4 1.0 1.2 0 1.0 1.4 1.0 1.2 2.8 1.0 2.1 1.0 1.7 1.0 1.7 1.0 1.2 2.8 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.2 2.8 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.2 2.1 1.0 1.7 1.0 1.7 1.0 1.0 1.7 1.0 1.2 2.1 1.0 1.2 2.1 1.0 1.0 1.7 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	2.3 nd Snot 5 2.1 5.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.7 1.0 1.4 1.1 2.5 1.0 2.0 1.1 1.1 2.5 1.0 2.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.7 1.0 1.3 1.1 1.3 1.1 1.3 1.1 1.3 1.1 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.7 1.0 1.7 1.0 1.3 1.1 1.3 1.1 1.3 1.1 1.5 1.0 1.0 1.7 1.0 1.3 1.1 1.5 1.0 1.5 1.0 1.0 1.5 1.0 1.0 1.3 1.1 1.5 1.0 1.5 1.0 1.5 1.0 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.0 1.5 1.0 1.0 1.3 1.1 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.5 1.0 1.5 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.5 1.0 1.5 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.5 1.0 1.5 1.5 1.0 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	2.7 pw: 40 er Spacin 6 2.4 5.9 1.6 3.9 1.2 3.0 1.0 2.4 1.0 2.6 1.0 1.0 2.4 1.0 2.6 1.0 1.0 2.4 1.0 2.6 1.0 2.6 1.0 2.6 1.0 2.6 1.0 2.6 1.0 1.0 1.7 1.0 1.7 1.0 1.5 /all Open 14 12.7 8.5 6.3	3.0 psf ng (ft) 7 2.7 6.8 1.8 4.5 1.3 3.4 1.1 2.7 1.0 2.3 1.0 1.9 1.0 1.7 ing Widtl 16 14.4 9.6 7.2	3.4 8 2.9 7.7 2.0 5.1 1.5 3.8 1.2 3.1 1.0 2.6 1.0 2.2 1.0 1.9 h (ft) 18 16.2 10.8 8.1	3.8 10 3.5 9.4 2.3 6.3 1.8 4.7 1.4 3.8 1.2 3.1 1.0 2.7 1.0 2.4 20 17.9 11.9 8.9
Net Soi Pres (pr 1000 1500 2000 2000 2500 2500 3500 3500 Net Soi Pres (ps 000 500 500 500	il ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage f) marriage marriage marriage	4 1.8 3.7 1.2 2.5 1.0 1.9 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.5 1.0 1.2 1.0 1.5 1.0 1.2 1.0 1.5 1.0 1.2 1.0 1.5 1.0 1.5 1.0 1.2 1.0 1.5 1.0 1.2 1.0 1.5 1.0 1.2 1.0 1.5 1.0 1.5 1.0 1.2 1.0 1.5 1.0 1.2 1.0 1.5 1.0 1.1 1.0 1.0	30 psf P: 5 2.1 4.5 1.4 3.0 1.1 2.3 1.0 1.8 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.2 3 1.0 1.5 1.0 1.1 1.5 1.0 1.5 1.0 1.1 1.1 1.5 1.0 1.1 1.5 1.0 1.1 1.1 1.1 1.5 1.0 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1.1	& Min ier Spacin 2.4 5.3 1.6 3.6 1.2 2.7 1.0 2.1 1.0 1.8 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.3 Vall Oper 14 11.4 7.6 5.7 4.5	1.         Roo           12         7           2.7         6.1           1.8         4.1           1.3         3.1           1.1         2.4           1.0         1.5           1.0         1.5           1.0         1.6           12.9         8.6           6.4         5.2	f: 20 p 8 2.9 6.9 2.0 4.6 1.5 3.5 1.2 2.8 1.0 2.3 1.0 2.0 1.0 2.0 1.0 1.7 h (ft) 18 14.4 9.6 7.2 5.8	10         3.5         8.5         2.3         5.7         1.8         4.2         1.4         3.4         1.2         2.8         1.0         2.4         1.0         2.1         20         16.0         10.6         8.0         6.4	Net Soi           Pres (pr           1000           1500           2000           2500           3000           3500           4000           Net Soi           Pres (ps           1000           3500           2000           2500	marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage f) marriage marriage marriage marriage	2.0 Grou 4 1.8 4.1 1.2 2.8 1.0 2.1 1.0 1.7 1.0 1.7 1.0 1.4 1.0 1.2 1.0 1.4 1.0 1.2 2.1 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.2 2.1 1.0 1.7 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	2.3 nd Snot 5 2.1 5.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.7 1.0 1.4 1.1 2.5 1.0 2.0 1.1 1.1 2.5 1.4 3.3 1.1 2.5 1.4 3.3 1.1 2.5 1.0 2.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.0 1.7 1.0 1.3 1.1 1.3 1.1 1.3 1.1 1.3 1.1 1.3 1.1 1.3 1.1 1.3 1.1 1.3 1.1 1.5 1.0 1.4 1.0 1.7 1.0 1.5 1.0 1.4 1.0 1.7 1.0 1.7 1.0 1.3 1.1 1.3 1.1 1.3 1.1 1.3 1.1 1.3 1.1 1.5 1.0 1.0 1.3 1.1 1.3 1.1 1.3 1.1 1.3 1.1 1.3 1.1 1.3 1.1 1.5 1.0 1.0 1.3 1.1 1.5 1.0 1.3 1.0 1.3 1.0 1.3 1.0 1.0 1.0 1.3 1.0 1.0 1.0 1.3 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	2.7 pw: 40 er Spacin 6 2.4 5.9 1.6 3.9 1.2 3.0 1.0 2.4 1.0 2.4 1.0 2.4 1.0 2.4 1.0 2.4 1.0 2.4 1.0 2.4 1.0 2.4 1.0 2.4 1.0 2.4 1.0 2.4 1.0 2.4 1.0 2.4 1.0 2.4 1.0 2.4 1.0 2.4 1.0 2.4 1.0 2.4 1.0 2.5 1.0 2.4 1.0 2.4 1.0 2.4 1.0 2.0 1.0 1.2 3.0 1.0 2.4 1.0 2.5 1.0 3.9 1.2 3.0 1.0 2.4 1.0 2.5 1.0 3.5 1.0 2.5 1.0 3.0 1.0 1.2 3.0 1.0 1.0 2.6 1.0 1.5 5 1.0 1.5 5 1.0 1.5 5 5 1.2 3.0 1.0 1.5 5 5 5 5 5 5 5 5 5 5 5 5 5	3.0 psf ng (ft) 7 2.7 6.8 1.8 4.5 1.3 3.4 1.1 2.7 1.0 2.3 1.0 1.9 1.0 1.7 ing Widdl 16 14.4 9.6 7.2 5.8	3.4 8 2.9 7.7 2.0 5.1 1.5 3.8 1.2 3.1 1.0 2.6 1.0 2.6 1.0 2.2 1.0 1.9 h (ft) 18 16.2 10.8 8.1 6.5	3.8 10 3.5 9.4 2.3 6.3 1.8 4.7 1.4 3.8 1.2 3.1 1.0 2.7 1.0 2.4 20 17.9 11.9 8.9 7.2
Net Soi Pres (pr 1000 1500 2000 2000 2000 2000 2000 2000	il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage sf) marriage marriage	4 1.8 3.7 1.2 2.5 1.0 1.9 1.0 1.5 1.0 1.2 1.0 1.5 1.0 1.2 1.0 1.2 M 1.0 1.1 1.0 1.2 1.0 1.9 1.0 1.5 1.0 1.9 1.0 1.5 1.0 1.9 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.1 1.0 1.5 1.0 1.1 1.0 1.5 1.0 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.0	30 psf P 5 2.1 4.5 1.4 3.0 1.1 2.3 1.0 1.8 1.0 1.5 1.0 1.5 1.0 1.3 1.0 1.1 1.1 1.0 1.1 1.0 1.1 1.0 1.1 1.0 1.1 2.9 8 6.6 4.9	& Min ier Spacir 2.4 5.3 1.6 3.6 1.2 2.7 1.0 2.1 1.0 1.8 1.0 1.5 1.0 1.5 1.0 1.3 Vall Oper 14 11.4 7.6 5.7	1. Roo 19 (ft) 7 2.7 6.1 1.8 4.1 1.3 3.1 1.1 2.4 1.0 2.0 1.0 1.7 1.0 1.5 1.5 12.9 8.6 6.4	f: 20 p 8 2.9 6.9 2.0 4.6 1.5 3.5 1.2 2.8 1.0 2.3 1.0 2.0 1.0 1.0 1.7 th (ft) 18 14.4 9.6 7.2	10         3.5         8.5         2.3         5.7         1.8         4.2         1.4         3.4         1.2         2.8         1.0         2.4         1.0         2.1         20         16.0         10.6         8.0	Net Soi           Pres (pr           1000           1500           2000           2500           3000           3500           4000           Net Soi           Pres (ps           1000           3500           4000           Net Soi           Pres (ps           1000           1500           2000	marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage f) marriage marriage marriage	2.0 Grou 4 1.8 4.1 1.2 2.8 1.0 2.1 1.0 1.7 1.0 1.7 1.0 1.4 1.0 1.2 0 1.0 1.4 1.0 1.2 2.8 1.0 2.1 1.0 1.7 1.0 1.7 1.0 1.2 2.8 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.2 2.8 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.7 1.0 1.2 2.1 1.0 1.7 1.0 1.7 1.0 1.0 1.7 1.0 1.2 2.1 1.0 1.2 2.1 1.0 1.0 1.7 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	2.3 nd Snot 5 2.1 5.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.7 1.0 1.4 1.1 2.5 1.0 2.0 1.1 1.1 2.5 1.0 2.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.4 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.7 1.0 1.3 1.1 1.3 1.1 1.3 1.1 1.3 1.1 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.7 1.0 1.7 1.0 1.3 1.1 1.3 1.1 1.3 1.1 1.5 1.0 1.0 1.7 1.0 1.3 1.1 1.5 1.0 1.5 1.0 1.0 1.5 1.0 1.0 1.3 1.1 1.5 1.0 1.5 1.0 1.5 1.0 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.0 1.5 1.0 1.0 1.3 1.1 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.5 1.0 1.5 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.5 1.0 1.5 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.5 1.0 1.5 1.5 1.0 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	2.7 pw: 40 er Spacin 6 2.4 5.9 1.6 3.9 1.2 3.0 1.0 2.4 1.0 2.6 1.0 1.0 2.4 1.0 2.6 1.0 1.0 2.4 1.0 2.6 1.0 2.6 1.0 2.6 1.0 2.6 1.0 2.6 1.0 1.0 1.7 1.0 1.7 1.0 1.5 /all Open 14 12.7 8.5 6.3	3.0 psf ng (ft) 7 2.7 6.8 1.8 4.5 1.3 3.4 1.1 2.7 1.0 2.3 1.0 1.9 1.0 1.7 ing Widtl 16 14.4 9.6 7.2	3.4 8 2.9 7.7 2.0 5.1 1.5 3.8 1.2 3.1 1.0 2.6 1.0 2.2 1.0 1.9 h (ft) 18 16.2 10.8 8.1	3.8 10 3.5 9.4 2.3 6.3 1.8 4.7 1.4 3.8 1.2 3.1 1.0 2.7 1.0 2.4 20 17.9 11.9 8.9

\* Minimum interior pier area is 1.0 sqft. Minimum exterior foundation wall footing width is 1'-0"; except for a 16' wide unit when the snow load is 100 psf and the allowable soil pressure is 1000 psf, use 1'-2".

Multi-Section	Aftg E, I
Width	14

		Grou	ind Sn	OW: SU	DSI				
Net Sc	oil	Pier Spacing (ft)							
Pres (p		4	5 -	6	7	8	10		
1000	ext, int	1.8	2.1	2.4	2:7	2.9	3.5		
	marriage	4.5	5.5	6.5	7.5	8.4	10.4		
1500	ext, int	1.2	1.4	1.6	1.8	2.0	2.3		
1.500	marriage	3.0	3.7	4.3	5.0	2.0 5.6	6.9		
2000		1.0	1.1	1.2	1.3	1.5			
2000	ext, int		2.7		3.7		1.8		
2500	marriage	2.3		3.2		4.2	5.2		
2300	ext, int	1.0	1.0	1.0	1.1	1.2	1.4		
2000	marriage	1.8	2.2	2.6	3.0	3.4	4.2		
3000	ext, int	1.0	1.0	1.0	1.0	1.0	1.2		
	marriage	1.5	1.8	2.2	2.5	2.8	3.5		
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	1.3	· 1.6	1.8	2.1	2.4	3.0		
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	1.1	1.4	1.6	1.9	2.1	2.6		
Net So			Marriage V				1		
Pres (p		.10	12	14	16	18	20		
1000	marriage	10.2	12.1	14.0	16.0	17.9	19.8		
1500	marriage	6.8	8.1	9.4	10.6	. 11.9	. 13.2		
2000	marriage	5.1	6.1	7.0	8.0	8.9	9.9		
2500	marriage	4.1	4.8	5.6	6.4	7.1	. 7.9		
				4 7	.5.3	<u> </u>	6.6		
3000	marriage	3.4	4.0	4.7		6.0	0.0		
3000 3500	marriage	2.9	3.5	4.0	4.6	5.1	5.7		
3000		2.9 2.6	3.5 3.0	4.0 3.5	4.6 4.0				
3000 3500	marriage marriage	2.9 2.6	3.5 3.0 nd Sno	4.0 3.5 5 5w: 70	4.6 4.0 psf	5.1	5.7		
3000 3500 4000	marriage marriage	2.9 2.6	3.5 3.0 nd Sno	4.0 3.5	4.6 4.0 psf	5.1	5.7		
3000 3500 4000 Net So	marriage marriage	2.9 2.6 Grou	3.5 3.0 nd Sno P	4.0 3.5 0w: 70 ier Spacir	4.6 4.0 psf ng (ft)	5.1 4.5	5.7		
3000 3500 4000 Net So Pres (p	marriage marriage il sf)	2.9 2.6 Grou	3.5 3.0 nd Sno P 5	4.0 3.5 ow: 70 er Spacir 6	4.6 4.0 psf ng (ft) 7	5.1 4.5 8	5.7 <u>4.9</u> 10		
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3000 3500 4000 Net So Pres (p 1000 1500	marriage marriage il sf) ext, int marriage ext, int marriage ext, int	2.9 2.6 Grou 4 1.8 5.3 1.2 3.5	3.5 3.0 nd Snd 5 2.1 6.5 1.4 4.3 1.1	4.0 3.5 <b>DW: 70</b> er Spacir 6 2.4 7.6 1.6 5.1 1.2	4.6 4.0 psf g (ft) 7 2.7 8.8 1.8 5.9	5.1 4.5 8 2.9 10.0 2.0 6.6 1.5	5.7 4.9 10 3.5 12.3 2.3 8.2 1.8		
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3000 3500 4000 Net So Pres (p 1000 1500 2000 2500	marriage marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int	2.9 2.6 Grou 4 1.8 5.3 1.2 3.5 1.0 2.6 1.0 2.1 1.0	3.5 3.0 nd Snc 5 2.1 6.5 1.4 4.3 1.1 3.2 1.0 2.6 1.0	$     \begin{array}{r}       4.0 \\       3.5 \\       \hline       0 w: 70 \\       er Spacin \\       6 \\       2.4 \\       7.6 \\       1.6 \\       5.1 \\       1.2 \\       3.8 \\       1.0 \\       3.0 \\       1.0 \\       3.0 \\       1.0 \\       3.0 \\       1.0 \\       3.0 \\       1.0 \\       3.0 \\       1.0 \\       3.0 \\       1.0 \\       3.0 \\       1.0 \\       3.0 \\       1.0 \\       3.0 \\       1.0 \\       3.0 \\       1.0 \\       3.0 \\       1.0 \\       3.0 \\       1.0 \\       3.0 \\       1.0 \\       3.0 \\       1.0 \\       3.0 \\   $	4.6 4.0 <b>psf</b> 1.3 4.4 1 1 3.5 1.0	5.1 4.5 8 2.9 10.0 2.0 6.6 1.5 5.0 1.2 4.0 1.0	5.7 4.9 10 3.5 12.3 2.3 8.2 1.8 6.2 1.4 4.9 1.2		
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3000 3500 4000 Pres (p 1000 1500 2000 2500 3500 4000 Pres (p 1000 Pres (p 1000 2500 2000 2500	marriage marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage marriage marriage marriage	2.9 2.6 Grou 4 1.8 5.3 1.2 3.5 1.0 2.6 1.0 2.1 1.0 1.5 1.0 1.5 1.0 1.3 N 10 12.1 8.1 6.1 4.8	3.5 3.0 nd Sm 5 2.1 6.5 1.4 4.3 1.1 3.2 1.0 2.6 1.0 2.6 1.0 2.2 1.0 2.6 1.0 2.2 1.0 2.6 1.0 2.2 1.0 2.6 1.0 2.5 1.4 4.3 1.1 3.2 1.0 2.6 1.0 2.5 1.4 4.3 1.1 3.2 1.0 2.6 1.0 2.5 1.4 4.3 1.1 3.2 1.0 2.6 1.0 2.5 1.4 4.3 1.1 3.2 1.0 2.6 1.0 2.5 1.0 2.5 1.4 4.3 1.1 3.2 1.0 2.6 1.0 2.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1	4.0 3.5 0w: 70 er Spacir 6 2.4 7.6 1.6 5.1 1.2 3.8 1.0 3.0 1.0 2.5 1.0 1.0 2.5 1.0 2.5 1.0 2.5 1.0 1.5 1.0 2.5 1.0 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 1.0 2.5 1.0 1.0 1.0 2.5 1.0 1.0 2.5 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 1.0 1.0 2.5 1.0 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.5 1.0 2.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1	4.6 4.0 <b>psf</b> 7 2.7 8.8 1.8 5.9 1.3 4.4 1 1 3.5 1.0 2.9 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.7 8.8 1.3 4.4 1 1 3.5 1.0 2.7 1.0 2.7 5 7 .7 1.0 2.5 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 1.0 2.5 1.0 2.5 1.0 2.7 1.0 2.5 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 1.0 2.5 2.5 1.0 2.5 2.5 1.5 2.5 1.5 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 2.5 1.5 2.5 2.5 2.5 2.5 2.5 1.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2	5.1 4.5 8 2.9 10.0 2.0 6.6 1.5 5.0 1.2 4.0 1.0 3.3 1.0 2.8 1.0 2.5 h (ft) 18 21.3 14.2 10.7 8.5	5.7 4.9 10 3.5 12.3 2.3 8.2 1.8 6.2 1.4 4.9 1.2 4.1 1.0 3.5 1.0 3.1 2.3 8.2 1.8 6.2 1.4 4.9 1.2 4.1 1.0 3.5 1.2 3 8.2 1.8 6.2 1.8 6.2 1.2 1.8 6.2 1.2 1.8 6.2 1.2 3 8.2 1.8 6.2 1.2 1.8 6.2 1.2 1.8 6.2 1.2 1.8 6.2 1.2 1.8 6.2 1.2 1.8 6.2 1.2 1.8 6.2 1.2 1.8 6.2 1.2 1.8 6.2 1.2 1.8 6.2 1.2 1.8 6.2 1.2 1.8 6.2 1.2 1.8 6.2 1.2 1.8 6.2 1.2 1.8 6.2 1.2 1.8 6.2 1.2 1.8 7 7 1.2 7 7 8.2 1.2 7 7 8.2 1.2 7 7 8.2 1.2 7 7 8.2 1.2 7 8.2 1.2 7 8.2 1.2 7 8.2 1.2 8 1.2 7 8.2 1.2 8 1.2 7 8.2 1.8 8 1.2 7 8.2 1.2 8 1.2 8 1.2 7 8.2 1.8 8 1.2 8 1.2 8 1.2 8 1.2 8 1.2 8 1.2 8 1.2 8 1.2 8 1.2 8 1.2 8 1.2 8 1.2 8 1.0 8 1.2 8 1.0 1.0 8 1.0 1.0 8 1.0 1.0 8 1.0 8 1.0 8 1.0 8 1.0 8 1.0 8 1.0 1.0 8 1.0 8 1.0 1.0 1.0 1.0 8 1.0 8 1.0 1.0 8 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0		
3000 3500 4000 Net So Pres (p 1000 1500 22500 3500 4000 Net So Pres (p Pres (p 1000 1500 2000	marriage marriage il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.9 2.6 Grou 4 1.8 5.3 1.2 3.5 1.0 2.6 1.0 2.1 1.0 1.5 1.0 1.5 1.0 1.3 N 10 12.1 8.1 6.1	3.5 3.0 nd Sno 5 2.1 6.5 1.4 4.3 1.1 3.2 1.0 2.6 1.0 2.6 1.0 2.2 1.0 2.6 1.0 2.2 1.0 2.6 1.0 2.2 1.0 2.6 1.0 2.2 1.0 2.6 1.0 2.2 1.0 2.6 1.0 2.2 1.0 2.6 1.0 2.2 1.0 2.6 1.0 2.2 1.0 2.6 1.0 2.2 1.0 2.6 1.0 2.1 5 1.1 4 4.3 1.1 3.2 1.0 2.6 1.0 2.1 6.5 1.4 4.3 1.1 3.2 1.0 2.6 1.0 2.5 1.0 2.7 1.0 2.6 1.0 2.5 1.0 2.7 1.0 2.6 1.0 2.7 1.0 2.6 1.0 2.5 1.0 2.7 1.0 2.6 1.0 2.5 1.0 2.7 1.0 2.6 1.0 2.5 1.0 2.7 1.0 2.6 1.0 2.2 1.0 2.6 1.0 2.2 1.0 2.5 1.0 2.6 1.0 2.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1	4.0 3.5 0w: 70 ier Spacir 6 2.4 7.6 1.6 5.1 1.2 3.8 1.0 3.0 1.0 2.5 1.0 2.2 1.0 1.4 Vall Oper 14 16 7.1 1.4 16 7.6 1.6 5.1 1.0 2.5 1.0 1.6 5.1 1.0 2.5 1.0 1.6 5.1 1.0 2.5 1.0 1.6 5.1 1.0 2.5 1.0 1.0 1.6 5.1 1.0 2.5 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	4.6 4.0 <b>Psf</b> 7 2.7 8.8 1.8 5.9 1.3 4.4 1 1 3.5 1.0 2.9 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5	5.1 4.5 8 2.9 10.0 2.0 6.6 1.5 5.0 1.2 4.0 1.0 2.8 1.0 2.5 h (ft) 18 21.3 14.2 10.7	5.7 4.9 10 3.5 12.3 2.3 8.2 1.8 6.2 1.4 4.9 1.2 4.1 1.0 3.5 1.0 3.1 20 23.6 15.7 11.8		

		Grou	ind Sno	ow: 60	) pst		
Net So	il	1.11		ier Spacir			•
Pres (p	sf)	4	5	6	7	8	10
1000	ext, int	1.8	2.1	2.4	2.7	2.9	3.5
	marriage	4.9	6.0	7.0	8.1	.9.2	11.4
1500	ext, int	1.2	1.4	1.6	1.8	2.0	2.3
	marriage	3.3	4.0	4.7	5.4	6.1	7.6
2000	ext, înt	1.0	1.1	1.2	1.3	1.5	1.8
	marriage	2.4	3.0	3.5	4.1	4.6	5.7
2500	ext, int	1.0	1.0	1.0	1.1	1.2	1.4
	marriage	2.0	2.4	2.8	3.3	3.7	4.5
3000	ext, int	1.0	1.0	1.0	1.0	1.0	1.2
	marriage	1.6	2.0	2.3	2.7	3.1	3.8
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.4	1,7	2.0	2.3	2.6	3.2
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
-	marriage	1.2	1.5	1.8	2.0	2.3	.2.8
Net Soi	il	1	Marriage V	Vall Open	ing Wid	th (ft)	
Pres (p:	sf)	10	12	14	16	18	20
1000	marriage	11.2	13.3	15.4	17.5	19.6	21.7
1500	marriage	7.4	8.8	10.3	11.7		14.5
2000	marriage	5.6	6.6	7.7	8.7	9.8	10.9
2500	marriage	4.5	5.3	6.2	7.0	7.8	- 8.7
		3.7	4.4	5.1	5.8	6.5	7.2
	marriage			0.1			
3500	marnage marnage	3.2	3.8	4.4	5.0	5.6	6.2
3500						5.6 4.9	6.2 5.4
3000 3500 4000 Net Soi	marriage marriage	3.2 2.8	3.8 3.3 nd Snc	4.4 3.8 w: 80	5.0 4.4 psf		
3500 4000 Net Soi	marriage marriage	3.2 2.8	3.8 3.3 nd Snc Pi	4.4 3.8	5.0 4.4 psf g (ft)	4.9	5.4
3500 4000	marriage marriage	3.2 2.8 Grou	3.8 3.3 nd Snc	4.4 3.8 0w: 80 er Spacing	5.0 4.4 psf	<u>4.9</u> 8	5.4
3500 4000 Net Soi Pres (ps	marriage marriage	3.2 2.8 Grou	3.8 3.3 Ind Snc Pi 5	4.4 3.8 0w: 80 er Spacin 6	5.0 4.4 <b>psf</b> g (ft) 7 2.7	4.9	5.4
3500 4000 Net Soi Pres (ps	marriage marriage 1 sf) ext, int	3.2 2.8 Grou 4 1.8	3.8 3.3 Ind Snc Pi 5 2.1	4.4 3.8 <b>DW: 80</b> er Spacin 6 2.4 8.2	5.0 4.4 psf g (ft) 7	<u>4.9</u> <u>8</u> 2.9	<u>5.4</u> <u>10</u> <u>3.5</u>
3500 4000 Net Soi Pres (ps 1000	marriage marriage 1 sf) ext, int marriage	3.2 2.8 Grou 4 1.8 5.7	3.8 3.3 ind Snc Pi 5 2.1 6.9	4.4 3.8 0w: 80 er Spacing 6 2.4	5.0 4.4 psf g (ft) 7 2.7 9.5	4.9 8 2.9 10.7	5.4 10 3.5 13.3
3500 4000 Net Soi Pres (ps 1000	marriage marriage I sf) ext, int marriage ext, int	3.2 2.8 Grou 4 1.8 5.7 1.2	3.8 3.3 ind Snc Pi 5 2.1 6.9 1.4	4.4 3.8 <b>DW: 80</b> er Spacin 6 2.4 8.2 1.6	5.0 4.4 <b>psf</b> g (ft) 7 2.7 9.5 1.8	4.9 8 2.9 10.7 2.0 7.2	5.4 10 3.5 13.3 2.3 8.8
3500 4000 Net Soi Pres (ps 1000 1500	marriage marriage [] sf) ext, int marriage ext, int marriage	3.2 2.8 Grou 4 1.8 5.7 1.2 3.8	3.8 3.3 nd Snc Pi 5 2.1 6.9 1.4 4.6	4.4 3.8 <b>DW: 80</b> er Spacing 6 2.4 8.2 1.6 5.5	5.0 4.4 psf g (ft) 7 2.7 9.5 1.8 6.3	4.9 8 2.9 10.7 2.0	10 3.5 13.3 2.3
3500 4000 Net Soi Pres (ps 1000 1500	marriage marriage 1 sf) ext, int marriage ext, int marriage ext, int	3.2 2.8 Grou 4 1.8 5.7 1.2 3.8 1.0	3.8 3.3 nd Snc 5 2.1 6.9 1.4 4.6 1.1	4.4 3.8 <b>DW: 80</b> er Spacing 6 2.4 8.2 1.6 5.5 1.2	5.0 4.4 <b>psf</b> g (ft) 7 2.7 9.5 1.8 6.3 1.3	4.9 8 2.9 10.7 2.0 7.2 1.5	5.4 10 3.5 13.3 2.3 8.8 1.8
3500 4000 Net Soi Pres (ps 1000 1500 2000	marriage marriage sf) ext, int marriage ext, int marriage ext, int marriage	3.2 2.8 Grou 4 1.8 5.7 1.2 3.8 1.0 2.8	3.8 3.3 nd Snc Pi 5 2.1 6.9 1.4 4.6 1.1 3.5	4.4 3.8 <b>Dw: 80</b> er Spacing 6 2.4 8.2 1.6 5.5 1.2 4.1	5.0 4.4 <b>psf</b> 7 2.7 9.5 1.8 6.3 1.3 4.7	4.9 8 2.9 10.7 2.0 7.2 1.5 5.4	5.4 10 3.5 13.3 2.3 8.8 1.8 6.6 1.4
3500 4000 Net Soi Pres (ps 1000 1500 2000	marriage marriage ext, int marriage ext, int marriage ext, int marriage ext, int	3.2 2.8 Grou 4 1.8 5.7 1.2 3.8 1.0 2.8 1.0	3.8 3.3 nd Snc 5 2.1 6.9 1.4 4.6 1.1 3.5 1.0	4.4 3.8 <b>DW: 80</b> er Spacin 6 2.4 8.2 1.6 5.5 1.2 4.1 1.0	5.0 4.4 <b>psf</b> g (ft) 7 2.7 9.5 1.8 6.3 1.3 4.7 1.1	4.9 8 2.9 10.7 2.0 7.2 1.5 5.4 1.2	5.4 10 3.5 13.3 2.3 8.8 1.8 6.6
3500 4000 Net Soi Pres (ps 1000 1500 2000 2500	marriage marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	3.2 2.8 Grou 4 1.8 5.7 1.2 3.8 1.0 2.8 1.0 2.3	3.8 3.3 nd Snc Pi 5 2.1 6.9 1.4 4.6 1.1 3.5 1.0 2.8	4.4 3.8 <b>DW: 80</b> er Spacin 6 2.4 8.2 1.6 5.5 1.2 4.1 1.0 3.3	5.0 4.4 <b>psf</b> g(ft) 7 2.7 9.5 1.8 6.3 1.3 4.7 1.1 3.8	4.9 8 2.9 10.7 2.0 7.2 1.5 5.4 1.2 4.3	5.4 10 3.5 13.3 2.3 8.8 1.8 6.6 1.4 5.3
3500 4000 Net Soi Pres (ps 1000 1500 2000 2500	marriage marriage sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	3.2 2.8 Grou 4 1.8 5.7 1.2 3.8 1.0 2.8 1.0 2.3 1.0	3.8 3.3 md Snc Pi 5 2.1 6.9 1.4 4.6 1.1 3.5 1.0 2.8 1.0	4.4 3.8 <b>DW: 80</b> er Spacin 6 2.4 8.2 1.6 5.5 1.2 4.1 1.0 3.3 1.0	5.0 4.4 <b>psf</b> g(ft) 7 2.7 9.5 1.8 6.3 1.3 4.7 1.1 3.8 1.0	4.9 8 2.9 10.7 2.0 7.2 1.5 5.4 1.2 4.3 1.0	10 3.5 13.3 2.3 8.8 1.8 6.6 1.4 5.3 1.2
3500 4000 Net Soi Pres (ps 1000 1500 2000 2500 3000	marriage marriage sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	3.2 2.8 Grou 4 1.8 5.7 1.2 3.8 1.0 2.8 1.0 2.3 1.0 2.3 1.0 1.9	3.8 3.3 md Snc Pi 5 2.1 6.9 1.4 4.6 1.1 3.5 1.0 2.8 1.0 2.3	4.4 3.8 <b>DW: 80</b> er Spacin 6 2.4 8.2 1.6 5.5 1.2 4.1 1.0 3.3 1.0 2.7	5.0 4.4 <b>psf</b> g(ft) 7 2.7 9.5 1.8 6.3 1.3 4.7 1.1 3.8 1.0 3.2	4.9 8 2.9 10.7 2.0 7.2 1.5 5.4 1.2 4.3 1.0 3.6	10 3.5 13.3 2.3 8.8 1.8 6.6 1.4 5.3 1.2 4.4
3500 4000 Net Soi Pres (ps 1000 1500 2000 2500 3000	marriage marriage sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	3.2 2.8 Grou 4 1.8 5.7 1.2 3.8 1.0 2.8 1.0 2.3 1.0 2.3 1.0 1.9 1.0	3.8 3.3 md Snc Pi 5 2.1 6.9 1.4 4.6 1.1 3.5 1.0 2.8 1.0 2.3 1.0	4.4 3.8 <b>DW: 80</b> er Spacin 6 2.4 8.2 1.6 5.5 1.2 4.1 1.0 3.3 1.0 2.7 1.0	5.0 4.4 <b>psf</b> g(ft) 7 2.7 9.5 1.8 6.3 1.3 4.7 1.1 3.8 1.0 3.2 1.0	4.9 8 2.9 10.7 2.0 7.2 1.5 5.4 1.2 4.3 1.0 3.6 1.0	5.4 10 3.5 13.3 2.3 8.8 1.8 6.6 1.4 5.3 1.2 4.4 1.0
3500 4000 Net Soi Pres (ps 1000 1500 2000 2500 3000 3500	marriage marriage sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	3.2 2.8 Grou 4 1.8 5.7 1.2 3.8 1.0 2.8 1.0 2.3 1.0 2.3 1.0 1.9 1.0 1.6	3.8 3.3 md Snc Pi 5 2.1 6.9 1.4 4.6 1.1 3.5 1.0 2.8 1.0 2.3 1.0 2.3 1.0 2.0	4.4 3.8 <b>DW: 80</b> er Spacin 6 2.4 8.2 1.6 5.5 1.2 4.1 1.0 3.3 1.0 2.7 1.0 2.3	5.0 4.4 <b>psf</b> g(ft) 7 2.7 9.5 1.8 6.3 1.3 4.7 1.1 3.8 1.0 3.2 1.0 2.7	4.9 8 2.9 10.7 2.0 7.2 1.5 5.4 1.2 4.3 1.0 3.6 1.0 3.1	5.4 10 3.5 13.3 2.3 8.8 1.8 6.6 1.4 5.3 1.2 4.4 1.0 3.8
3500 4000 Net Soi Pres (ps 1000 1500 2000 2500 3000 3500	marriage marriage sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	3.2 2.8 Grou 4 1.8 5.7 1.2 3.8 1.0 2.8 1.0 2.3 1.0 2.3 1.0 1.9 1.0 1.6 1.0 1.4	3.8 3.3 ind Snc Pi 5 2.1 6.9 1.4 4.6 1.1 3.5 1.0 2.8 1.0 2.3 1.0 2.0 1.0 2.0 1.0 1.7	4.4 3.8 <b>bw: 80</b> er Spacin, 6 2.4 8.2 1.6 5.5 1.2 4.1 1.0 3.3 1.0 2.7 1.0 2.3 1.0 2.0	5.0 4.4 <b>psf</b> g (ft) 7 2.7 9.5 1.8 6.3 1.3 4.7 1.1 3.8 1.0 3.2 1.0 2.7 1.0 2.4	4.9           8           2.9           10.7           2.0           7.2           1.5           5.4           1.2           4.3           1.0           3.6           1.0           3.1           1.0           2.7	5.4 10 3.5 13.3 2.3 8.8 1.8 6.6 1.4 5.3 1.2 4.4 1.0 3.8 1.0
3500 4000 Net Soi Pres (ps 1000 1500 2500 3000 3500 4000 Net Soi	marriage marriage sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	3.2 2.8 Grou 4 1.8 5.7 1.2 3.8 1.0 2.8 1.0 2.3 1.0 2.3 1.0 1.9 1.0 1.6 1.0 1.4	3.8 3.3 md Snc Pi 5 2.1 6.9 1.4 4.6 1.1 3.5 1.0 2.8 1.0 2.3 1.0 2.3 1.0 2.0 1.0	4.4 3.8 <b>bw: 80</b> er Spacin, 6 2.4 8.2 1.6 5.5 1.2 4.1 1.0 3.3 1.0 2.7 1.0 2.3 1.0 2.0	5.0 4.4 <b>psf</b> g (ft) 7 2.7 9.5 1.8 6.3 1.3 4.7 1.1 3.8 1.0 3.2 1.0 2.7 1.0 2.4	4.9           8           2.9           10.7           2.0           7.2           1.5           5.4           1.2           4.3           1.0           3.6           1.0           3.1           1.0           2.7	5.4 10 3.5 13.3 2.3 8.8 6.6 1.4 5.3 1.2 4.4 1.0 3.8 1.0
3500 4000 Net Soi Pres (ps 1000 1500 22000 22500 3000 3500 4000 Net Soi Pres (ps	marriage marriage sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	3.2 2.8 Grou 4 1.8 5.7 1.2 3.8 1.0 2.8 1.0 2.3 1.0 2.3 1.0 1.9 1.0 1.6 1.0 1.4	3.8 3.3 ind Snc Pi 5 2.1 6.9 1.4 4.6 1.1 3.5 1.0 2.8 1.0 2.3 1.0 2.0 1.0 2.0 1.0 1.7 Marriage W	4.4 3.8 <b>ww: 80</b> er Spacin, 6 2.4 8.2 1.6 5.5 1.2 4.1 1.0 3.3 1.0 2.7 1.0 2.3 1.0 2.3 1.0 2.0 Vall Openi	5.0 4.4 <b>psf</b> g (ft) 7 2.7 9.5 1.8 6.3 1.3 4.7 1.1 3.8 1.0 3.2 1.0 2.7 1.0 2.4 ing Widt	4.9 8 2.9 10.7 2.0 7.2 1.5 5.4 1.2 4.3 1.0 3.1 1.0 2.7 h (ft)	5.4 10 3.5 13.3 2.3 8.8 1.8 6.6 1.4 5.3 1.2 4.4 1.0 3.8 1.0 3.3
3500 4000 Net Soi Pres (ps 1000 1500 2500 3000 3500 4000 Net Soi Pres (ps 1000	marriage marriage sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ist, int marriage ext, int	3.2 2.8 Grou 4 1.8 5.7 1.2 3.8 1.0 2.8 1.0 2.3 1.0 2.3 1.0 1.9 1.0 1.6 1.0 1.4 N 10	3.8 3.3 ind Snc Pi 5 2.1 6.9 1.4 4.6 1.1 3.5 1.0 2.8 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.0 1.0 1.7 4arriage W 12	4.4 3.8 <b>bw: 80</b> er Spacin, 6 2.4 8.2 1.6 5.5 1.2 4.1 1.0 2.7 1.0 2.3 1.0 2.3 1.0 2.0 /all Openi 14	5.0 4.4 <b>psf</b> g (ft) 7 2.7 9.5 1.8 6.3 1.3 4.7 1.1 3.8 1.0 3.2 1.0 2.7 1.0 2.4 ing Widt 16	4.9 8 2.9 10.7 2.0 7.2 1.5 5.4 1.2 4.3 1.0 3.6 1.0 3.1 1.0 2.7 h (ft) 18	5.4 10 3.5 13.3 2.3 8.8 1.8 6.6 1.4 5.3 1.2 4.4 1.0 3.8 1.0 3.3 20
3500 4000 Net Soi Pres (ps 1000 1500 2500 3000 3500	marriage marriage sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage st, int marriage st, int marriage st, int marriage	3.2 2.8 Grou 4 1.8 5.7 1.2 3.8 1.0 2.8 1.0 2.3 1.0 2.3 1.0 1.9 1.0 1.6 1.0 1.4 N 10 13.1	3.8 3.3 nd Snc Pi 5 2.1 6.9 1.4 4.6 1.1 3.5 1.0 2.8 1.0 2.3 1.0 2.0 1.0 1.7 4arriage W 12 15.6	4.4 3.8 <b>bw: 80</b> er Spacin, 6 2.4 8.2 1.6 5.5 1.2 4.1 1.0 3.3 1.0 2.7 1.0 2.3 1.0 2.3 1.0 2.4 1.0 3.3 1.0 2.7 1.0 2.3 1.0 2.1 1.0 2.0 1.0 2.1 1.0 2.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1	5.0 4.4 <b>psf</b> <i>g</i> (ft) 7 2.7 9.5 1.8 6.3 1.3 4.7 1.1 3.8 1.0 3.2 1.0 2.7 1.0 2.4 ing Widt 16 20.5	4.9 8 2.9 10.7 2.0 7.2 1.5 5.4 1.2 4.3 1.0 3.6 1.0 3.1 1.0 2.7 h (ft) 18 23.0	5.4 10 3.5 13.3 2.3 8.8 1.8 6.6 1.4 5.3 1.2 4.4 1.0 3.8 1.0 3.3 20 25.5
3500 4000 Pres (ps 1000 1500 2000 2500 3500 4000 Net Soi Pres (ps 1000 1500 2000 2500	marriage marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage isf) marriage	3.2 2.8 Grou 4 1.8 5.7 1.2 3.8 1.0 2.8 1.0 2.3 1.0 2.3 1.0 1.9 1.0 1.6 1.0 1.4 1.8 1.0 1.4 1.8 5.7	3.8 3.3 nd Snc Pi 5 2.1 6.9 1.4 4.6 1.1 3.5 1.0 2.8 1.0 2.8 1.0 2.3 1.0 2.0 1.0 1.7 Marriage W 12 15.6 10.4	4.4 3.8 <b>DW: 80</b> er Spacin, 6 2.4 8.2 1.6 5.5 1.2 4.1 1.0 3.3 1.0 2.7 1.0 2.3 1.0 2.3 1.0 2.0 //all Openi 14 18.1 12.0	5.0 4.4 <b>psf</b> g (ft) 7 2.7 9.5 1.8 6.3 1.3 4.7 1.1 3.8 1.0 3.2 1.0 2.7 1.0 2.4 ing Widt 16 20.5 13.7	4.9 8 2.9 10.7 2.0 7.2 1.5 5.4 1.2 4.3 1.0 3.6 1.0 3.6 1.0 3.1 1.0 2.7 h (ft) 18 23.0 15.4	5.4 10 3.5 13.3 2.3 8.8 1.8 6.6 1.4 5.3 1.2 4.4 1.0 3.8 1.0 3.3 20 25.5 17.0
3500 4000 Pres (ps 1000 1500 2000 2500 3000 3500 Net Soi Pres (ps 1000 1500 2200 2500 3000	marriage marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage f) marriage marriage	3.2 2.8 Grou 4 1.8 5.7 1.2 3.8 1.0 2.3 1.0 2.3 1.0 2.3 1.0 1.9 1.0 1.6 1.0 1.4 N 10 13.1 8.7 6.5 5.2 4.4	3.8 3.3 md Snc Pi 5 2.1 6.9 1.4 4.6 1.1 3.5 1.0 2.8 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.0 1.0 1.7 Marriage W 12 15.6 10.4 7.8 6.2 5.2	4.4 3.8 <b>DW: 80</b> er Spacin 6 2.4 8.2 1.6 5.5 1.2 4.1 1.0 3.3 1.0 2.7 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.0 2.0 (algorithdown of the second sec	5.0 4.4 <b>psf</b> g (ft) 7 2.7 9.5 1.8 6.3 1.3 4.7 1.1 3.8 1.0 3.2 1.0 2.7 1.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2	4.9 8 2.9 10.7 2.0 7.2 1.5 5.4 1.2 4.3 1.0 3.6 1.0 3.1 1.0 3.6 1.0 3.1 1.0 1.5 5.4 1.2 4.3 1.0 3.6 1.0 3.1 1.5 5.7 1.5 5.4 1.2 4.3 1.5 5.4 1.2 4.3 1.0 3.6 1.0 3.1 1.5 5.7 1.5 5.4 1.2 4.3 1.5 5.4 1.2 4.3 1.0 3.6 1.0 3.1 1.5 5.7 1.5 5.4 1.0 3.6 1.0 3.1 1.5 5.7 1.5 5.7 1.5 5.4 1.0 3.6 1.0 3.1 1.5 5.7 1.5 5.7 1.5 5.4 1.0 3.1 1.5 5.7 1.5 5.7 1.5 5.4 1.0 3.1 1.5 5.7 1.5 5.7 1.5 5.4 1.0 3.1 1.5 5.7 1.5 5.7 1.5 5.7 1.5 5.4 1.5 5.7 1.5 5.4 1.0 3.1 1.5 5.7 5.7 1.5 5.7 5.7 5.7 5.7 5.7 5.7 5.7 5	5.4 10 3.5 13.3 2.3 8.8 1.8 6.6 1.4 5.3 1.2 4.4 1.0 3.8 1.0 3.3 20 25.5 17.0 12.8
3500 4000 Pres (ps 1000 1500 2000 2500 3500 4000 Net Soi Pres (ps 1000 1500 2000 2500	marriage marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage if) marriage marriage	3.2 2.8 Grou 4 1.8 5.7 1.2 3.8 1.0 2.3 1.0 2.3 1.0 2.3 1.0 1.9 1.0 1.9 1.0 1.6 1.0 1.4 1.8 5.7 1.2 3.8 1.0 2.3 1.0 2.3 1.0 1.9 1.0 1.9 1.0 1.5 5.7 1.2 3.8 1.0 2.3 1.0 1.9 1.0 1.0 2.3 1.0 1.0 1.9 1.0 1.0 1.9 1.0 1.0 1.0 1.0 2.3 1.0 1.0 2.3 1.0 1.0 2.3 1.0 1.0 2.3 1.0 1.0 2.3 1.0 1.0 2.3 1.0 1.0 2.3 1.0 1.0 2.3 1.0 1.0 2.3 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 2.3 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	3.8 3.3 nd Snc Pi 5 2.1 6.9 1.4 4.6 1.1 3.5 1.0 2.8 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.5 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.0 1.7 Marriage With 5 5 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.0 1.7 5 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.0 1.7 5 1.0 2.3 1.0 2.0 1.0 2.3 1.0 2.0 1.0 2.0 1.0 2.0 1.0 2.0 1.0 2.0 2.0 1.0 2.0 1.0 2.0 1.0 2.0 1.0 2.0 1.0 2.0 1.0 2.0 2.0 1.0 2.5 1.0 2.0 1.0 2.5 1.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.5 1.0 2.5 1.0 2.5 1.0 2.5 1.0 2.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1	4.4 3.8 <b>DW: 80</b> er Spacin 6 2.4 8.2 1.6 5.5 1.2 4.1 1.0 3.3 1.0 2.7 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.3 1.0 2.0 /all Openin 14 18.1 12.0 9.0 7.2	5.0 4.4 <b>psf</b> g (ft) 7 2.7 9.5 1.8 6.3 1.3 4.7 1.1 3.8 1.0 3.2 1.0 2.7 1.0 2.4 ing Widt 16 20.5 13.7 10.3 8.2	4.9 8 2.9 10.7 2.0 7.2 1.5 5.4 1.2 4.3 1.0 3.6 1.0 3.1 1.0 2.7 h (ft) 18 23.0 15.4 11.5 9.2	5.4 10 3.5 13.3 2.3 8.8 1.8 6.6 1.4 5.3 1.2 4.4 1.0 3.8 1.0 3.3 20 25.5 17.0 12.8 10.2

\* Minimum interior pier area is 1.0 sqft Minimum exterior foundation wall footing width is 1'-0"; except for a 16' wide unit when the snow load is 100 psf and the allowable soil pressure is 1000 psf, use 1'-2".

Aftg	
<b>E, I</b>	<b>Multi-Section</b>
14'	Width

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Ground Snow: 90 psf Net Soil Pier Spacing (ft) Pres (psf) 4 5 6 7 8 10 1000 ext, int 1.8 2.1 2.4 2.7 2.9 3.5 marriage 6.0 7.4 8.8 11.5 10.1 14.2 1500 ext, int 1.2 1.4 1.6 1.8 2.0 2.3 marriage 4.0 4.9 5.8 6.8 7.7 9.5 2000 1.0 ext, int 1.1 1.2 1.3 1.5 1.8 marriage 3.0 3.7 4.4 5.1 5.7 7.1 2500 ext, int 1.0 1.0 1.0 1.1 1.2 1.4 2.4 3.0 3.5 marriage 41 4.6 5.7 3000 1.2 ext, int 1.0 1.0 1.0 1.0 1.0 2.0 2.5 marriage 2.9 3.4 3.8 4.7 3500 ext, int 1.0 1.0 1.0 1.0 1.0 1.0 1.7 marriage 2.1 2.5 2.9 3.3 4.1 4000 1.0 1.0 1.0 ext, int 1.0 1.0 1.0 marriage 1.5 1.9 2.2 2.5 2.9 3.6 Net Soil Marriage Wall Opening Width (ft) Pres (psf) 10 12 14 16 20 18 1000 marriage 14.0 16.7 19.4 22.1 24.8 27.4 1500 marriage 9.4 12.9 14.7 11.1 16.5 18.3 2000 marriage 7.0 8.4 9.7 11.0 12.4 13.7 5.6 2500 marriage 6.7 7.8 8.8 9.9 11.0 3000 4.7 marriage 5.6 6.5 7:4 8.3 9.1 3500 4.0 5.5 marriage 4.8 6.3 7.1 7.8 4000 marriage 3.5 4.2 4.8 5.5 6.2 6.9

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		Grou	nd Sno	<u>w: 10</u>	0 psf		. [
Net So	il		F	<sup>p</sup> ier Spaci	ng (ft)		
Pres (p	sf)	4	5	6	7	8	. 10
1000	ext, int	1.8	2.1	2.4	2.7	2.9	3.5
	marriage	6.4	7.9	9.3	10.8	12.3	15.2
1500	ext, int	1.2	1.4	1.6	1.8	2.0	2.3
	marriage	4.3	5.3	6.2	7.2	8.2	10.1
2000	ext, int	1.0	1.1	1.2	1.3	1.5	1.8
·	marriage	3.2	3.9	4.7	5.4	6.1	7.6
2500	ext, int	1.0	1.0	1.0	1.1	1.2	1.4
	marriage	2.6	3.2	3.7	4.3	4.9	6.1
3000	ext, int	1.0	1.0	1.0	1.0	1.0	1.2
	marriage	2.1	2.6	3.1	3.6	4.1	5.1
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.8	2.3	2.7	3.1	3.5	4.3
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	_ marriage	1.6	2.0	. 2.3	2.7	3.1	3.8
Net Soi	1	N	Aarriage V		ning Widt		
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	15.0	17.9	20.7	23.6	26.5	29.4
1500	marriage	10.0	11.9	13.8	15.7	17.7	19.6
2000	marriage	7.5	8.9	10.4	11.8	13.2	14.7
2500	marriage	6.0	7.1	8.3	9.4	10.6	11.7
3000	marriage	5.0	6.0	6.9	7.9	8.8	9.8
3500	marriage	4.3	5.1	5.9	6.7	7.6	8.4
4000	marriage	3.7	4.5	5.2	5.9	6.6	7.3

\* Minimum interior pier area is 1.0 sqft. Minimum exterior foundation wall footing width is 1'-0"; except for a 16' wide unit when the snow load is 100 psf and the allowable soil pressure is 1000 psf, use  $1^{\circ}-\overline{2}^{\circ}$ .

#### Required Effective Footing Area - Aftg (sqft) \*

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Required Effective Footing Area - Aftg (sqft) *	Required	Effective	Footing	Area -	Aftg	(sqft) *
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	Aftg
Multi-Section	E, I
Width	16'

	· · · ·	Mi	n. Roc	of: 15 p	osf		
Net Sc	oil 🗌			ier Spaci			
Pres (p	osf)	4	5.	6	7	8	10
1000	ext, int	2.0	2.3	2.6	2.9	3.3	3.9
	marriage	3.7	4.5	5.3	6.1	6.9	8.5
1500	ext, int	1.3	1.5	1.7	2.0	2.2	2.6
	marriage	2.5	3.0	3.6	4.1	4.6	5.7
2000	ext, int	1.0	1.1	1.3	1.5	1.6	1.9
	marriage	1.9	2.3	2.7	3.1	3.5	4.2
2500	ext, int	1.0	1.0	1.0	1.2	1.3	1.6
	marriage	1.5	1.8	2.1	2.4	2.8	3.4
3000	ext, int	1.0	1.0	1.0	1.0	1.1	1.3
	marriage	1.2	1.5	1.8		2.3	2.8
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.1
	marriage	1.1	1.3	1.5	1.7	2.0	2.4
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.0	1.1	1.3	1.5	1.0	2.1
Net So				Wall Oper			- 4-1
Pres (p		10	12	14	16	18	20
1000	marriage	8.3	9.8	11.4	12,9	14.4	16.0
500	marriage	5.5	6.6	7.6	8.6	9.6	10.6
2000	marriage	4.1	4.9	5.7	6.5	7.2	8.0
2500	marriage	3.3	3.9	4.5	5.2	5.8	6.4
					4.3		
3000		2.8	33	18	4 1		
3000 3500	marriage	2.8 2.4	3.3 2.8	3.8 3.2		4.8 4.1	5.3
500 000	marriage marriage marriage	2.4 2.1	2.8 2.5	3.2 2.8	3.7 3.2	4.1 3.6	4.6 4.0
3500 1000	marriage marriage marriage	2.4 2.1	2.8 2.5 30 psf	3.2 2.8 & Mir	3.7 3.2	4.1 3.6	4.6 4.0
500 1000 G	marriage marriage marriage round St	2.4 2.1	2.8 2.5 30 psf	3.2 2.8	3.7 3.2	4.1 3.6	4.6 4.0
3500 4000 G Vet Soi Pres (p	marriage marriage marriage round St	2.4 2.1 now: 3	2.8 2.5 30 psf	3.2 2.8 & Min	3.7 3.2 1. Root	4.1 3.6 f: 20 p	4.6 4.0 sf 10
3500 1000 G Vet Soi	marriage marriage round Sr il sf) ext, int	2.4 2.1 now: 3	2.8 2.5 30 psf 5	3.2 2.8 & Min ier Spacin 6 2.6	3.7 3.2 1. Root g (ft) 7 2.9	$\frac{4.1}{3.6}$ f: 20 p $\frac{8}{3.3}$	$ \begin{array}{r} 4.6 \\ 4.0 \\ \hline sf \\ \hline 10 \\ 3.9 \\ \end{array} $
3500 4000 G Vet Soi Pres (p	marriage marriage marriage round SI	2.4 2.1 now: 3 4 2.0	2.8 2.5 30 psf <u>P</u> 5 2.3	3.2 2.8 & Mir ier Spacin 6	3.7 3.2 1. Root	4.1 3.6 f: 20 p	$     \frac{4.6}{4.0}     sf     10                          $
500 000 G Vet So Pres (p 000	marriage marriage round Sr il sf) ext, int marriage ext, int	2.4 2.1 now: 2 4 2.0 4.1 1.3	2.8 2.5 30 psf P 5 2.3 5.0 1.5	3.2 2.8 & Mirr ier Spacin 6 2.6 5.9 1.7	3.7 3.2 a. Root g (ft) 7 2.9 6.8 2.0	4.1 3.6 f: 20 p 8 3.3 7.7 2.2	4.6 4.0 sf 10 3.9 9.4 2.6
500 000 G Vet So Pres (p 000	marriage marriage round SI sf) ext, int marriage ext, int marriage	2.4 2.1 now: 2 4 2.0 4.1	2.8 2.5 30 psf 9 5 2.3 5.0 1.5 3.3	3.2 2.8 & Min ier Spacin 6 2.6 5.9 1.7 3.9	3.7 3.2 a. Root g (ft) 7 2.9 6.8 2.0 4.5	4.1 3.6 f: 20 p 8 3.3 7.7 2.2 5.1	4.6 4.0 sf 10 3.9 9.4 2.6 6.3
3500 1000 G Vet Soi Pres (p 000 500	marriage marriage round Sr il sf) ext, int marriage ext, int	2.4 2.1 now: 2 4 2.0 4.1 1.3 2.7	2.8 2.5 30 psf P 5 2.3 5.0 1.5	3.2 2.8 & Mirr ier Spacin 6 2.6 5.9 1.7	3.7 3.2 a. Root g (ft) 7 2.9 6.8 2.0	4.1 3.6 f: 20 p 8 3.3 7.7 2.2 5.1 1.6	4.6 4.0 sf 10 3.9 9.4 2.6 6.3 1.9
3500 1000 G Vet Soi Pres (p 000 500	marriage marriage round SI sf) ext, int marriage ext, int marriage ext, int	2.4 2.1 NOW: 2 4 2.0 4.1 1.3 2.7 1.0	2.8 2.5 30 psf 90 psf 2.3 5.0 1.5 3.3 1.1 2.5	3.2 2.8 & Mirr ier Spacin 6 2.6 5.9 1.7 3.9 1.3	3.7 3.2 1. Root g (ft) 7 2.9 6.8 2.0 4.5 1.5 3.4	4.1 3.6 f: 20 p 8 3.3 7.7 2.2 5.1 1.6 3.8	4.6 4.0 sf 10 3.9 9.4 2.6 6.3 1.9 4.7
500 1000 G Vet So Pres (p 000 500 000	marriage marriage marriage round SI il sf) ext, int marriage ext, int marriage ext, int marriage ext, int	2.4 2.1 NOW: 2 4 2.0 4.1 1.3 2.7 1.0 2.1 1.0	2.8 2.5 30 psf 5 2.3 5.0 1.5 3.3 1.1	3.2 2.8 & Min ier Spacin 6 2.6 5.9 1.7 3.9 1.3 2.9 1.0.	3.7 3.2 1. Rool g (ft) 7 2.9 6.8 2.0 4.5 1.5 3.4 1.2	4.1 3.6 f: 20 p 8 3.3 7.7 2.2 5.1 1.6 3.8 1.3	4.6 4.0 sf 10 3.9 9.4 2.6 6.3 1.9 4.7 1.6
500 1000 G Vet So Pres (p 000 500 000	marriage marriage round SI sf) ext, int marriage ext, int marriage ext, int marriage	2.4 2.1 NOW: 2 4 2.0 4.1 1.3 2.7 1.0 2.1	2.8 2.5 30 psf P 5 2.3 5.0 1.5 3.3 1.1 2.5 1.0	3.2 2.8 & Min ier Spacin 6 2.6 5.9 1.7 3.9 1.3 2.9 1.0. 2.4	3.7 3.2 1. Rool g (ft) 7 2.9 6.8 2.0 4.5 1.5 3.4 1.2 2.7	4.1 3.6 f: 20 p 8 3.3 7.7 2.2 5.1 1.6 3.8 1.3 3.1	4.6 4.0 sf 10 3.9 9.4 2.6 6.3 1.9 4.7 1.6 3.8
500 000 G Vet Soi 2000 500 500 500	marriage marriage marriage round SI sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.4 2.1 NOW: 1 4 2.0 4.1 1.3 2.7 1.0 2.1 1.0 1.6	2.8 2.5 30 psf P 5 2.3 5.0 1.5 3.3 1.1 2.5 1.0 2.0	3.2 2.8 & Min ier Spacin 6 2.6 5.9 1.7 3.9 1.3 2.9 1.0 2.4 1.0	3.7 3.2 1. Rool g (ft) 7 2.9 6.8 2.0 4.5 1.5 3.4 1.2 2.7 1.0	4.1 3.6 <b>f: 20 p</b> 8 3.3 7.7 2.2 5.1 1.6 3.8 1.3 3.1 1.1	4.6 4.0 sf 10 9.4 2.6 6.3 1.9 4.7 1.6 3.8 1.3
500 000 G Vet Soi 2000 500 500 500	marriage marriage marriage round SI sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage	2.4 2.1 10W: 1 4 2.0 4.1 1.3 2.7 1.0 2.1 1.0 1.6 1.0 1.4	2.8 2.5 30 psf P 5 2.3 5.0 1.5 3.3 1.1 2.5 1.0 2.0 1.0 1.7	3.2 2.8 & Min ier Spacin 6 2.6 5.9 1.7 3.9 1.3 2.9 1.0 2.4 1.0 2.0	3.7 3.2 1. Rool g (ft) 7 2.9 6.8 2.0 4.5 1.5 3.4 1.2 2.7 1.0 2.3	4.1 3.6 <b>f: 20 p</b> 8 3.3 7.7 2.2 5.1 1.6 3.8 1.3 3.1 1.1 2.6	4.6 4.0 sf 10 3.9 9.4 2.6 6.3 1.9 4.7 1.6 3.8 1.3 3.1
500 000 G Net So Pres (p 000 500 500 000	marriage marriage marriage round SI il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	2.4 2.1 10W: 1 4 2.0 4.1 1.3 2.7 1.0 2.1 1.0 1.6 1.0 1.4 1.0	2.8 2.5 30 psf P 5 2.3 5.0 1.5 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0	3.2 2.8 & Min ier Spacin 6 2.6 5.9 1.7 3.9 1.3 2.9 1.0 2.4 1.0 2.0 1.0	3.7 3.2 1. Rool g (ft) 7 2.9 6.8 2.0 4.5 1.5 3.4 1.2 2.7 1.0 2.3 1.0	4.1 3.6 <b>f: 20 p</b> 8 3.3 7.7 2.2 5.1 1.6 3.8 1.3 3.1 1.1 2.6 1.0	4.6 4.0 sf 10 3.9 9.4 2.6 6.3 1.9 4.7 1.6 3.8 1.3 3.1 1.1
500 000 G Net So Pres (p 000 500 500 000	marriage marriage marriage round SI sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.4 2.1 10W: 1 4 2.0 4.1 1.3 2.7 1.0 2.1 1.0 1.6 1.0 1.4	2.8 2.5 30 psf P 5 2.3 5.0 1.5 3.3 1.1 2.5 1.0 2.0 1.0 1.7	3.2 2.8 & Min ier Spacin 6 2.6 5.9 1.7 3.9 1.3 2.9 1.0 2.4 1.0 2.0 1.0 1.0 1.7	3.7 3.2 9 9 9 9 6.8 2.0 4.5 1.5 3.4 1.2 2.7 1.0 2.3 1.0 1.9	4.1 3.6 <b>f: 20 p</b> 8 3.3 7.7 2.2 5.1 1.6 3.8 1.3 3.1 1.1 2.6 1.0 2.2	4.6 4.0 sf 10 3.9 9.4 2.6 6.3 1.9 4.7 1.6 3.8 1.3 3.1 1.1 2.7
3500 100 1000 1	marriage marriage marriage round SI sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.4 2.1 <b>NOW:</b> 2 4 2.0 4.1 1.3 2.7 1.0 2.1 1.0 1.6 1.0 1.4 1.0 1.2	2.8 2.5 30 psf P 5 2.3 5.0 1.5 3.3 1.1 2.5 1.0 2.0 1.0 1.0 1.0 1.4	3.2 2.8 & Mirr ier Spacin 6 2.6 5.9 1.7 3.9 1.3 2.9 1.0 2.4 1.0 2.0 1.0 1.7 1.0	3.7 3.2 <b>1.</b> Root g (ft) 7 2.9 6.8 2.0 4.5 1.5 3.4 1.2 2.7 1.0 2.3 1.0 1.9 1.0	4.1 3.6 <b>f: 20 p</b> 8 3.3 7.7 2.2 5.1 1.6 3.8 1.3 3.1 1.1 2.6 1.0 2.2 1.0	4.6 4.0 sf <u>10</u> 3.9 9.4 2.6 6.3 1.9 4.7 1.6 3.8 1.3 1.3 1.1 2.7 1.0
3500 1000 G Net Soi 27res (p) 27res (p)	marriage marriage marriage round Sr il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.4 2.1 NOW: 2 4 2.0 4.1 1.3 2.7 1.0 2.1 1.0 1.6 1.0 1.4 1.0 1.2 1.0 1.0 1.2	2.8 2.5 30 psf 5 2.3 5.0 1.5 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.4 1.0 1.3	3.2 2.8 & Min ier Spacin 6 2.6 5.9 1.7 3.9 1.3 2.9 1.0 2.4 1.0 2.0 1.0 1.7 1.0 1.5	3.7 3.2 3. Rool g (ft) 7 2.9 6.8 2.0 4.5 1.5 3.4 1.2 2.7 1.0 2.3 1.0 1.9 1.0 1.7	4.1 3.6 f: 20 p 8 3.3 7.7 2.2 5.1 1.6 3.8 1.3 3.1 1.1 2.6 1.0 2.2 1.0 1.9	4.6 4.0 sf 10 3.9 9.4 2.6 6.3 1.9 4.7 1.6 3.8 1.3 3.1 1.1 2.7
3500 1000 G Vet Soi 2000 500 500 500 500 1000 500 1000 500 100 1000 1	marriage marriage marriage round Sr il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	2.4 2.1 NOW: 2 4 2.0 4.1 1.3 2.7 1.0 2.1 1.0 1.6 1.0 1.4 1.0 1.2 1.0 1.0 1.0 M	2.8 2.5 30 psf 5 2.3 5.0 1.5 3.3 1.1 2.5 1.0 2.0 1.0 1.0 1.7 1.0 1.4 1.0 1.3 Iarriage V	3.2 2.8 & Mirr ier Spacin 6 2.6 5.9 1.7 3.9 1.3 2.9 1.0 2.4 1.0 2.0 1.0 1.7 1.0 1.5 Vall Open	3.7 3.2 1. Root g (ft) 7 2.9 6.8 2.0 4.5 1.5 3.4 1.2 2.7 1.0 2.3 1.0 1.9 1.0 1.7 ing Widt	4.1 3.6 f: 20 p 8 3.3 7.7 2.2 5.1 1.6 3.8 1.3 3.1 1.1 2.6 1.0 2.2 1.0 1.9 h (ft)	4.6 4.0 5f 9.4 2.6 6.3 1.9 4.7 1.6 3.8 1.3 3.1 1.1 2.7 1.0 2.4
3500 1000 G Net Soi 27res (p) 27res (p) 27res (p) 3500 350	marriage marriage marriage round Sr il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage int marriage ext, int	2.4 2.1 NOW: 2 4 2.0 4.1 1.3 2.7 1.0 2.1 1.0 1.0 1.4 1.0 1.2 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	2.8 2.5 30 psf P 5 2.3 5.0 1.5 3.3 1.1 2.5 1.0 2.0 1.0 1.0 1.0 1.7 1.0 1.4 1.0 1.3 Marriage V 12	3.2 2.8 & Min ier Spacin 6 2.6 5.9 1.7 3.9 1.3 2.9 1.0 2.4 1.0 2.0 1.0 1.7 1.0 1.7 1.0 1.5 Vall Open 14	3.7 3.2 1. Rool g (ft) 7 2.9 6.8 2.0 4.5 1.5 3.4 1.2 2.7 1.0 2.3 1.0 1.9 1.0 1.7 ing Widtl 16	4.1 3.6 f: 20 p 8 3.3 7.7 2.2 5.1 1.6 3.8 1.3 3.1 1.1 2.6 1.0 2.2 1.0 1.9 h (ft) 18	4.6 4.0 5f 10 3.9 9.4 2.6 6.3 1.9 4.7 1.6 3.8 1.3 3.1 1.7 7.0 2.4 20
3500 1000 G Net Soi 7res (p 7res (p 7res (p 7res (p 7res (p 7000 500 500 000 500 000 10	marriage marriage marriage round Sr il sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage it, int marriage ext, int marriage ext, int marriage it sf) marriage	2.4 2.1 10W: 2 4 2.0 4.1 1.3 2.7 1.0 2.1 1.0 1.6 1.0 1.4 1.0 1.2 1.0 1.0 1.0 M 0 9.2	2.8 2.5 30 psf P 5 2.3 5.0 1.5 3.3 1.1 2.5 1.0 2.0 1.0 2.0 1.0 1.7 1.0 1.4 1.0 1.3 Marriage V 12 10.9	3.2 2.8 & Min ier Spacin 6 2.6 5.9 1.7 3.9 1.3 2.9 1.0 2.4 1.0 2.0 1.0 1.7 1.0 1.5 Vall Open 14 12.7	3.7 3.2 1. Rool g (ft) 7 2.9 6.8 2.0 4.5 1.5 3.4 1.2 2.7 1.0 2.3 1.0 1.9 1.0 1.7 ing Widtl 16 14.4	4.1 3.6 f: 20 p 8 3.3 7.7 2.2 5.1 1.6 3.8 1.3 3.1 1.1 2.6 1.0 2.2 1.0 1.9 h (ft) 18 16.1	4.6 4.0 5f 10 3.9 9.4 2.6 6.3 1.9 4.7 1.6 3.8 1.3 3.1 1.1 1.1 2.7 1.0 2.4 20 17.8
3500 1000 G Net Soi 7res (p 7res (p) 7res (	marriage marriage marriage round SI sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage st, int marriage st, int marriage st, int marriage st, int marriage	2.4 2.1 10W: 2 4 2.0 4.1 1.3 2.7 1.0 2.1 1.0 1.6 1.0 1.4 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 2.1 1.0 2.1 1.0 2.1 1.0 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	2.8 2.5 30 psf P 5 2.3 5.0 1.5 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.7 1.0 1.4 1.0 1.3 Iarriage V 12 10.9 7.3	3.2 2.8 & Min ier Spacin 6 2.6 5.9 1.7 3.9 1.3 2.9 1.0 2.4 1.0 2.0 1.0 1.0 1.7 1.0 1.7 1.0 1.5 Vall Open 14 12.7 8.4	3.7 3.2 1. Rool g (ft) 7 2.9 6.8 2.0 4.5 1.5 3.4 1.2 2.7 1.0 2.3 1.0 1.9 1.0 1.7 ing Widt 16 14.4 9.6	4.1 3.6 f: 20 p 8 3.3 7.7 2.2 5.1 1.6 3.8 1.3 3.1 1.1 2.6 1.0 2.2 1.0 1.9 h (ft)) 18 16.1 10.7	4.6 4.0 5f 10 3.9 9.4 2.6 6.3 1.9 4.7 1.6 3.8 1.3 3.1 1.1 1.1 2.7 1.0 2.4 20 17.8 11.9
3500 1000 G Net Soi 27res (p) 27res (p) 27res (p) 3500 350	marriage marriage marriage round SI ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage f) marriage marriage	2.4 2.1 10W: 2 4 2.0 4.1 1.3 2.7 1.0 2.1 1.0 1.6 1.0 1.4 1.0 1.2 1.0 1.0 1.0 1.0 1.0 1.0 4.1 1.2 1.0 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.2 1.0 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.0 1.0 1.2 1.0 1.0 1.0 1.0 1.0 1.2 1.0 1.0 1.0 1.0 1.2 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	2.8 2.5 30 psf P 5 2.3 5.0 1.5 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.7 1.0 1.4 1.0 1.3 Iarriage V 12 10.9 7.3 5.5	3.2 2.8 & Min ier Spacin 6 2.6 5.9 1.7 3.9 1.3 2.9 1.0 2.4 1.0 2.0 1.0 1.7 1.0 1.7 1.0 1.5 Vall Open 14 12.7 8.4 6.3	3.7 3.2 1. Rool g (ft) 7 2.9 6.8 2.0 4.5 1.5 3.4 1.2 2.7 1.0 2.3 1.0 1.9 1.0 1.7 ing Widtl 16 14.4 9.6 7.2	4.1 3.6 f: 20 p 8 3.3 7.7 2.2 5.1 1.6 3.8 1.3 3.1 1.1 2.6 1.0 2.2 1.0 1.9 h (ft) 18 16.1 10.7 8.1	4.6 4.0 5f 10 3.9 9.4 2.6 6.3 1.9 4.7 1.6 3.8 1.3 3.1 1.1 2.7 1.0 2.4 20 17.8 11.9 8.9
3500 1000 G Net Soi 17res (p 17res (p 17res (p 1000 500 500 500 500 500 500 50	marriage marriage marriage round SI sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage I sf) marriage marriage marriage	2.4 2.1 10W: 2 4 2.0 4.1 1.3 2.7 1.0 2.1 1.0 1.6 1.0 1.2 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	2.8 2.5 30 psf P 5 2.3 5.0 1.5 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.4 1.0 1.3 Iarriage V 12 10.9 7.3 5.5 4.4	3.2 2.8 & Min ier Spacin 6 2.6 5.9 1.7 3.9 1.3 2.9 1.0 2.4 1.0 2.0 1.0 1.7 1.0 2.4 1.0 2.0 1.0 1.5 Vall Open 14 12.7 8.4 6.3 5.1	3.7 3.2 9 (ft) 7 2.9 6.8 2.0 4.5 1.5 3.4 1.2 2.7 1.0 2.3 1.0 1.9 1.0 1.7 ing Widtl 16 14.4 9.6 7.2 5.8	4.1 3.6 f: 20 p 8 3.3 7.7 2.2 5.1 1.6 3.8 1.3 3.1 1.1 2.6 1.0 2.2 1.0 1.9 h (ft) 18 16.1 10.7 8.1 6.4	4.6 4.0 5f 10 3.9 9.4 2.6 6.3 1.9 4.7 1.6 3.8 1.3 3.1 1.1 2.7 1.0 2.4 20 17.8 11.9 8.9 7.1
3500 1000 G Net Soi 2500 500 500 500 500 500 500 000 500	marriage marriage marriage round SI sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage st, int marriage st, int marriage sf) marriage	2.4 2.1 10W: 2 4 2.0 4.1 1.3 2.7 1.0 2.1 1.0 1.6 1.0 1.4 1.0 1.2 1.0 1.0 1.0 1.0 1.0 1.0 4.1 1.2 1.0 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.2 1.0 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.2 1.0 1.0 1.0 1.0 1.2 1.0 1.0 1.0 1.0 1.0 1.2 1.0 1.0 1.0 1.0 1.2 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	2.8 2.5 30 psf P 5 2.3 5.0 1.5 3.3 1.1 2.5 1.0 2.0 1.0 1.7 1.0 1.7 1.0 1.4 1.0 1.3 Iarriage V 12 10.9 7.3 5.5	3.2 2.8 & Min ier Spacin 6 2.6 5.9 1.7 3.9 1.3 2.9 1.0 2.4 1.0 2.0 1.0 1.7 1.0 1.7 1.0 1.5 Vall Open 14 12.7 8.4 6.3	3.7 3.2 1. Rool g (ft) 7 2.9 6.8 2.0 4.5 1.5 3.4 1.2 2.7 1.0 2.3 1.0 1.9 1.0 1.7 ing Widtl 16 14.4 9.6 7.2	4.1 3.6 f: 20 p 8 3.3 7.7 2.2 5.1 1.6 3.8 1.3 3.1 1.1 2.6 1.0 2.2 1.0 1.9 h (ft) 18 16.1 10.7 8.1	4.6 4.0 5f 10 3.9 9.4 2.6 6.3 1.9 4.7 1.6 3.8 1.3 3.1 1.1 2.7 1.0 2.4 20 17.8 11.9 8.9

	<u> </u>	Gro	und Sr	low: 2	5 nof	<u> </u>	
Net So	~1	010					
Pres (	-	4	5	Pier Spac 6		<u>.</u>	10
1000	ext, int	2.0	2.3	2.6	2.9	8	<u>10</u> 3.9
	marriage	3.9	4.7	5.6	6.4	7.2	8.9
1500	ext, int	1.3	1.5	1.7	2.0	2.2	2.6
	marriage	2.6	3.2	3.7	4.3	4.8	5.9
2000	ext, int	1.0	1.1	1.3	1.5	1.6	1.9
	marriage	2.0	2.4	2.8	3.2	3.6	4.4
2500	ext, int	1.0	1.0	1.0	1.2	1.3	1.6
	marriage	1.6	1.9	2.2	2.6	2.9	3.6
3000	ext, int	1.0	1.0	1.0	1.0	1.1	1.3
	marriage	1.3	1.6	1.9	2.1	2.4	3.0
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.1
	marriage	1.1	1.4	1.6	1.8	2.1	2.5
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.0	1.2	1.4	1.6	1.8	2.2
Net So	il		Marriage '	Wall Ope	ning Wid	th (ft)	
Pres (p		10	12	14	16	18	20
1000	marriage	8.7	10.3	11.9	13.5	15.1	16.7
1500	marriage	5.8	6.9	7.9	. 9 <b>.</b> 0	10.1	11.2
2000	marriage	4.3	5.1	6.0	6.8	7.6	8.4
2500	marriage	3:5	4.1	4.8	5.4	6.1	6.7
3000	marriage	2.9	3.4	4.0	4.5	5.0	5.6
3500 . 4000	marriage	2.5	2.9	3.4	3.9	4.3	4.8
1000	marriage	2.2	2.6	3.0	3.4	3.8	4.2
	· · · · · ·	Grou	nd Sn	ow: 40	nef		<u> </u>
Net So	;1	0100		ier Spacin			
Pres (p		4	5	6 6	19 (11) 7	8.	10
1000	ext, int	2.0	2.3	2.6	2.9	3.3	3.9
	marriage	4.6	5.5	6.5	7.5	8.5	10.5
1500	ext, int	1.3	1.5	1.7	2.0	2.2	2.6
	marriage	3.0	3.7	4.4	5.0	5.7	7.0
2000	ext, int	1.0	1.1	1.3	1.5	1.6	1.9
	marriage	2.3	2.8	3.3	3.8	4.3	. 5.3
2500 -	ext, int	1.0	1.0	1.0	1.2	1.3	1.6
	marriage	1.8	2.2	2.6	3.0	3.4	4.2
3000	ext, int	1.0	1.0	1.0	1.0	1.1	1.3
	marriage	1.5	1.8	2.2	2.5	2.8	3.5
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.1
	marriage	1.3	1.6	1,9	2:2	2.4	3.0
1000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.1	1.4	1.6	1.9	2.1	2.6
Net Soi		N			uing Widt	h (ft)	•
res (ps		10	12	14	16	18	20
000	marriage	10.3	12.2	14.2	16.1	18.1	20.0
500	marriage	6.9	8.2	9.5	10.7	12.0	13.3
2000	marriage	5.2	6.1	7.1	8.1	9.0	10.0
2500	marriage	4.1	4.9	5.7	6.4	7.2	8.0
3000 3500	marriage	3.4	4.1	4.7	5.4	6.0	6.7
1000 1000	marriage marriage	2.9 2.6	3.5	4.1	4.6	5.2	5.7
000	mainage	2.0	3.1	3.5	4.0	4.5	5.0

\* Minimum interior pier area is 1.0 sqft. Minimum exterior foundation wall footing width is 1'-0"; except for a 16' wide unit when the snow load is 100 psf and the allowable soil pressure is 1000 psf, use 1'-2".

Aftg E, I	Multi-Section
16'	Width

		Grou	ind Sn	ow: 50	) psf			
Net So	il		Pier Spacing (ft)					
Pres (p	sf)	4	5	6	7	8	10	
1000	ext, int	2.0	2.3	2.6	2.9	, 3.3	3.9	
	marriage	. 5.0	6.1	7.2	8.3	9.4	11.6	
1500	ext, int	1.3	1.5	1.7	2.0	2.2	2.6	
	marriage	3.3	4.1	4.8	5.5	6.3	7.7	
2000	ext, int	1.0	1.1	1.3	1.5	1.6	1.9	
	marriage	2.5	3.0	3.6	4.1	4.7	5.8	
2500	ext, int	1.0	1.0	1.0	1.2	1.3	1.6	
	marriage	2.0	2.4	2.9	3.3	3:8	4.6	
3000	ext, int	1.0	1.0	1.0	1.0	1.1	1.3	
-	marriage	1.7	2.0	2.4	2.8	3.1	3.9	
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.1	
	marriage	1.4	1.7	2.1	2.4	2.7	3.3	
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0	
	marriage	1.2	1.5	1.8	2.1	2.3	2.9	
Net Soi		N	Aarriage V	Wall Oper	ning Widt	h (ft)		
Pres (p.	sf)	10	12	14	16	18	20	
1000	marriage	11.4	13.6	15.7	17.9	20.0	22.2	
1500	marriage	7.6	9.0	10.5	11.9	. 13.3	14.8	
2000	marriage	5.7	6.8	7.9	8.9	10.0	11.1	
2500	marriage	4.6	5.4	6.3	7.1	. 8.0	. 8.9	
3000	marriage	3.8	4.5	5.2	6.0	6.7	7.4	
3500	marriage	3.3	3.9	4.5	5.1	5.7	6.3	
4000	marriage	2.8	3.4	3.9	4.5	5.0	5.5	

		Grou	nd Sn	ow: 70	) psf		
Net Soi	1	· .	P	ier Spaci	ng (ft)	·	
Pres (ps	sf)	4	5	6	7	8	. 10
1000	ext, int	2.0	2.3	2.6	2.9	3.3	3.9
	marriage	.5.9	7.2	8.5	9.8	11.1	13.8
1500	ext, int	1.3	1.5	1.7	2.0	2:2	2.6
	marriage	3.9	4.8	5.7	6.5	7.4	9.2
2000	ext, int	1.0	1.1	1.3	1.5	1.6	1.9
	marriage	2.9	3.6	4.2	4.9	5.6	6.9
2500	ext, int	1.0	1.0	1.0	1.2	1.3	1.6
	marriage	2.3	2.9	3.4	3.9	4.5	5.5
3000	ext, int	1.0	1.0	1.0	1.0	1.1	1.3
	marriage	2.0	2.4	2.8	3.3	3.7	4.6
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.1
	marriage	1.7	2.0	2.4	2.8	3.2	. 3.9
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.5	1.8	2.1	2.5	2.8	3.4
Net Soi	1	N	/larriage \	Wall Oper	ning Widt	h (ft)	
Pres (ps	:f)	10	12	14	. 16	- 18	20
1000	marriage	13.6	16.2	18.7	21.3	23.9	26.5
1500	marriage	9.0	10.8	12.5	14.2	15.9	17.7
2000	marriage	6.8	8.1	9.4	10.7	12.0	13.3
2500	marriage	5.4	6.5	7.5	8.5	9.6	10.6
3000	marriage	4.5	5.4	6.2	7.1	8.0	8.8
3500	marriage	3.9	4.6	54	6.1	6.8	7.6
4000	marriage	3.4	4.0	4.7	5.3	6.0	6.6

#### Required Effective Footing Area - Aftg (sqft) \*

· · · · ·		Gree	und C-	0111 61			
Nu C	-1	GIO	und Sn			. <u>.</u>	
Net Sc				Pier Spaci		2.4	
Pres (r		4	5	6	7	8 -	10
1000	ext, int	2.0	2.3	2.6	2.9	3.3	3.9
	marriage	5.4	6.6	7.8	9.0	10.3	12.7
1500	ext, int	1.3	1.5	1.7	2.0	2.2	2.6
	marriage	3.6	4.4	5.2	6.0	6.8	8.5
2000	ext, int	1.0	1.1	1.3	1,5	1.6	İ.9
0500	marriage	2.7	3.3	3.9	4.5	5.1	6.3
2500	ext, int	1.0	1.0	1.0	1.2	1.3	1.6
2000	marriage	2.2	2.7	3.1	3.6	4.1	5.1
3000	ext, int	1.0	1.0	1.0	1.0	1.1	1.3
0.000	marriage	1.8	2.2	2.6	3.0	3.4	4.2
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.1
	marriage	1.5	1.9	2.2	2.6	2.9	3.6
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.4		2.0	2.3	2.6	3.2
Net So			Marriage '				
Pres (p		10	12	14	16	18	20
1000	marriage	12.5	14.9	17.2	19.6	22.0	24.3
1500	marriage	8.3	9.9	11.5	13.1	14.6	16.2
2000	marriage	6.2	7.4	8.6	9.8	11.0	12.2
2500	marriage	5.0	5.9	6.9	7.8	8.8	9.7
3000	marriage	4.2	5.0	5.7	6.5	7.3	8.1
3500	marriage	3.6	4.2	4.9	5.6	6.3	7.0
4000	marriage	3.1	3.7	4.3	4.9	5.5	6.1
	<u> </u>	· · ·				<u> </u>	i
		Grou	ind Sn				
Net Soi			P	ier Spacir	ng (ft)		
Pres (p	sf)	4	P 5	ier Spacir 6	ng (ft) 7	8	10
	sf) ext, int	4	P 5 2.3	ier Spacir 6 2.6	ng (ft) 7 2.9	3.3	3.9
Pres (p. 1000	sf) ext, int marriage	4 2.0 6.3	P 5 2.3 7.7	ier Spacir 6 2.6 9.1	ng (ft) 7 2.9 10.6	3.3 12.0	3.9 14.8
Pres (p	ext, int marriage ext, int	4 2.0 6.3 1.3	P 5 2.3 7.7 1.5	ier Spacir 6 2.6 9.1 1.7	ng (ft) 7 2.9 10.6 2.0	3.3 12.0 2.2	3.9 14.8 2.6
Pres (p. 1000 1500	sf) ext, int marriage ext, int marriage	4 2.0 6.3 1.3 4.2	P 5 2.3 7.7 1.5 5.1	ier Spacir 6 2.6 9.1 1.7 6.1	ng (ft) 7 2.9 10.6 2.0 7.0	3.3 12.0 2.2 8.0	3.9 14.8 2.6 9.9
Pres (p. 1000	sf) ext, int marriage ext, int marriage ext, int	4 2.0 6.3 1.3 4.2 1.0	P 5 2.3 7.7 1.5 5.1 1.1	ier Spacir 6 2.6 9.1 1.7 6.1 1.3	ng (ft) 7 2.9 10.6 2.0 7.0 1.5	3.3 12.0 2.2 8.0 1.6	3.9 14.8 2.6 9.9 1.9
Pres (p. 1000 1500 2000	sf) ext, int marriage ext, int marriage ext, int marriage	4 2.0 6.3 1.3 4.2 1.0 3.1	P 5 2.3 7.7 1.5 5.1 1.1 3.9	ier Spacir 6 2.6 9.1 1.7 6.1 1.3 4.6	ng (ft) 7 2.9 10.6 2.0 7.0 1.5 5.3	3.3 12.0 2.2 8.0 1.6 6.0	3.9 14.8 2.6 9.9 1.9 7.4
Pres (p. 1000 1500	sf) ext, int marriage ext, int marriage ext, int marriage ext, int	4 2.0 6.3 1.3 4.2 1.0 3.1 1.0	P 5 2.3 7.7 1.5 5.1 1.1 3.9 1.0	ier Spacir 6 2.6 9.1 1.7 6.1 1.3 4.6 1.0	ng (ft) 7 2.9 10.6 2.0 7.0 1.5 5.3 1.2	3.3 12.0 2.2 8.0 1.6 6.0 1.3	3.9 14.8 2.6 9.9 1.9 7.4 1.6
Pres (pr 1000 1500 2000 2500	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage	4 2.0 6.3 1.3 4.2 1.0 3.1 1.0 2.5	P 5 2.3 7.7 1.5 5.1 1.1 3.9 1.0 3.1	ier Spacir 6 2.6 9.1 1.7 6.1 1.3 4.6 1.0 3.7	ng (ft) 7 2.9 10.6 2.0 7.0 1.5 5.3 1.2 4.2	3.3 12.0 2.2 8.0 1.6 6.0 1.3 4.8	3.9 14.8 2.6 9.9 1.9 7.4 1.6 5.9
Pres (p. 1000 1500 2000	ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	4 2.0 6.3 1.3 4.2 1.0 3.1 1.0 2.5 1.0	P 5 2.3 7.7 1.5 5.1 1.1 3.9 1.0 3.1 1.0	ier Spacir 6 2.6 9.1 1.7 6.1 1.3 4.6 1.0 3.7 1.0	$\begin{array}{r} & \text{ng (ft)} \\ & 7 \\ & 2.9 \\ & 10.6 \\ & 2.0 \\ & 7.0 \\ & 1.5 \\ & 5.3 \\ & 1.2 \\ & 4.2 \\ & 1.0 \end{array}$	3.3 12.0 2.2 8.0 1.6 6.0 1.3 4.8 1.1	3.9 14.8 2.6 9.9 1.9 7.4 1.6 5.9 1.3
Pres (p) 1000 1500 2000 2500 3000	ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	4 2.0 6.3 1.3 4.2 1.0 3.1 1.0 2.5 1.0 2.1	P 5 2.3 7.7 1.5 5.1 1.1 3.9 1.0 3.1 1.0 2.6	ier Spacir 6 2.6 9.1 1.7 6.1 1.3 4.6 1.0 3.7 1.0 3.0	ng (ft) 7 2.9 10.6 2.0 7.0 1.5 5.3 1.2 4.2 1.0 3.5	3.3 12.0 2.2 8.0 1.6 6.0 1.3 4.8 1.1 4.0	3.9 14.8 2.6 9.9 1.9 7.4 1.6 5.9 1.3 4.9
Pres (pr 1000 1500 2000 2500	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	4 2.0 6.3 1.3 4.2 1.0 3.1 1.0 2.5 1.0 2.1 1.0	P 5 2.3 7.7 1.5 5.1 1.1 3.9 1.0 3.1 1.0 2.6 1.0	ier Spacir 6 2.6 9.1 1.7 6.1 1.3 4.6 1.0 3.7 1.0 3.0 1.0	g (ft) 7 2.9 10.6 2.0 7.0 1.5 5.3 1.2 4.2 1.0 3.5 1.0	3.3 12.0 2.2 8.0 1.6 6.0 1.3 4.8 1.1 4.0 1.0	3.9 14.8 2.6 9.9 1.9 7.4 1.6 5.9 1.3 4.9 1.1
Pres (p) 1000 1500 2000 2500 3000 3500	ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	4 2.0 6.3 1.3 4.2 1.0 3.1 1.0 2.5 1.0 2.1 1.0 1.8	P 5 2.3 7.7 1.5 5.1 1.1 3.9 1.0 3.1 1.0 2.6 1.0 2.2	ier Spacir 6 2.6 9.1 1.7 6.1 1.3 4.6 1.0 3.7 1.0 3.0 1.0 2.6	g (ft) 7 2.9 10.6 2.0 7.0 1.5 5.3 1.2 4.2 1.0 3.5 1.0 3.0	3.3 12.0 2.2 8.0 1.6 6.0 1.3 4.8 1.1 4.0 1.0 3.4	3.9 14.8 2.6 9.9 7.4 1.6 5.9 1.3 4.9 1.1 4.2
Pres (p) 1000 1500 2000 2500 3000	ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	4 2.0 6.3 1.3 4.2 1.0 3.1 1.0 2.5 1.0 2.1 1.0 1.8 1.0	P 5 2.3 7.7 1.5 5.1 1.1 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0	ier Spacir 6 2.6 9.1 1.7 6.1 1.3 4.6 1.0 3.7 1.0 3.0 1.0 2.6 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	g (ft) 7 2.9 10.6 2.0 7.0 1.5 5.3 1.2 4.2 1.0 3.5 1.0 3.0 1.0	3.3 12.0 2.2 8.0 1.6 6.0 1.3 4.8 1.1 4.0 1.0 3.4 1.0	3.9 14.8 2.6 9.9 1.9 7.4 1.6 5.9 1.3 4.9 1.1 4.2 1.0
Pres (p)           1000           1500           2000           2500           3000           3500           4000	ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage	4 2.0 6.3 1.3 4.2 1.0 3.1 1.0 2.5 1.0 2.1 1.0 1.8 1.0 1.6	P 5 2.3 7.7 1.5 5.1 1.1 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0 1.9	ier Spacir 6 2.6 9.1 1.7 6.1 1.3 4.6 1.0 3.7 1.0 3.0 1.0 2.6 1.0 2.3	g (ft) 7 2.9 10.6 2.0 7.0 1.5 5.3 1.2 4.2 1.0 3.5 1.0 3.0 1.0 2.6	3.3 12.0 2.2 8.0 1.6 6.0 1.3 4.8 1.1 4.0 1.0 3.4 1.0 3.0	3.9 14.8 2.6 9.9 7.4 1.6 5.9 1.3 4.9 1.1 4.2
Pres (p.           1000           1500           2000           2500           3000           3500           4000           Net Soi	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int	4 2.0 6.3 1.3 4.2 1.0 3.1 1.0 2.5 1.0 2.1 1.0 2.1 1.0 1.8 1.0 1.6	P 5 2.3 7.7 1.5 5.1 1.1 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0 1.9 Marriage V	ier Spacir 6 2.6 9.1 1.7 6.1 1.3 4.6 1.0 3.7 1.0 3.0 1.0 2.6 1.0 2.3 Vall Oper	g (ft) 7 2.9 10.6 2.0 7.0 1.5 5.3 1.2 4.2 1.0 3.5 1.0 3.5 1.0 3.0 1.0 2.6 widt	3.3 12.0 2.2 8.0 1.6 6.0 1.3 4.8 1.1 4.0 1.0 3.4 1.0 3.0 h (ft)	3.9 14.8 2.6 9.9 1.9 7.4 1.6 5.9 1.3 4.9 1.1 4.2 1.0 3.7
Pres (p.           1000           1500           2000           2500           3000           3500           4000           Net Soi           Pres (ps)	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage st, int marriage 1 sf)	4 2.0 6.3 1.3 4.2 1.0 3.1 1.0 2.5 1.0 2.1 1.0 2.1 1.0 1.8 1.0 1.6	P 5 2.3 7.7 1.5 5.1 1.1 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0 1.9 Marriage V 12	ier Spacir 6 2.6 9.1 1.7 6.1 1.3 4.6 1.0 3.7 1.0 3.0 1.0 2.6 1.0 2.3 Vall Oper 14	g (ft) 7 2.9 10.6 2.0 7.0 1.5 5.3 1.2 4.2 1.0 3.5 1.0 3.5 1.0 3.0 1.0 2.6 widt 16	3.3 12.0 2.2 8.0 1.6 6.0 1.3 4.8 1.1 1.0 3.4 1.0 3.4 1.0 3.0 h (ft) 1.8	3.9 14.8 2.6 9.9 1.9 7.4 1.6 5.9 1.3 4.9 1.1 4.2 1.0 3.7 20
Pres (p.           1000           1500           2000           2500           3000           3500           4000           Net Soi           Pres (ps           1000	st) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage st, int marriage l sf) marriage	4 2.0 6.3 1.3 4.2 1.0 3.1 1.0 2.5 1.0 2.1 1.0 2.1 1.0 1.8 1.0 1.6 N 10 14.7	P 5 2.3 7.7 1.5 5.1 1.1 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0 1.9 Marriage V 12 17.5	ier Spacir 6 2.6 9.1 1.7 6.1 1.3 4.6 1.0 3.7 1.0 3.0 1.0 2.6 1.0 2.3 Vall Oper 14 20.3	g (ft) 7 2.9 10.6 2.0 7.0 1.5 5.3 1.2 4.2 1.0 3.5 1.0 3.5 1.0 3.0 1.0 2.6 ing Widd 16 23.1	3.3 12.0 2.2 8.0 1.6 6.0 1.3 4.8 1.1 4.0 1.0 3.4 1.0 3.4 1.0 3.0 h (ft) 18 25.9	3.9 14.8 2.6 9.9 1.9 7.4 1.6 5.9 1.3 1.3 4.9 1.1 4.2 1.0 3.7 20 28.7
Pres (p.           1000           1500           2000           2500           3000           3500           4000           Net Soi           Pres (p.           1000           1500	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage st, int marriage sf) marriage	4 2.0 6.3 1.3 4.2 1.0 3.1 1.0 2.5 1.0 2.1 1.0 1.8 1.0 1.6 N 10 14.7 9.8	P 5 2.3 7.7 1.5 5.1 1.1 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0 1.9 Marriage V 12 17.5 11.6	ier Spacir 6 2.6 9.1 1.7 6.1 1.3 4.6 1.0 3.7 1.0 3.0 1.0 2.6 1.0 2.3 Vall Oper 14 20.3 13.5	g (ft) 7 2.9 10.6 2.0 7.0 1.5 5.3 1.2 4.2 1.0 3.5 1.0 3.0 1.0 2.6 1.0 2.6 1.0 1.0 3.0 1.0 3.5 1.2 4.2 1.0 3.5 1.2 4.2 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 1.0 1.0 3.5 1.0 1.0 3.5 1.0 1.0 3.5 1.0 1.0 3.5 1.0 1.0 3.5 1.0 1.0 3.5 1.0 1.0 3.5 1.0 1.0 3.5 1.0 1.0 3.5 1.0 1.0 3.5 1.0 1.5 3.5 1.0 1.0 1.5 3.5 1.0 1.0 1.5 3.5 1.0 1.0 1.5 3.5 1.0 1.0 1.0 1.5 3.5 1.0 1.0 1.5 3.5 1.0 1.0 1.0 1.5 3.1 1.5 1.0 1.0 1.5 3.1 1.5 1.0 1.5 3.1 1.5 1.0 1.5 1.0 1.5 1.0 1.5 1.0 1.0 1.5 1.0 1.5 1.0 1.0 1.5 1.0 1.0 1.5 1.0 1.0 1.0 1.0 1.0 1.0 1.5 1.5 1.0 1.0 1.0 1.0 1.0 1.5 1.5 1.0 1.0 1.0 1.5 1.5 1.5 1.0 1.0 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	3.3 12.0 2.2 8.0 1.6 6.0 1.3 4.8 1.1 4.0 1.0 3.4 1.0 3.0 h (ft) 18 25.9 17.2	3.9           14.8           2.6           9.9           1.9           7.4           1.6           5.9           1.3           4.9           1.1           4.2           1.0           3.7           20           28.7           19.1
Pres (p.           1000           1500           2000           2500           3000           3500           4000           Net Soi           Pres (p.           1000           1500	ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage sf) marriage marriage	4 2.0 6.3 1.3 4.2 1.0 3.1 1.0 2.5 1.0 2.1 1.0 1.8 1.0 1.6 N 10 14.7 9.8 7.3	P 5 2.3 7.7 1.5 5.1 1.1 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0 1.0 2.2 1.0 1.9 Marriage V 12 17.5 11.6 8.7	ier Spacir 6 2.6 9.1 1.7 6.1 1.3 4.6 1.0 3.7 1.0 3.0 1.0 2.6 1.0 2.3 Vall Oper 14 20.3 13.5 10.1	g (ft) 7 2.9 10.6 2.0 7.0 1.5 5.3 1.2 4.2 1.0 3.5 1.0 3.0 1.0 3.0 1.0 2.6 1.5 1.0 3.0 1.0 3.5 1.1 1.5 1.5 1.5 1.5 1.5 1.5 1	3.3 12.0 2.2 8.0 1.6 6.0 1.3 4.8 1.1 4.0 1.0 3.4 1.0 3.0 h (ft) 18 25.9 17.2 12.9	3.9           14.8           2.6           9.9           1.9           7.4           1.6           5.9           1.3           4.9           1.1           4.2           1.0           3.7           20           28.7           19.1           14.3
Pres (p.           1000           1500           2000           2500           3000           3500           4000           Net Soi           Pres (p.           1000           1500           2000	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage f) marriage marriage marriage marriage	4 2.0 6.3 1.3 4.2 1.0 3.1 1.0 2.5 1.0 2.1 1.0 2.1 1.0 1.8 1.0 1.6 N 10 14.7 9.8 7.3 5.9	P 5 2.3 7.7 1.5 5.1 1.1 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0 1.0 2.2 1.0 1.9 Marriage V 12 17.5 11.6 8.7 7.0	ier Spacir 6 2.6 9.1 1.7 6.1 1.3 4.6 1.0 3.7 1.0 3.0 1.0 2.6 1.0 2.3 Vall Oper 14 20.3 13.5 10.1 8.1	g (ft) 7 2.9 10.6 2.0 7.0 1.5 5.3 1.2 4.2 1.0 3.5 1.0 3.0 1.0 2.6 ing Widt 16 23.1 15.4 11.5 9.2	3.3 12.0 2.2 8.0 1.6 6.0 1.3 4.8 1.1 4.0 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 1.0 3.4 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	3.9           14.8           2.6           9.9           1.9           7.4           1.6           5.9           1.3           4.9           1.1           4.2           1.0           3.7           20           28.7           19.1           14.3           11.5
Pres (p.           1000           1500           2000           2500           3000           3500           4000           Net Soi           Pres (p.           1000           1500           2000           3000           3000           3000           2500           3000	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage f) marriage marriage marriage marriage marriage	4 2.0 6.3 1.3 4.2 1.0 3.1 1.0 2.5 1.0 2.1 1.0 1.8 1.0 1.6 N 10 14.7 9.8 7.3 5.9 4.9	P 5 2.3 7.7 1.5 5.1 1.1 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0 2.2 1.0 1.9 Marriage V 12 17.5 11.6 8.7 7.0 5.8	ier Spacir 6 2.6 9.1 1.7 6.1 1.3 4.6 1.0 3.7 1.0 3.0 1.0 2.6 1.0 2.3 Vall Oper 14 20.3 13.5 10.1 8.1 6.8	g (ft) 7 2.9 10.6 2.0 7.0 1.5 5.3 1.2 4.2 1.0 3.5 1.0 3.0 1.0 2.6 1.0 3.0 1.0 2.6 1.1 1.2 4.2 1.0 3.5 1.0 3.0 1.0 3.0 1.0 3.5 1.0 3.0 1.0 3.5 1.0 3.0 1.0 3.5 1.0 3.5 1.0 3.0 1.0 3.5 1.0 3.0 1.0 3.5 1.0 3.0 1.0 3.0 1.0 3.0 1.0 3.0 1.0 3.0 1.0 3.0 1.0 3.0 1.0 3.0 1.0 3.0 1.0 3.0 1.0 3.0 1.0 3.0 1.0 3.0 1.0 3.0 1.0 3.0 1.0 3.5 1.0 3.0 1.0 3.0 1.0 3.5 1.0 3.0 1.0 3.5 1.0 3.0 1.0 3.5 1.0 3.0 1.0 3.5 1.0 3.5 1.0 3.0 1.0 3.5 1.0 3.0 1.0 3.5 1.0 3.5 1.0 3.0 1.0 3.5 1.5 4 1.5 9.2 7.7	3.3 12.0 2.2 8.0 1.6 6.0 1.3 4.8 1.1 4.0 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.6 17.2 12.9 10.3 8.6	3.9           14.8           2.6           9.9           1.9           7.4           1.6           5.9           1.3           4.9           1.1           4.2           1.0           3.7           20           28.7           19.1           14.3           11.5           9.6
Pres (p.           1000           1500           2000           2500           3000           3500           4000           Net Soi           Pres (p.           1000           1500           2000	sf) ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage ext, int marriage f) marriage marriage marriage marriage	4 2.0 6.3 1.3 4.2 1.0 3.1 1.0 2.5 1.0 2.1 1.0 2.1 1.0 1.8 1.0 1.6 N 10 14.7 9.8 7.3 5.9	P 5 2.3 7.7 1.5 5.1 1.1 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0 1.0 2.2 1.0 1.9 Marriage V 12 17.5 11.6 8.7 7.0	ier Spacir 6 2.6 9.1 1.7 6.1 1.3 4.6 1.0 3.7 1.0 3.0 1.0 2.6 1.0 2.3 Vall Oper 14 20.3 13.5 10.1 8.1	g (ft) 7 2.9 10.6 2.0 7.0 1.5 5.3 1.2 4.2 1.0 3.5 1.0 3.0 1.0 2.6 ing Widt 16 23.1 15.4 11.5 9.2	3.3 12.0 2.2 8.0 1.6 6.0 1.3 4.8 1.1 4.0 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 1.0 3.4 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	3.9           14.8           2.6           9.9           1.9           7.4           1.6           5.9           1.3           4.9           1.1           4.2           1.0           3.7           20           28.7           19.1           14.3           11.5

\* Minimum interior pier area is 1.0 sqft. Minimum exterior foundation wall footing width is 1'-0"; except for a 16' wide unit when the snow load is 100 psf and the allowable soil pressure is 1000 psf, use 1'-2".

Multi-Section	Aftg E, I
Width	16'

		Grou	ind Sn	ow: 90	) psf		
Net So	il		I	Pier Spaci	ng (ft)		
Pres (p	osf)	4	5	6	7	8	10
1000	ext, int	2.0	2.3	2.6	2.9	3.3	3.9
	marriage	6.7	8.3	9.8	11.3	12.9	15.9
1500 -	ext, int	1.3	1.5	1.7	2.0	2.2	2.6
	marriage	4.5	5.5	6.5	7.6	8.6	10.6
2000	ext, int	1.0	1.1	1.3	1.5	1.6	1.9
	marriage	3.4	4.1	4.9	5.7	6.4	8.0
2500	ext, int	1.0	1.0	1.0	1.2	1.3	1.6
	marriage	2.7	3.3	3.9	4.5	5.1	6.4
3000	ext, int	1.0	1.0	1.0	1.0	1.1	1.3
	marriage	2.2	2.8	3.3	3.8	4.3	5.3
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.1
	marriage	1.9	2.4	2.8	3.2	3.7	4.6
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.7	2.1	2.4	2.8	3.2	4.0
Net So		. 1	Marriage `	Wall Ope	ning Wid	th (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	15.7	18.8	21.8	24.8	27.8	30.9
1500	marriage	10.5	12.5	14.5	16.5	18.6	20.6
2000	marriage	7.9	9.4	10.9	12.4	13.9	15.4
2500	marriage	6.3	7.5	8.7	9.9	11.1	12.3
3000	marriage	5.2	6.3	7.3	8.3	9.3	10.3
3500	marriage	4.5	5.4	6.2	7.1	8.0	8.8
4000	marriage	3.9	4.7	5.4	6.2	7.0	7.7

		Grou	nd Sno	ow: 10	0 psf		
Net So	oil		F	ier Spaci	ng (ft)		
Pres (p	osf)	4	5	6	7	8	10
1000	ext, int	2.0	2.3	2.6	2.9	3.3	3.9
	marriage	7.2	8.8	10.4	12.1	13.7	17.0
1500	ext, int	1.3	1.5	1.7	2.0	2.2	2.6
	marriage	4.8	5.9	7.0	8.1	9.2	11.3
2000	ext, int	1.0	· 1.1	1.3	1.5	1.6	1.9
	marriage	3.6	4.4	5.2	6.0	6.9	8.5
2500	ext, int	1.0	1.0	1.0	1.2	1.3	1.6
	marriage	2.9	3.5	4.2	4.8	5.5	6.8
3000	ext, int	1.0	1.0	1.0	1.0	1.1	1.3
	marriage	2.4	2.9	3.5	4.0	4.6	5.7
3500	ext, int	1.0	1.0	1.0	1.0	1.0	1.1
	marriage	2.0	2.5	3.0	3.5	3.9	4.9
4000	ext, int	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.8	2.2	2.6	3.0	3.4	4.3
Net So	il	ľ	Marriage V	Wall Oper	ning Widt	th (ft)	
Pres (p		10	12	.14	16	18	20
1000	marriage	16.8	20.1	23.3	26.5	29.8	33.0
1500	marriage	11.2	13.4	15.5	17.7	19.9	22.0
2000	marriage	8.4	10.0	11.7	13.3	14.9	16.5
2500	marriage	6.7	8.0	9.3	10.6	11.9	13.2
3000	marriage	5.6	6.7	7.8	8.8	9.9	11.0
3500	marriage	4.8	5.7	6.7	7.6	8.5	9.4
4000	marriage	4.2	5.0	5.8	6.6	7.4	8.3

\* Minimum interior pier area is 1.0 soft. Minimum exterior foundation wall footing width is 1'-0"; except for a 16' wide unit when the snow load is 100 psf and the allowable soil pressure is 1000 psf, use 1'-2".



<b>Multi-Section</b>	E5,	<b>E6</b>
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11		Mi	n. Roo	f: 15 p	osf	1 - A	
Net So	il .	Tra	ansverse C	Hirder and	l Pier Spa	cing (ft)	
Pres (p	sf)	4	5	6.	7	8	10
1000	ext wall	1.0	1.1	1.1	1.2	1.3	1.4
-	marriage	5.2	6.3	7.4	8.5	9.6	11.8
1500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
-	marriage	3.5	4.2	4.9	5.7	6.4	7.8
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.6	3.1	3.7	4.2	4.8	5.9
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.1	2.5	3.0	3.4	3.8	4.7
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.7	2.1	2.5	2.8	3.2	3.9
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.5	1.8	2.1	2.4	2.7	3.4
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.3	1.6	1.8	2.1	2.4	2.9
Net So	11	N	Marriage V	Wall Oper	ning Widt	h (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	9.4	11.1	12.8	14.5	16.3	18.0
1500	marriage	6.3	7.4	8.6	9.7	10.8	12.0
2000	marriage	4.7	5.6	6.4	7:3	8.1	9.0
2500	marriage	3.8	4.4	5.1	5.8	6.5	7.2
3000	marriage	3.1	3.7	4.3	4.8	5.4	6.0
3500	marriage	2.7	3.2	3.7	4.2	4.6	5.1
4000	marriage	2.4	2.8	3.2	3.6	4.1	4.5

		-	<u> </u>			· · · ·	<u> </u>
<u> </u>			nd Sno				
Net So	il	Tra	nsverse C	irder and	l Pier Spa	cing (ft)	
Pres (p	sf)	4	5	6	7	8	10
1000	ext wall	1.0	1.1	1.2	1.2	1.3	1.4
	marriage	5.3	6.4	7.6	8.7	9.8	12.0
1500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.5	4.3	5.0	5.8	6.5	8.0
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
· · ·	marriage	2.7	3.2	3.8	4.3	4.9	6.0
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.1	2.6	3.0	3.5	3.9	4.8
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.8	2.1	2.5	2.9	3.3	4.0
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.5	1.8	2.2	2.5	2.8	3.4
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
·	marriage	1.3	1.6	1.9	2.2	2.5	3.0
Net So	il	1	Marriage V	Wall Ope	ning Widt	th (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	97	11.5	13.2	15.0	16.8	18.5
1500	marriage	6.5	7.6	8.8	10.0	11.2	12.4
2000	marriage	4.9	5.7	6.6	7.5	8.4	9.3
<b>250</b> 0	marriage	3.9	4.6	5.3	6.0	6.7	7.4
3000	marriage	3.2	3.8	4.4	5.0	5.6	6.2
3500	marriage	2.8	3.3	3.8	4.3	4.8	5.3
4000	marriage	2.4	2.9	3.3	3.8	4.2	4.6

G	round S	now:	30 psf	& Min	1. Roo	f: 20 p	sf
Net So	il .	Tra	insverse C	birder and	Pier Spa	cing (ft)	
Pres (p	sf)	4	5	6	7	8	10
1000	ext wall	1.1	1.1	1.2	1.2	1.3	1.4
<u> </u>	marriage	5.5	6.6	7.8	9.0	10.1	12.5
1500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.7	4.4	5.2	6.0	6.8	8.3
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.7	3.3	3.9	4.5	5.1	6.2
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
1.1.1.4	marriage	2.2	.2.7	3.1	3.6	4.1	5.0
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.8	2.2	2.6	3.0	3.4	4.2
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.6	1.9	2.2	2.6	2.9	3.6
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.4	1.7	2.0	2.2	2.5	3.1
Net So	il	1	Marriage V	Wall Oper	ning Widt	h (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	10.1	12.0	13.8	15.7	17.5	19.4
1500	marriage	6.7	8.0	9.2	10.4	11.7	12.9
2000	marriage	5.1	6.0	6.9	7.8	8.8	9.7
2500	marriage	4.0	4.8	5.5	6.3	7.0	7.7
3000	marriage	3.4	4.0	4.6	5.2	5.8	6.5
3500	marriage	2.9	3.4	3.9	4.5	5.0	5.5
4000	ma <del>n</del> iage	2:5	3.0	3.5	3.9	4.4	4.8

\* Minimum interior pier area is 1.0 sqft. The Exterior Footing Widths are shown in feet. The Marriage Wall Footing Areas are shown in square feet.

Multi-Section	Aftg E5, E6
Width	12'

11.7 9.4 7.8 6.7 5.8

8.6 7.4 6.5

6.0 5.2

· · · · ·		Grou	ind Sn	ow: 40	) psf		
Net So	il		ansverse (			cing (ft)	
Pres (p	sf)	4	5	6	7	8.	10
1000	ext wall	1.1	1.2	1.2	1.3	1.3	1.5
	marriage	5.8	7.0	8.3	9.5	10.8	13.3
1500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.9	4.7	5.5	6.4	7.2	. 8.8
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.9	3.5	4.1	4.8	5.4	6.6
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.3	2.8	3.3	3.8	4.3	5.3
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.9	2.3	2.8	3.2	3.6	4.4
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.7	2.0	2.4	2.7	3.1	3.8
4000 -	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.5	1.8	2.1	.2.4	2.7	3.3
Net Soi	11	M	Aarriage V	Wall Oper	ning Widt	h (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	10.9	12.9	15.0	17.0	19.0	21.0
1500	marriage	7.3	8.6	10.0	11.3	. 12.7	14.0
2000	marriage	5.5	6.5	7.5	8.5	9.5	10.5
2500	marriage	4.4	5.2	6.0	6.8	7.6	8.4
3000	marriage	3:6	4.3	5.0	5.7	6.3	7.0
3500	marriage	3.1	3.7	4.3	4.8	5.4	6.0
4000	marriage	2.7	3.2	3.7	4.2	4.7	5.2

		Grou	ind Sn	ow: 60	) psf		
Net So	il	Tra	ansverse (	Sirder and	Pier Spa	cing (ft)	
Pres (p	sf)	4	5	6	7	. 8	10
1000	ext wall	1.2	1.2	1.3	1.4	1.4	1.5
	marriage	6.5	7.9	9.3	. 10.7	12.1	14.9
1500	ext wall	1.0	1.0	1.0	.1.0	1.0	1.0
	marriage	4.3	5.2	6.2	7.1	8.1	9.9
2000	ext wall	1.0	1.0	10	1:0	1.0	1.0
	marriage	3.2	3.9	4.6	5.3	6.0	7.5
2500	ext wall	1.0	10	10	1.0	1.0	1.0
	marriage	2.6	3.1	3.7	4.3	4.8	6.0
3000	ext wall	1.0	- 1.0	1.0	1.0	1.0	1.0
1.	marriage	2.2	2.6	3.1	3.6	4.0	5.0
3500	ext wall	1.0	1_0	10	1.0	1.0	1.0
	marriage	1.8	2.2	2.6	3.1	3.5	4.3
4000	ext wall	1.0	1.0	10	-1.0	1.0	1.0
1.1	marriage	1.6	2.0	23	2.7	3.0	3.7
Net So	il	ľ	Marriage V	Wall Oper	ning Widi	th (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	12.6	149	17.2	196	21.9	24.3
1500	marriage	8.4	99	11.5	13.1	14.6	16.2
2000	marriage	6.3	74	86	9.8	11.0	12.1
2500	marriage	5.0	60	69	7.8	8.8	9.7
3000	marriage	4.2	50	57	6.5	7.3	8.1
3500	marriage	3.6	4.3	49	5.6	6.3	69
4000	marriage	3.1	3.7	4,3	4.9	5.5	6.1

		Grou	and Sn	ow: 50	0 psf		
Net Sc	oil				d Pier Spa	icing (ft)	
Pres (p	osf)	4	5	6	7	8	10
1000	ext wall	1.1	1.2	1.3	1.3	1.4	1.5
	marriage	6.1	7.5	8.8	10.1	.11.4	14.1
1500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	4.1	5.0	5.9	6.7	7.6	9.4
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.1	3.7	4.4	5.1	5.7	7.0
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.5	3.0	3.5	4.0	4.6	5.6
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.0	2.5	2.9	3.4	3.8	4.7
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.8	2.1	2.5	2.9	3.3	4.0
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.5	1.9	2.2	2.5	2.9	. 3.5
Net So	il 👘	<b>]</b>	Marriage '	Wall Ope	ning Wid	th (ft)	
Pres (p	sf)	10	12	14	16	. 18	20
1000	marriage	11.7	13.9	16.1	18.3	20.5	22.6
1500	marriage	7.8	9.3	10.7	12.2	13.6	15.1
2000	marriage	5.9	7.0	8.0	9.1	10.2	11.3
2500	marriage	4.7	5.6	6.4	7.3	8.2	9.1
3000	marriage	3.9	4.6	5.4	6.1	6.8	7.5
3500	marriage	3.4	4.0	4.6	5.2 -	5.8	6.5
4000	marriage	2.9	. 3.5	4.0	4.6	5.1	5.7
	····			<u></u>	<u></u>		
			nd Sno				·
Net Soi Pres (ps		Тга 4	nsverse C	irder and	Pier Snac	mag (ft)	
1000							10
			13	6	. 7.	8	10
UQU	ext wall	1.2	1.3	<u>6</u> 1.3	7	8	1.6
1500	ext wall marriage	1.2 6.8	1.3 8.3	<u>6</u> 1.3 9.8	7 1.4 11.3	8 1.5 12.7	1.6 15.7
1500	ext wall marriage ext wall	1.2 6.8 1.0	1.3 8.3 1.0	6 1.3 9.8 1.0	7 1.4 11.3 1.0	8 1.5 12.7 1.0	1.6 15.7 1.1
	ext wall marriage ext wall marriage	1.2 6.8 1.0 4.5	1.3 8.3 1.0 5.5	6 1.3 9.8 1.0 6.5	7 1.4 11.3 1.0 7.5	8 1.5 12.7 1.0 8.5	1.6 15.7 1.1 10.5
	ext wall marriage ext wall marriage ext wall	1.2 6.8 1.0 4.5 1.0	1.3 8.3 1.0 5.5 1.0	6 1.3 9.8 1.0 6.5 1.0	7 1.4 11.3 1.0 7.5 1.0	8 1.5 12.7 1.0 8.5 1.0	1.6 15.7 1.1 10.5 1.0
2000	ext wall marriage ext wall marriage ext wall marriage	1.2 6.8 1.0 4.5 1.0 3.4	1.3 8.3 1.0 5.5 1.0 4.1	6 1-3 9.8 1.0 6.5 1.0 4.9	7 1.4 11.3 1.0 7.5 1.0 5.6	8 1.5 12.7 1.0 8.5 1.0 6.4	1.6 15.7 1.1 10.5 1.0 7.9
2000	ext wall marriage ext wall marriage ext wall marriage ext wall	1.2 6.8 1.0 4.5 1.0 3.4 1.0	1.3 8.3 1.0 5.5 1.0 4.1 1.0	6 1.3 9.8 1.0 6.5 1.0 4.9 1.0	7 1.4 11.3 1.0 7.5 1.0 5.6 1.0	8 1.5 12.7 1.0 8.5 1.0 6.4 1.0	1.6 15.7 1.1 10.5 1.0 7.9 1.0
2000	ext wall marriage ext wall marriage ext wall marriage ext wall marriage	1.2 6.8 1.0 4.5 1.0 3.4 1.0 2.7	1.3 8.3 1.0 5.5 1.0 4.1 1.0 3.3	6 1.3 9.8 1.0 6.5 1.0 4.9 1.0 3.9	7 1.4 11.3 1.0 7.5 1.0 5.6 1.0 4.5	8 1.5 12.7 1.0 8.5 1.0 6.4 1.0 5.1	1.6 15.7 1.1 10.5 1.0 7.9 1.0 6.3
2000	ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall	1.2 6.8 1.0 4.5 1.0 3.4 1.0 2.7 1.0	$     \begin{array}{r}       1.3 \\       8.3 \\       1.0 \\       5.5 \\       1.0 \\       4.1 \\       1.0 \\       3.3 \\       1.0 \\       \end{array} $	6 1.3 9.8 1.0 6.5 1.0 4.9 1.0 3.9 1.0	7 1.4 11.3 1.0 7.5 1.0 5.6 1.0 4.5 1.0	8 1.5 12.7 1.0 8.5 1.0 6.4 1.0 5.1 1.0	1.6 15.7 1.1 10.5 1.0 7.9 1.0 6.3 1.0
2000 2500 3000	ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage	1.2 6.8 1.0 4.5 1.0 3.4 1.0 2.7 1.0 2.3	$   \begin{array}{r}     1.3 \\     8.3 \\     1.0 \\     5.5 \\     1.0 \\     4.1 \\     1.0 \\     3.3 \\     1.0 \\     2.8 \\   \end{array} $	6 1.3 9.8 1.0 6.5 1.0 4.9 1.0 3.9 1.0 3.3	7 1.4 11.3 1.0 7.5 1.0 5.6 1.0 4.5 1.0 3.8	8 1.5 12.7 1.0 8.5 1.0 6.4 1.0 5.1 1.0 4.2	1.6 15.7 1.1 10.5 1.0 7.9 1.0 6.3 1.0 5.2
2000 2500 3000	ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall	1.2 6.8 1.0 4.5 1.0 3.4 1.0 2.7 1.0 2.3 1.0	$     \begin{array}{r}       1.3 \\       8.3 \\       1.0 \\       5.5 \\       1.0 \\       4.1 \\       1.0 \\       3.3 \\       1.0 \\       2.8 \\       1.0 \\     \end{array} $	6 1.3 9.8 1.0 6.5 1.0 4.9 1.0 3.9 1.0 3.3 1.0	$\begin{array}{r} 7 \\ 1.4 \\ 11.3 \\ 1.0 \\ 7.5 \\ 1.0 \\ 5.6 \\ 1.0 \\ 4.5 \\ 1.0 \\ 3.8 \\ 1.0 \end{array}$	8 1.5 12.7 1.0 8.5 1.0 6.4 1.0 5.1 1.0 4.2 1.0	$ \begin{array}{r} 1.6\\ 15.7\\ 1.1\\ 10.5\\ 1.0\\ 7.9\\ 1.0\\ 6.3\\ 1.0\\ 5.2\\ 1.0\\ \end{array} $
2000 2500 3000 3500	ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage	1.2 6.8 1.0 4.5 1.0 3.4 1.0 2.7 1.0 2.3 1.0 1.9	$     \begin{array}{r}       1.3 \\       8.3 \\       1.0 \\       5.5 \\       1.0 \\       4.1 \\       1.0 \\       3.3 \\       1.0 \\       2.8 \\       1.0 \\       2.4 \\     \end{array} $	6 1.3 9.8 1.0 6.5 1.0 4.9 1.0 3.9 1.0 3.3 1.0 2.8	7 1.4 11.3 1.0 7.5 1.0 5.6 1.0 4.5 1.0 3.8 1.0 3.2	8 1.5 12.7 1.0 8.5 1.0 6.4 1.0 5.1 1.0 4.2 1.0 3.6	$ \begin{array}{r} 1.6\\ 15.7\\ 1.1\\ 10.5\\ 1.0\\ 7.9\\ 1.0\\ 6.3\\ 1.0\\ 5.2\\ 1.0\\ 4.5\\ \end{array} $
2000 2500 3000 3500	ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall	1.2 6.8 1.0 4.5 1.0 3.4 1.0 2.7 1.0 2.3 1.0 1.9 1.0	$ \begin{array}{c} 1.3\\ 8.3\\ 1.0\\ 5.5\\ 1.0\\ 4.1\\ 1.0\\ 2.8\\ 1.0\\ 2.4\\ 1.0\\ \end{array} $	6 1.3 9.8 1.0 6.5 1.0 4.9 1.0 3.9 1.0 3.3 1.0 2.8 1.0	7 1.4 11.3 1.0 7.5 1.0 5.6 1.0 4.5 1.0 3.8 1.0 3.2 1.0	8 1.5 12.7 1.0 8.5 1.0 6.4 1.0 5.1 1.0 4.2 1.0 3.6 1.0	$ \begin{array}{r} 1.6\\ 15.7\\ 1.1\\ 10.5\\ 1.0\\ 7.9\\ 1.0\\ 6.3\\ 1.0\\ 5.2\\ 1.0\\ 4.5\\ 1.0\\ \end{array} $
2000 2500 3000 3500 4000	ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage	$\begin{array}{c} 1.2 \\ 6.8 \\ 1.0 \\ 4.5 \\ 1.0 \\ 3.4 \\ 1.0 \\ 2.7 \\ 1.0 \\ 2.3 \\ 1.0 \\ 1.9 \\ 1.0 \\ 1.7 \end{array}$	1.3 8.3 1.0 5.5 1.0 4.1 1.0 2.8 1.0 2.4 1.0 2.1	6 1.3 9.8 1.0 6.5 1.0 4.9 1.0 3.9 1.0 3.3 1.0 2.8 1.0 2.4	7 1.4 11.3 1.0 7.5 1.0 5.6 1.0 4.5 1.0 3.8 1.0 3.2 1.0 2.8	8 1.5 12.7 1.0 8.5 1.0 6.4 1.0 5.1 1.0 4.2 1.0 3.6 1.0 3.2	$ \begin{array}{r} 1.6\\ 15.7\\ 1.1\\ 10.5\\ 1.0\\ 7.9\\ 1.0\\ 6.3\\ 1.0\\ 5.2\\ 1.0\\ 4.5\\ \end{array} $
2000 2500 3000 3500 4000 Net Soi	ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage	1.2 6.8 1.0 4.5 1.0 3.4 1.0 2.7 1.0 2.3 1.0 1.9 1.0 1.7 N	1.3 8.3 1.0 5.5 1.0 4.1 1.0 2.8 1.0 2.4 1.0 2.1 Marriage V	6 1.3 9.8 1.0 6.5 1.0 4.9 1.0 3.9 1.0 3.3 1.0 2.8 1.0 2.4 Vall Oper	7 1.4 11.3 1.0 7.5 1.0 5.6 1.0 4.5 1.0 3.8 1.0 3.2 1.0 2.8 ning Width	8 1.5 12.7 1.0 8.5 1.0 6.4 1.0 5.1 1.0 4.2 1.0 3.6 1.0 3.2 h (ft)	1.6 15.7 1.1 10.5 1.0 7.9 1.0 6.3 1.0 5.2 1.0 4.5 1.0 3.9
2000 2500 3000 3500 4000 Net Soi Pres (ps	ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage	1.2 6.8 1.0 4.5 1.0 3.4 1.0 2.7 1.0 2.3 1.0 1.9 1.0 1.7 1.0 1.7	1.3 8.3 1.0 5.5 1.0 4.1 1.0 2.8 1.0 2.4 1.0 2.1 Marriage V 12	6 1.3 9.8 1.0 6.5 1.0 4.9 1.0 3.9 1.0 3.3 1.0 2.8 1.0 2.4 Vall Oper 14	7 1.4 11.3 1.0 7.5 1.0 5.6 1.0 4.5 1.0 3.8 1.0 3.2 1.0 2.8 ning Widtl 16	8 1.5 12.7 1.0 8.5 1.0 6.4 1.0 5.1 1.0 4.2 1.0 3.6 1.0 3.2 h (ft) 18	1.6 15.7 1.1 10.5 1.0 7.9 1.0 6.3 1.0 5.2 1.0 4.5 1.0 3.9 20
2000 2500 3000 3500 4000 Net Soi Pres (ps 1000	ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage in marriage	1.2 6.8 1.0 4.5 1.0 3.4 1.0 2.7 1.0 2.3 1.0 1.9 1.0 1.7 N 10 13.4	1.3 8.3 1.0 5.5 1.0 4.1 1.0 2.8 1.0 2.4 1.0 2.1 Marriage V 12 15.9	6 1.3 9.8 1.0 6.5 1.0 4.9 1.0 3.9 1.0 3.3 1.0 2.8 1.0 2.4 Vall Oper 14 18.4	7     1.4     11.3     1.0     7.5     1.0     5.6     1.0     4.5     1.0     3.8     1.0     3.2     1.0     2.8     ming Widtl     16     20.9	8 1.5 12.7 1.0 8.5 1.0 6.4 1.0 5.1 1.0 4.2 1.0 3.6 1.0 3.2 h (ft) 18 23.4	1.6 15.7 1.1 10.5 1.0 7.9 1.0 6.3 1.0 5.2 1.0 4.5 1.0 3.9 20 25.9
2000 2500 3000 3500 4000 Net Soi Pres (ps 1000 1500	ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage in marriage st wall marriage	1.2 6.8 1.0 4.5 1.0 3.4 1.0 2.7 1.0 2.3 1.0 1.9 1.0 1.7 N 10 13.4 8.9	1.3 8.3 1.0 5.5 1.0 4.1 1.0 2.8 1.0 2.4 1.0 2.1 Marriage V 12 15.9 10.6	6 1.3 9.8 1.0 6.5 1.0 4.9 1.0 3.9 1.0 3.3 1.0 2.8 1.0 2.4 Vall Oper 14 18.4 12.3	7 1.4 11.3 1.0 7.5 1.0 5.6 1.0 4.5 1.0 3.8 1.0 3.2 1.0 2.8 ning Widtl 16 20.9 13.9	8 1.5 12.7 1.0 8.5 1.0 6.4 1.0 5.1 1.0 4.2 1.0 3.6 1.0 3.2 h (ft) 18 23.4 15.6	1.6           15.7           1.1           10.5           1.0           7.9           1.0           6.3           1.0           5.2           1.0           1.0           5.2           1.0           3.9           20           25.9           17.3
2000 2500 3000 3500 4000 Net Soi Pres (ps 1000 1500 2000	ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage if) marriage marriage marriage	1.2 6.8 1.0 4.5 1.0 3.4 1.0 2.7 1.0 2.3 1.0 1.9 1.0 1.7 N 10 13.4 8.9 6.7	1.3 8.3 1.0 5.5 1.0 4.1 1.0 2.8 1.0 2.4 1.0 2.1 Marriage V 12 15.9 10.6 7.9	6 1.3 9.8 1.0 6.5 1.0 4.9 1.0 3.9 1.0 3.3 1.0 2.8 1.0 2.4 Vall Oper 14 18.4 12.3 9.2	7 1.4 11.3 1.0 7.5 1.0 5.6 1.0 4.5 1.0 3.8 1.0 3.8 1.0 3.2 1.0 2.8 1.0 2.8 1.0 1.0 2.8 1.0 1.0 2.9 13.9 10.4	8 1.5 12.7 1.0 8.5 1.0 6.4 1.0 5.1 1.0 4.2 1.0 3.6 1.0 3.2 h (ft) 18 23.4 15.6 11.7	$\begin{array}{c} 1.6\\ 15.7\\ 1.1\\ 10.5\\ 1.0\\ 7.9\\ 1.0\\ 6.3\\ 1.0\\ 5.2\\ 1.0\\ 4.5\\ 1.0\\ 3.9\\ 20\\ 25.9\\ 17.3\\ 12.9 \end{array}$
2000 2500 3000 3500 4000 Net Soi Pres (ps 1000 1500 2000 2500	ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage f) marriage marriage marriage marriage	1.2 6.8 1.0 4.5 1.0 3.4 1.0 2.7 1.0 2.3 1.0 1.9 1.0 1.7 N 10 13.4 8.9 6.7 5.4	1.3 8.3 1.0 5.5 1.0 4.1 1.0 3.3 1.0 2.8 1.0 2.4 1.0 2.1 Marriage V 12 15.9 10.6 7.9 6.4	6 1.3 9.8 1.0 6.5 1.0 4.9 1.0 3.9 1.0 3.3 1.0 2.8 1.0 2.4 Vall Oper 14 12.3 9.2 7.4	7 1.4 11.3 1.0 7.5 1.0 5.6 1.0 4.5 1.0 3.8 1.0 3.2 1.0 3.2 1.0 3.2 1.0 3.2 1.0 3.2 1.0 3.2 1.0 3.2 1.0 3.2 1.0 3.2 1.0 3.2 1.0 3.8 1.0 3.2 1.0 3.8 1.0 3.2 1.0 3.8 1.0 3.2 1.0 3.8 1.0 3.2 1.0 3.8 1.0 3.2 1.0 3.8 1.0 3.8 1.0 3.2 1.0 3.8 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	8 1.5 12.7 1.0 8.5 1.0 6.4 1.0 5.1 1.0 4.2 1.0 3.6 1.0 3.2 h (ft) 18 23.4 15.6 11.7 9.4	$\begin{array}{c} 1.6\\ 15.7\\ 1.1\\ 10.5\\ 1.0\\ 7.9\\ 1.0\\ 6.3\\ 1.0\\ 5.2\\ 1.0\\ 4.5\\ 1.0\\ 3.9\\ 20\\ 25.9\\ 17.3\\ 12.9\\ 10.4\\ \end{array}$
1500 2000 2500 3000 3500 4000 Net Soi Pres (ps 1000 1500 2000 2500 3600 3500	ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage if) marriage marriage marriage	1.2 6.8 1.0 4.5 1.0 3.4 1.0 2.7 1.0 2.3 1.0 1.9 1.0 1.7 N 10 13.4 8.9 6.7	1.3 8.3 1.0 5.5 1.0 4.1 1.0 2.8 1.0 2.4 1.0 2.1 Marriage V 12 15.9 10.6 7.9	6 1.3 9.8 1.0 6.5 1.0 4.9 1.0 3.9 1.0 3.3 1.0 2.8 1.0 2.4 Vall Oper 14 18.4 12.3 9.2	7 1.4 11.3 1.0 7.5 1.0 5.6 1.0 4.5 1.0 3.8 1.0 3.8 1.0 3.2 1.0 2.8 1.0 2.8 1.0 1.0 2.8 1.0 1.0 2.9 13.9 10.4	8 1.5 12.7 1.0 8.5 1.0 6.4 1.0 5.1 1.0 4.2 1.0 3.6 1.0 3.2 h (ft) 18 23.4 15.6 11.7	$\begin{array}{c} 1.6\\ 15.7\\ 1.1\\ 10.5\\ 1.0\\ 7.9\\ 1.0\\ 6.3\\ 1.0\\ 5.2\\ 1.0\\ 4.5\\ 1.0\\ 3.9\\ 20\\ 25.9\\ 17.3\\ 12.9 \end{array}$

\* Minimum interior pier area is 1.0 sqft

The Exterior Footing Widths are shown in feet. The Marriage Wall Footing Areas are shown in square feet.

4000

marriage

4.0

4.6

Aftg E5, E6	Multi-Section
12'	Width

		Grou	ind Sn	ow: 80	) psf 👘		
Net So	il	Тп	ansverse (	Girder and	f Pier Spa	cing (ft)	
Pres (r	osf)	4	5	6	7	8	10
1000	ext wall	1.3	1.3	1.4	1.4	1.5	1.6
	marriage	7.1	8.7	10.3	11.8	13.4	16.5
1500	ext wall	1.0	1.0	1.0	1.0	1.0	1.1
	marriage	4.7	5.8	6.8	7.9	8.9	11.0
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.6	4.3	5.1	5.9	6.7	8.3
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.8	3.5	4.1	4.7	5.4	6.6
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.4	2.9	3.4	3.9	4.5	5.5
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.0	2.5	2.9	3.4	3.8	4.7
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.8	2.2	2.6	3.0	3.3	4.1
Net So	il (	N	Marriage V	Wall Oper	ning Widt	h (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	14.2	16.9	19.5	22.2	24,9	27.5
1500	marriage	9.5	11.2	13.0	14.8	16.6	18.4
2000	marriage	7.1	8.4	9.8	11.1	12.4	13.8
2500	marriage	5.7.	6.7	7.8	8.9	9.9	11.0
3000	marriage	4.7	5.6	6.5	7.4	8.3	9.2
3500	marriage	4.1	4.8	5.6	6.3	7.1	7.9
4000	marriage	3.5	4.2	4.9	5.5	6.2	6.9

	· · · · · ·	Grou	nd Sno	w: 10	0 psf	• • •	· · · ·
Net So	il.	Tra	insverse G	irder and	i Pier Spa	cing (ft)	
Pres (p	sf)	4	5 -	6	7	8	10
1000	ext wall	1.3	1.4	1.5	1.5	1.6	1.7
	marriage	7.8	9.5	11.2	13.0	14.7	18.2
1500	ext wall	1.0	1.0	1.0	1.0	1.1	1.1
·	marriage	5.2	6.3	7.5	8.6	9.8	12.1
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
<u> </u>	marriage	3.9	4.7	5.6	. 6.5	7.4	9.1
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.1	3.8	4.5	5.2	5.9	7.3
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.6	3.2	3.7	4.3	4.9	6.1
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.2	2.7	3.2	. 3.7	4.2	5.2
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.9	2.4	2.8	3.2	3.7	4.5
Net So	il	N	Marriage V	Vall Ope	ning Widt	th (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	15.8	18.8	21.8	24.8	27.8	30.8
1500	marriage	10.6	12.5	14.5	16.5	18.5	20.5
2000	marriage	7.9	9.4	10.9	12.4	13.9	15.4
2500 (	marriage	6.3	7.5	8.7	9.9	. 11.1	12.3
3000	marriage	5.3	6.3	7.3	8.3	9.3	10.3
3500	marriage	4.5	5.4	6.2	7.1	7.9	8.8
4000	marriage	4.0	4.7	5.5	6.2	7.0	7.7

			ind Sn						
Net So	il 📃 🗌	Tr	Transverse Girder and Pier Spacing (ft)						
Pres (p	sf)	4	5	. 6	. 7	8	10		
1000	ext wall	1.3	1.4	1.4	1.5	1.5	1.7		
	maniage	7.4	9.1	10.7	12.4	14.1	17.4		
1500	ext wall	1.0	1.0	1.0	1.0	1.0	1.1		
· ·	marriage	5.0	6.1	7.2	8.3	9.4	11.6		
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	3.7	4.5	5.4	6.2	7.0	8.7		
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	3.0	3.6	4.3	5.0	5.6	6.9		
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	2.5	3.0	3.6	4.1	4.7	5.8		
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	2.1	2.6	3.1	3.5	4.0	5.0		
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1:0		
1999 - 1999 1997 - 1999	marriage	1.9	2.3	- 2.7	3.1	3.5	4.3		
Net Soi	il .	1	Marriage V	Wall Oper	ning Widt	h (ft)			
Pres (p	sf)	10	12	14	16	18	20		
1000	marriage	15.0	17.8	20.7	23.5	26.3	29.2		
1500	marriage	10.0	11.9	13.8	15.7	17.6	19.4		
2000.	marriage	7.5	8.9	10.3	11.8	13.2	14.6		
2500	marriage	6.0	7.1	8.3	9.4	10.5	11.7		
3000	marriage	5.0	5.9	6.9	7.8	8.8	9.7		
3500 -	marriage	4.3	5.1	5.9	6.7	7.5	8.3		
4000	marriage	3.8	.4.5	5.2	5.9	6.6	7.3		

\* Minimum interior pier area is 1.0 sqft. The Exterior Footing Widths are shown in feet. The Marriage Wall Footing Areas are shown in square feet.

Multi-Section	Aftg E5, E6
Width	14

		Mi	n. Roo	f: 15 r	osf		
Net So	<b>i</b> ]		insverse C			cing (ft)	
Pres (p		4	5	6	7	8	10
1000	ext wall	1.1	1.2	1.3	1.3	1.4	1.5
	marriage	5.9	7.2	8.5	9.7	11.0	13.6
1500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
1000	marriage		4.8	5.7	6.5	7.3	9.0
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
2000	marriage	3.0	3.6	4.2	4.9	5.5	6.8
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
2200	marriage	2.4	2.9	3.4	3.9	4.4	5.4
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.0	2.4	2.8	3.2	3.7	4.5
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
5500	marriage	1.7	2.1	2.4	2.8	3.1	3.9
4000	ext wall	1.0	1.0	1.0	1.0	1.0	<u></u>
-000	marriage	1.5	1.8	2.1	2.4	2.8	3.4
Net So			Aarriage V				
Pres (p		10	12	14	16	18	20
1000	marriage	10.8	12.8	14.8	16.8	18.8	20.8
1500	marriage	7.2	8.6	9.9	11.2	12.5	13.9
2000	marriage	5.4	6.4	7.4	8.4	9.4	10.4
2500	marriage	4.3	5.1	5.9	6.7	7.5	8.3
3000	marriage	3.6	4.3	4,9	5.6	6.3	6.9
3500	marriage	3.1	3.7	4.2	4.8	5.4	5.9
4000	marriage	2.7	3.2	3.7	4.2	4.7	5.2
G	round S	now: :	30 psf	& Mir	1. Roo	f: 20 p	sf
Net Soi		Tra	nsverse C		Pier Spa	cing (ft)	
Pres (p	sf)	4	- 5	6	7	8	10
1000	ext wall	1.2	1.2	1.3	1.4	1.4	1.6
	marriage	6.3	7.6	9.0	10.3	11.7	14.4
1500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	4.2	5.1	6.0	6.9	7.8	9.6
2000	ext wall	1.0	1.0	1.0	1.0	1.0	- 1.0
	marriage	3.1	3.8	4.5	5.2	5.8	7.2
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
10 T	marriage	2.5	3.0	3.6	4.1	4.7	5.7
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
		2.1	25	20	24	2.0	4 0

		~ ~				-	
	<u> </u>		ınd Sn				
Net Sc	oil	Tr	ansverse (	Jirder and	l Pier Spa	cing (ft)	
Pres (p	osf)	4	5	6	7	8	10
1000	ext wall	1.1	1.2	1.3	1.3	1.4	1.5
	marriage	6.1	7.4	8.7	10.0	11.3	13.9
1500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	4.0	4.9	5.8	6.7	7.5	9.3
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.0	3.7	4.3	5.0	5.6	6.9
2500	ext wall	1.0	1.0	1.0	1.0	1.0	- 1.0
	marriage	2.4	3.0	3.5	4.0	4.5	5.6
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.0	2.5	2.9	3.3	3.8	4.6
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.7	2.1	2.5	2.9	3.2	4.0
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.5	1.8	2.2	2.5	2.8	3.5
Net So	il	. 1	Marriage '	Wall Oper	ning Widt	h (ft)	
Pres (p	sf)	10.	12	14	16	18	20
1000	marriage	11.2	13.3	15.3	17.4	19.4	21.5
1500	marriage	7.5	8.8	10.2	11.6	13.0	14.3
2000	marriage	5. <del>6</del>	6.6	7.7	8.7	9.7	10.7
2500	marriage	4.5	5.3	6.1	6.9	7.8	8.6
3000	marriage	3.7	4.4	5.1	5.8	6.5	7.2
3500	marriage	3.2	3.8	4.4	5.0	5.6	6.1
4000	marriage	2.8	3.3	3.8	4.3	4.9	5.4
. :							,
		Grou	ind Sne	ow: 40	psf		
Net So	il	Tra	insverse C	irder and	Pier Space	ring (ft)	<sup>-</sup>
Pres (p	sf)	4	5	6	7	8	10
1000	ext wall	1.2	1.3	1.3	1.4	1.5	1.6
· .	marriage	6.6	8.1	9.5	11.0	12.4	15.3
1500 -	ext wall	1.0	1.0	1.0	1.0	1_0 "	1.1
	marriage	4.4	5.4	6.4	7.3	8,3	10.2
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.3	4.0	4.8	5.5	6.2	7.7
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.7	3.2	3.8	4.4	5.0	6.1
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.2	2.7	3.2	3.7	4.1	.5.1
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.9	2.3	2.7	3.1	. 3.6	4.4
4000	ext wall	1.0	1.0	- 1.0	1.0	1.0	1.0
	marriage	1.7	2.0	2.4	2.7	3.1	3.8
Net So					ung Widt		
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	12.6	15.0	17.3	19.7	22.0	24.4
1500	marriage	8.4	10.0	11.5	13.1	14.7	16.2
2000	marriage	6.3	7.5	8.7	9.8	11.0	12.2
2500	marriage	51	6.0	60	70	88	07

7.9

6.6

5.6

4.9

8.8

7.3

6.3

5.5

6.9

5.8

4.9

4.3

9.7

8.1

7.0

6.1

\* Minimum interior pier area is 1.0 sqft.

marriage

ext wall

marriage

ext wall

marriage

marriage

marriage

marriage

marriage

marriage

marriage

marriage

3500

4000

1000

1500

2000

2500

3000

3500

4000

Net Soil

Pres (psf)

2.1

1.0

1.8

1.0

1.6

10

11.7

7.8

5.8

4.7

3.9

3.3

2.9

2.5

1.0

2.2

1.0

1.9

12

13.8

9.2

6.9

5.5

4.6

3.9

3.5

3.0

1.0

2.6

1.0

2.2

14

16.0

10.7

8.0

6.4

5.3

4.6

4.0

Marriage Wall Opening Width (ft)

3.4

1.0

2.9

1.0

2.6

16

18.1

12.1

9.1

7.3

6.0

5.2

4.5

3.9

1.0

3.3

1.0

2.9

18

20.3

13.5

10.1

8.1

6.8

5.8

5.1

4.8

1.0

4.1

1.0

3.6

20

22.4 15.0

11.2

9.0

7.5

6.4

5.6

The Exterior Footing Widths are shown in feet. The Marriage Wall Footing Areas are shown in square feet.

marriage

marriage

marriage

marriage

5.1

4.2

3.6

3.2

6.0

5.0

4.3

3.7

2500

3000

3500

4000

Aftg	
E5, E6	<b>Multi-Section</b>
14'	Width

		Grou	ind Sn	ow: 50	) psf			
Net So	il	Tra	Transverse Girder and Pier Spacing (ft)					
Pres (p	sf)	4	5	6	7	8	10	
1000	ext wall	1.2	1.3	1.4	1.5	1.5	1.7	
	marriage	7.0	8.6	10.1	11.7	13.2	16.3	
1500	ext wall	1.0	1.0	1.0	1.0	1.0	1.1	
	marriage	4.7	5.7	6.7	7.8	8.8	10.9	
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	
	marriage	3.5	4.3	5.1	5.8	6.6	8.1	
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	
	marriage	2.8	3.4	4.0	4.7	5.3	6.5	
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	
	marriage	2.3	2.9	3.4	3.9	4.4	5.4	
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	
	marriage	2.0	2.4	2.9	3.3	3.8	4.7	
4000	ext wall	1.0	1:0	1.0	1.0	1.0	1.0	
	marriage	1.8	2.1	2.5	2.9	3.3	.4.1	
Net Soi	il	Ν	Aarriage V	Wall Oper	ning Wid	h (ft)		
Pres (p	sf)	10	12	14	16	18	20	
1000	marriage	13.6	16.1	18.7	21.2	23.7	26.3	
1500	marriage	9.1	10.7	12.4	14.1	15.8	17.5	
2000	marriage	6.8	8.1	9.3	10.6	11.9	13.1	
2500	marriage	5.4	6.4	7.5	8.5	9.5	10.5	
3000	marriage	4.5	5.4	6.2	7.1	7.9	8.8	
3500	marriage	3.9	4.6	5.3	6.1	6.8	7.5	
4000	marriage	3.4	4.0	4.7	5.3	5.9	6.6	

		Grou	ind Sn	ow: 70	) psf		
Net So	oil	Tra	ansverse (	hirder and	Pier Spa	cing (ft)	<u></u>
Pres (p	sf)	4	5	6	7	8	10
1000	ext wall	1.3	1.4	1.5	1.6	1.6	1.8
	marriage	7.8	· 9.5 ·	11.3	13.0	14.7	18.2
1500	ext wall	1.0	1.0	1.0	1.0	1.1	1.2
	marriage	5.2	6.4	7.5	8.7	9.8	12.1
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.9	4.8	5.6	6.5	7.4	9.1
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
-	marriage	3.1	3.8	4.5	5.2	5.9	7.3
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.6	3.2	3.8	4.3	4.9	6.1
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
-	marriage	2.2	2.7	3.2	3.7	4.2	5.2
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.9	2.4	2.8	3.2	3.7	4.5
Net So	il	1	Marriage V	Wall Oper	ning Wid	th (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	15.5	18.4	21.3	24.3	27.2	30.1
1500	marriage	10.3	12.3	14.2	16.2	18.1	20.1
2000	marriage	7.7	9.2	10.7	12.1	13.6	15.0
2500	marriage	6.2	7.4	8.5	9.7	10.9	12.0
3000	marriage	5.2	6.1	7.1	8.1	9.1	10.0
3500	marriage	4.4	5.3	6.1	6.9	7.8	8.6
4000	marriage	3.9	4.6	5.3	6.1	6.8	7.5

#### Required Effective Footing - Aftg \*

		Grou	ind Sn	ow: 🕬	) psf		
Net Soi	1	Tr	ansverse (	Girder and	d Pier Spa	cing (ft)	
Pres (p	sf)	4	5	6	7.	8	10
1000	ext wali	1.3	1.4	1.4	1.5	1.6	1.
	marriage	7.4	9.1	10.7	12.3	14.0	17.:
1500	ext wall	1.0	1.0	1.0	1.0	1.1	1.
	marriage	4.9	.6.0	7.1	8.2	9.3	11.
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.7	4.5	5.3	6.2	7.0	8.6
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.0	3.6	4.3	4.9	5.6	6.9
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.5	3.0	3.6	4.1	4.7	5.7
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.1	2.6	3.1	3.5	4.0	4.9
4000	ext wall	1.0	1.0	1.0	1:0	1.0	1.0
	marriage	1.9	2.3	2.7	3.1	3.5	4.3
Net Soil		N	Marriage 1	Wall Oper	ning Widi	h (ft)	
Pres (ps	f)	10	12	14	16	18	20
1000	marriage	14.5	17.3	20.0	22.7	25.5	28.2
.500	marriage	9.7	11.5	13.3	15.2	17.0	18.8
2000	marriage	7.3	8.6	10.0	11.4	12.7	14.1
2500	marriage	5.8	6.9	8.0	9.1	10.2	11.3
3000 · · ·	marriage	4.8	5.8	6.7	7.6	8.5	9.4
500	marriage	4.2	4.9	5.7	6.5	7.3	8.1
000	marriage	3.6	4.3	5.0	5.7 ·	6.4	7.0
		<u> </u>		:	· · ·		
		Grou	nd Sno	ow: 80	DSf		
Vet Soil			nsverse G				

L		Grou	ınd Sn	ow: 8(	) psf	· · · ·	1.1.1
Net Sc	oil	Tr	ansverse (	Girder and	l Pier Spa	cing (ft)	
Pres (p	osf)	4	5	6	7	8	10
1000	ext wall	1.4	1.5	1.5	1.6	1.7	1.8
<u> </u>	marriage	8.2	10.0	11.8	13.7	15.5	19.2
1500	ext wall	1.0	1.0	1.0	1.1	1.1	1.2
<u>.</u>	marriage	5.5	6.7	7.9	9.1	10.3	12.8
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	4.I	5.0	5.9	6.8	7.7	9.6
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
<u> </u>	marriage	3.3	4.0	4.7	5.5	6.2	7.7
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.7	3.3	3.9	4.6	5.2	6.4
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.3	2.9	3.4	3.9	4.4	5.5
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.0	2.5	3.0	3.4	3.9	4.8
Net So			Marriage V	Wall Ope:	ning Widt	th (ft)	
Pres (p		10	12	14	16	18	20
1000	marriage	16.5	19.6	22.7	25.8	28.9	32.0
1500	marriage	11.0	13.0	15.1	17.2	19.3	21.3
2000	marriage	8.2	9.8	11.3	12.9	14.4	16.0
2500	marriage	6.6	7.8	9.1	10.3	11.6	12.8
3000	marriage	5.5	6.5	7.6	8.6	9.6	10.7
3500	marriage	4.7	5.6	6.5	7.4	8.3	9.1
4000	marriage	4.1	4.9	5.7	6.4	7.2	8.0

\* Minimum interior pier area is 1.0 sqft. The Exterior Footing Widths are shown in feet. The Marriage Wall Footing Areas are shown in square feet.

Multi-Section	Aftg E5, E6
Width	14

	·			ow: 90			
Net Sc	oil 👘	Tra	ansverse (	Sirder and	Pier Spa	cing (ft)	·
Pres (p	osf)	4	5	6	·7 Î	8	10
1000	ext wall	1.4	1.5	1.6	1.7	1.7	1.9
	marriage	8.6	10.5	12.4	14.3	16.3	20.1
1500	ext wall	1.0	1.0	1.1	1.1	1.1	1.2
	marriage	5.7	7.0	8.3	9.6	10.8	13.4
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
· .	marriage	4.3	5.2	6.2	7.2	8.1	10.1
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.4	4.2	5.0	5.7	6.5	8.0
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.9	3.5	4.1	4.8	5.4	6.7
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.4	3.0	3.5	4.1	4.6	5.7
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.1	2.6	3.1	3.6	4.1	5.0
Net So	iI	N	Aarriage V	Wall Oper	ung Widt	h (ft)	<u> </u>
Pres (p	sf)	10	12	14	16	Ì18	20
1000	marriage	17.4	20.7	24.0	27.3	30.6	33.9
1500	marriage	11.6	13.8	16.0	18.2	20.4	22.6
2000	marriage	8.7	10.4	12.0	13.7	15.3	17.0
2500	marriage	7.0	8.3	9.6	10.9	12.2	13.6
3000	marriage	5.8	6.9	8.0	9.1	10.2	11.3
3500	marriage	5.0	5.9	6.9	7.8	. 8.7	9.7
4000	marriage	4.4	5.2	6.0	6.8	. 7.7	8.5

			ind Sno				
Net Sc		Tr	ansverse G	irder an	d Pier Spa	cing (ft)	
Pres (p	osf)	4	. 5	6	7	8	10
1000	ext wall	1.5	1.6	1.6	1.7	1.8	1.9
	marriage	8.9	11.0	_13.0	15.0	17.0	21.1
1500	ext wall	· 1.0 ·	1.0	1.1	1.1	1.2	1.3
	marriage	6:0	7.3	8.7	10.0	11.4	14.0
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	. 4.5	5.5	6.5	7.5	8.5	10.5
2500	ext wall	1.0	1.0	1.0	1.0	1,0	1.0
	marriage	3.6	4.4	5.2	6.0 ·	6.8	8.4
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.0	3.7	4.3	5.0	5.7	7.0
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.6	3.1	3.7	4.3	4.9	6.0
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
-	marriage	2.2	2.7	3.2	3.8	4.3	5.3
Net So		]	Marriage W	/all Ope	ning Widt	h (ft)	
Pres (p.		10	12	14	16	18	20
1000	marriage	18.4	21.9	25.4	28.8	32.3	35.8
1500	marriage	12.2	14.6	16.9	19.2	21.6	23.9
2000	marriage	9.2	10.9	12.7	14.4	16.2	17.9
2500	marriage	7.3	8.7	10.1	11.5	12.9	14.3
3000	marriage	6.1	7.3	8.5	9.6	10.8	11.9
3500	marriage	5.2	6.2	7.2	8.2	9.2	10.2
4000	marriage	4.6	5.5	6.3	7.2	8.1	9.0

\* Minimum interior pier area is 1.0 sqft. The Exterior Footing Widths are shown in feet. The Marriage Wall Footing Areas are shown in square feet.

Aftg E5, E6 16'	Multi-Section Width
	Min Roof

		Mi	n. Roc	of: 15 p	osf	2	·
Net Soi		Tra	insverse (	Girder and	l Pier Spa	cing (ft)	
Pres (ps	sf)	4	5	6 /	7	8	10
1000	ext wall	1.2	1.3	1.4	1.4	1.5	1.
	marriage	6.6	8.0	9.5	10.9	12.3	15.:
1500	ext wall	1.0	1.0	1.0	1.0	1.0	1.
	marriage	4.4	5.4	6.3	7.3	8.2	10.
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.
	marriage	3.3	4.0	4.7	5.5	6.2	7.
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.6	3.2	3.8	4.4	4.9	6.
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.
	marriage	2.2	2.7	3.2	3.6	4 1	5.
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.9	2.3	2.7	3.1	3.5	4.3
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.7	2.0	2.4	2.7	3.1	. 3.
Net Soil		N	Aarriage '	Wall Oper	ning Widt	h (ft)	
Pres (ps	f)	10	12	14	16	18	20
1000	marriage	12.2	14.4	16.7	18.9	21.2	23.4
1500	marriage	8.1	9.6	11.1	12.6	14.I	15.6
2000	marriage	6.1	7.2	8.3	9.5	10.6	11.
2500	marriage	4.9	5.8	6.7	7.6	8.5	. 9.4
3000 .	marriage	4.1	4.8	5.6	6.3	7.1	7.8
3500	marriage	3.5	4.1	4.8	5.4	6.0	6.1
4000	marriage	3.0	3.6	4.2	4.7	5.3	5.9

G	round S	now:	30 psf	& Mi	n. Roo	f: 20 p	sf
Net So			insverse (				
Pres (p	isf)	4	5	6	7	8	10
1000	ext wall	1.2	1.3	1.4	1.5	1.6	1.7
	marriage	7.0	8.5	10.0	11.6	13.1	16.1
1500	ext wall	1.0	1.0	1.0	1.0	1.0	1.1
	marriage	4.7	5.7	6.7	7.7	8.7	10.8
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.5	4.3	5.0	5.8	6.5	8.1
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.8	3.4	4.0	4.6	5.2	6.5
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.0	2.8	3.3	3.9	4.4	5.4
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.0	2.4	2.9	3.3	. 3.7	4.6
4000	ext wall	1.0	1.0	· 0	1.0	1.0	1.0
<u>.</u>	marriage	1.7	2.1	- 5	2.9	3.3	4.0
Net So	il	N	Aarriage V	Wall Oper	ning Widt	th (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	13.1	15.5	18.0	20.4	22.8	25.3
1500	marriage	8.7	10.4	12.0	13.6	15.2	16.8
2000	marriage	6.5	7.8	9.0	10.2	11.4	12.6
2500	marriage	5.2	6.2	7.2	8.2	9.1	10.1
3000	marriage	4.4	5.2	6.0	6.8	7.6	8.4
3500	marriage	3.7	4.4	5.1	5.8	6.5	7.2
4000	marriage	3.3	3.9	4.5	5.1	5.7	6.3

			ind Sn						
Net Sc	il	. Tra	insverse (	Firder and	l Pier Spa	cing (ft)	,		
Pres (psf)		4	5	6	7	8	10		
1000	ext wall	1.2	1.3	1.4	1.5	1.5	1.7		
	maniage	6.8	8.2	9.7	11.2	12.6	15.6		
1500	ext wall	1.0	1.0	1.0	1.0	1.0	1.1		
	_ marriage	4.5	.5.5	6.5	7.5	8.4	10.4		
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	3.4	4.1	4.9	5.6	6.3	7.8		
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	2.7	3.3	3.9	4.5	5.1	6.2		
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	2.3	2.7	3.2	3.7	4.2	5.2		
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	1.9	2.4	2.8	3.2	3.6	4:5		
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	1.7	2.1	2.4	2.8	3.2	3.9		
Net Soil		Marriage Wall Opening Width (ft)							
Pres (psf)		10	12	14	16	18	20		
1000	marriage	12.6	14.9	17.2	19.5	21.9	24.2		
1500	marriage	8.4	9.9	11.5	13.0	14.6	16.1		
2000	marriage	6.3	7.4	8.6	9.8	10.9	12.1		
2500	marriage	5.0	6.0	6.9	7.8	8.7	9.7		
3000	marriage	4.2	5.0	5.7	6.5	7.3	8.1		
3500	marriage	3.6	4.3	4.9	5.6	6.2	6.9		
4000 👘	marriage	3.1	3.7	4.3	4.9	5.5	6.0		

			ind Sn					
Net So	il	Transverse Girder and Pier Spacing (ft)						
Pres (psf)		4	5	6	.7	8	10	
1000	ext wall	1.3	1.4	1.5	1.5	1.6	1.8	
	marriage	7.4	9.1	10.7	12.3	13.9	17.2	
1500	ext wall	1.0	1.0	1.0	1.0	1.1	1.2	
	marriage	4.9	6.0	7.1	8.2	9.3	11.5	
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	
	marriage	3.7	4.5	. 5.3	6.2	7.0	8.6	
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	
	marriage	3.0	3.6	4.3	4.9	5.6	6.9	
3000 -	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	
	marriage	2.5	3.0	3.6	4.1	4.6	5.7	
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	
	marriage	2.1	. 2.6	3.1	3.5	4.0	4.9	
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	
	marriage	1.9	2.3	2.7	3.1	3.5	4.3	
Net Soil		Marriage Wall Opening Width (ft)						
Pres (psf)		10	12	14	16	18	20	
1000	marriage	14.2	16.8	19.5	22.1	24.8	27.4	
1500	marriage	9.5	11.2	13.0	14.8	16.5	18.3	
2000	marriage	7.1	8.4	9.7	11.1	12.4	13.7	
2500	marriage	5.7	6.7	7.8	8.9	9.9	11.0	
3000	marriage	4.7	5.6	6.5	7.4	8.3	9.1	
3500	marriage	4.1	4.8	5.6	6.3	7.1	7.8	
4000	marriage	3.5	4.2	4.9	5.5	6.2	6.9	

\*

Minimum interior pier area is 1.0.sqft. The Exterior Footing Widths are shown in feet. The Marriage Wall Footing Areas are shown in square feet.
		Aftg
Multi-Section	on 🛛	E5, E6
Width		16'

7

1.6

13.8

1.1

9:2

1.0

<u>6.9</u>

1.0

5.5

1.0

4.6

1.0

4.0

1.0

3.5

16

25.6

17.1

8

1.7

15.7

1.2

10.5

1.0

7.8

1.0

6.3

1.0

5.2

1.0

4.5

1.0

<u>3.9</u>

-18

28.7

19.1

10

1.9

19.4

1.3

12.9

1.0

9.7

1.0

7.8

1.0

6.5

1.0

5.5

1.0

4.8

20

31.8

21.2

Ground Snow: 60 psf

5

1.5

1.0

6.8

1.0

5.1

1.0

4.1

1.0

3.4

1.0

2.9

1.0

2.5

12

19.4

13.0

10.1

4

1.4

8.3

1.0

5.5

1.0

4.1

1.0

3.3

1.0

2.8

1:0

2.4

1.0

2.1

10

16.4

10.9

Net Soil Pres (psf)

ext wall

marriage

ext wall

marriage

ext wall

marriage

ext wall

marriage

ext wall

marriage

ext wall

marriage

ext wall

marriage

marriage

marriage

1000

1500

2000

2500

3000

3500

4000

1000

1500

Net Soil

Pres (psf)

Transverse Girder and Pier Spacing (ft)

6

12.0

1.0

8.0

1.0

6.0

1.0

4.8

1.0

4.0

1.0

3.4

1.0

3.0

14

22.5

15.0

Marriage Wall Opening Width (ft)

1.6

		Grou	and Sn	ow: 50	) psf		
Net So			ansverse (	Jirder and	l Pier Spa	cing (ft)	
Pres (p	osf)	4	5	6	7	8	10
1000	ext wall	1.4	1.4	1.5	1.6	1.7	1.8
	marriage	7.9	9.6	11.3	13.1	14.8	18.3
1500	ext wall	1.0	1.0	1.0	1.1	1.1	1.2
	marriage	5.2	6.4	7.6	8.7	9.9	12.2
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.9	4.8	5.7	6.5	7.4	9.1
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.1	3.8	4.5	5.2	5.9	7.3
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.6	3.2	3.8	4.4	4.9	6.1
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.2	2.7	3.2	3.7	4.2	5.2
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
•	marriage	2.0	2.4	2.8	3.3	3:7	4.6
Net So	il	N	Marriage V	Wall Oper	ning Widt	h (ft)	
Pres (p.	sf)	10	12	14	16	18	20
1000	marriage	15.3	18.1	21.0	23.9	26.7	29.6
1500	marriage	10.2	12.1	14.0	15.9	17.8	19.7
2000	marriage	7.6	9.1	10.5	11.9	13.4	14.8
2500	marriage	6.1	7.3	8.4	9.5	10.7	11.8
3000	marriage	5.1	6.0	7.0	8.0	8.9	9.9
3500	marriage	4.4	5.2	6.0	6.8	7.6	8.5
4000.	marriage	3.8	4.5	5.3	6.0	6.7	7.4
			nd Sno				
Net Soi		Tra	nsverse G	irder and	Pier Space	ing (ft)	
Pres (ps	sf) ···	4	. 5	6	7	8	10
1000	ext wall	1.5	1.5	1.6	1.7	1.8	1.9
	,	~ -					

			10.0	10.0	A/-1	. 12.1	
2000	marriage	8.2	9.7	11.3	12.8	14.3	15.9
2500	marriage	6.5	7.8	9.0	10.2	11.5	12.7
3000	marriage	5.5	6.5	7.5	8.5	9.6	10.6
3500	marriage	4.7	5.6	6.4	7.3	8.2	9.1
4000	marriage	4.1	49	5.6	6.4	7.2	7.9
							· · · ·
·		Grou	ind Sn	ow: 80	) psf		
Net So	il	Tra	risverse (	Firder and	Pier Spa	cing (ft)	
Pres (p	sf)	4	5	6.	7	8	10
1000	ext wall	1.5	1.6	1.7	1.8	1.8	2.0
	marriage	9.2	11.2	13.3	15.4	17.4	21.6
1500	ext wall	1.0	1.1	1.1	1.2	1.2	1.3
	marriage	6.1	7.5	8.9	10.2	11.6	14.4
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	4.6	5.6	6.6	7.7	8.7	10.8
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
-	marriage	3.7	4.5	5.3	6.1	7.0	8.6
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.1	3.7	4.4	5.1	5.8	7.2
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.6	3.2	3.8	4.4	5.0	6.2
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.3	2.8	3.3	3.8	4.4	5.4
Net Soi	1	N	Aarriage V	Wall Oper	ning Widt	th (ft)	
Pres (p	sf)	10	12	14	- 16	18	20
1000	marriage	18.5	22.0	25.6	29.1	32.6	36.1
1500	marriage	12.3	14.7	17.0	19.4	21.7	24.1
2000	marriage	9.3	11.0	12.8	14.5	16.3	18.1
2500	marriage	7.4	8.8	10.2	11.6	13.0	14.4
3000	marriage	6.2	7.3	8.5	9.7	10.9	12.0
3500	marriage	5.3	6.3	7.3	8.3	9.3	10.3
4000	marriage	4.6	5.5	6.4	7.3	8.2	9.0

	marriage	2.5	3.1 -	3.6	4.2	4.7
4000	ext wall	1.0	10	1.0	1.0	1.0
-	marriage	2.2	2.7	3.2	3.6	4.1
Net So	il	1	Marriage V	Wall Oper	ning Widt	th (ft)
Pres (p	sf)	10	12	14	16	18
1000	marriage	17.4	20.7	24.0	27.3	30.6
1500	marriage	11.6	13.8	16.0	18.2	20.4
2000	marriage	8.7	10.4	12.0	13.7	15.3
2500	marriage	7.0	8.3	9.6	10.9	12.3
3000	marriage	5.8	6.9	8.0	9.1	10.2
3500	marriage	5.0	5.9	6.9	7.8	8-8
4000	marriage	4.4	5.2	6.0	6.8	7.7

\* Minimum interior pier area is 1.0 sqft.

marriage

ext wall

marriage

ext wall

marriage

ext wail

marriage

ext wall

marriage

ext wall

1500

2000

2500

3000

3500

8.7

1.0

5.8

1.0

4.4

1.0

3.5

1.0

2.9

1.0

10.7

1.0

7.1

1.0

5.3

1.0

4.3

1.0

3.6

1.0

12.6

1.1

8.4

1.0

6.3

1.0

5.1

1.0

4.2

1.0

14.6

1.1

9.7

1.0

7.3

1.0

5.8

1.0

4.9

1.0

16.6

11.0

1.0

8.3

1.0

6.6

1.0

5.5

1.0

1.2

20.5

1.3

13.6

1.0

1.0

8.2

1.0

6.8

1.0 5.8

1.0 5.1

20 33.9 22.6 17.0 13.6

11.3

9.7 8.5

10.2

The Exterior Footing Widths are shown in feet. The Marriage Wall Footing Areas are shown in square feet.

16	<u>9</u>	Wie	lth				
	· · · ·	Grou	ind Sn	ow: 90	psf		
Net So	il	Tra	insverse (	Girder and	Pier Spa	cing (ft)	
Pres (p	sf)	4	5	6	. 7	8	10
1000	ext wall	1.6	1.6	1.7	1.8	1.9	2.0
	marriage	9.6	11.8	13.9	16.1	18.3	22.6
1500	ext wall	1.0	1.1	1.2	1.2	1.3	1.4
	marriage	6.4	7.8	9.3	10.7	12.2	15.1
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	4.8	5.9	7.0	8.1	9.1	11.3
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.8	4.7	5.6 :	6.4	7.3	9.1
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.2	3.9	4.6	5.4	6.1	7.5
3500	ext wall	1.07	1.0	1.0	1.0	1.0	1.0
	marriage	2.7	3.4	4.0	4.6	5.2	6.5
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
÷.,	marriage	2.4	2.9	3.5	4.0	4.6	5.7
Net So	il	1	Marriage V	Wall Oper	uing Widt	th (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	19.6	23.3	27.1	30.8	34.6	38.3
1500	marriage	13.1	15.6	18.1	20.5	23.0	25.5
2000	marriage	9.8	11.7	13.5	15.4	17.3	19.1
2500	marriage	7.8	9.3	10.8	12.3	13.8	15.3
3000	marriage	6.5	7.8	9.0	10.3	11.5	12.8
3500	marriage	5.6	6.7	7.7	8.8	9.9	10.9
4000	marriage	4.9	5.8	6.8	7.7	8.6	9.6

	· ·	Grou	nd Sno	w: 10	0 psf		
Net So	il	Tra	insverse (	Girder and	l Pier Spa	cing (ft)	
Pres (p	sf)	4	5	6	7	8	10
1000	ext wall	1.6	1.7	1.8	1.9	1.9	2.1
	mairiage	10.0	12.3	14.6	16.9	19.2	23.7
1500	ext wall	1.1	1.1	1.2	1.2	1.3	1.4
	marriage	6.7	8.2	9.7	11.2	12.8	15.8
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.1
	marriage	5.0	6.2 \	7.3	8.4	9.6	11.9
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	4.0	4.9	5.8	6.7	7.7	9.5
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
· · ·	marriage	3.3	4.1	4.9	5.6	6.4	7.9
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.9	3.5	4.2	4.8	5.5	6.8
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.5	3.1	3.6	4.2	4.8	5.9
Net Soi		N	Aarriage V	Vall Oper	ning Widt	th (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	20.7	24.6	28.6	32.6	36.5	40 ~
1500	marriage	13.8	16.4	19.1	21.7	24.3	27
2000	marriage	10.3	12.3	14.3	16.3	18.3	20.2
2500	marriage	8.3	9.9	11.4	13.0	14.6	16.2
3000	marriage	6.9	8.2	9.5	10.9	12.2	13.5
3500	marriage	5.9	7.0	8.2	9.3	10.4	11.6
4000	marriage	5.2	6.2	7.2	8.1	9.1	10.1

Aftg

Г E5, E6 Multi-Section

### **Multi-Section E7**

Required Effective Footing - Aftg \*

	· . · ·	۸/:	n Doo	f. 15-	nof		
Net So			<u>n. Roo</u>				
			ansverse C				. 10
Pres (p 1000	ext wall	4	5	6	7	8	10
1000			1.7	1.7	1.7	1.7	1.7
1500	marriage	<u>60</u> 12	7.1	8.2	9.3	10.4	12.6
1000	ext wall		1.2	1.2	1.2	1.2	. 1.2
2000	marriage	4.0	47	5.5	6.2	6.9	8.4
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
2500	marriage	3.0	3.6	4.1	4.6	5.2	6.3
2300	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
2000	marriage	2.4	2.8	3.3	-3.7	4.2	5.0
3000	ext wali	1.0	1.0	1.0	1.0	1.0	1.0
2500	marriage	2.0	2.4	2.7	3.1	3:5	4.2
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
1000	marriage	1.7	2.0	2.3	2.7	3.0	3.6
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage		1.8	2.0	2.3	2.6	3.1
Net So			Marriage V		· ·		1
Pres (p		10	12	14	16	18	20
1000	marriage	10.2	11.9	13,6	15.4	17.1	18.8
1500	marriage	6.8	8.0	9.1	10.2	11.4	12.5
2000	marriage	5.1	6.0	6.8	7.7	. 8.5	9.4
2500	marriage	4.1	4.8	5.5	6.1	6.8	7.5
3000	marriage	3.4	4.0	4.5	5.1	5.7	6.3
3500	marriage	2.9	3.4	3.9	4.4	. 4.9	5.4
4000	marriage	2.6	3.0	3.4	3.8	4.3	4.7
1	*** * * **** *		······		··· ·· ·		
	· · · · ·		ind Sno		-	- <u>u</u>	
Net Soi			insverse G		-	-	
Pres (p		4	5	6	7	8	10
1000	ext wall	1.8	1.8	1.7	1.7	1.7	1.7
	marriage	6.1	7.3	8.4	9.5	10.6	12.9
1500	ext wall	1.2	1.2	1.2	1.2	1.2	1.2
¢	marriage	4.1	4.8	5.6	6.3	7.1	8.6
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.1	3.6	4.2	47	5.3	6.4
2500	ext wall	1.0	1.0	1.0	1.0	10	1.0
	marriage	2.5	2.9	3.3	3.8	4.2	5.1
3000	ext wall	1.0	1.0				
				1.0	1.0	- 1.0	1.0
	marriage	2.0	2.4	1.0 2.8	1.0 3.2	1.0 3.5	1.0 <u>4.3</u>
3500							
	marriage	2.0	2.4	2.8	3.2	3.5	4.3
3500 4000	marriage ext wall	2.0	2.4 1.0 2.1 1.0	2.8 1.0 2.4 1.0	<u>3.2</u> 1.0	3.5	4.3
4000	marriage ext wall marriage ext wall marriage	2.0 1.0 1.8 1.0 1.5	2.4 1.0 2.1 1.0 1.8	2.8 1.0 2.4 1.0 2.1	3.2 1.0 2.7 1.0 2.4	3.5 10 3.0 1.0 2.7	4.3 1.0 3.7
4000 Net Soi	marriage ext wall marriage ext wall marriage	2.0 1.0 1.8 1.0 1.5	2.4 1.0 2.1 1.0 1.8 Marriage V	2.8 1.0 2.4 1.0 2.1	3.2 1.0 2.7 1.0 2.4 ning Widt	3.5 10 3.0 1.0 2.7	4.3 1.0 3.7 1.0 3.2
4000	marriage ext wall marriage ext wall marriage	2.0 1.0 1.8 1.0 1.5	2.4 1.0 2.1 1.0 1.8	2.8 1.0 2.4 1.0 2.1 Vall Oper 14	3.2 1.0 2.7 1.0 2.4	3.5 10 3.0 1.0 2.7	4.3 1.0 3.7 1.0 3.2 20
4000 Net Soi Pres (pr 1000	marriage ext wall marriage ext wall marriage il sf) marriage	2.0 1.0 1.8 1.0 1.5	2.4 1.0 2.1 1.0 1.8 Marriage V	2.8 1.0 2.4 1.0 2.1 Vall Oper	3.2 1.0 2.7 1.0 2.4 ning Widt	3.5 10 3.0 1.0 2.7 h (ft)	4.3 1.0 3.7 1.0 3.2
4000 Net Soi Pres (p: 1000 1500	marriage ext wall marriage ext wall marriage il sf)	2.0 1.0 1.8 1.0 1.5 M 10 10.5 7.0	2.4 1.0 2.1 1.0 1.8 Marriage V 12	2.8 1.0 2.4 1.0 2.1 Vall Oper 14	3.2 1.0 2.7 1.0 2.4 ning Widt 16	3.5 10 3.0 1.0 2.7 h (ft) 18	4.3 1.0 3.7 1.0 3.2 20
4000 Net Soi Pres (p 1000 1500 2000	marriage ext wall marriage ext wall marriage il sf) marriage	2.0 1.0 1.8 1.0 1.5 N 10 10.5 7.0 5.3	2.4 1.0 2.1 1.0 1.8 Marriage V 12 12.3 8.2 6.1	2.8 1.0 2.4 1.0 2.1 Vall Oper 14 14.1 9.4 7.0	3.2 1.0 2.7 1.0 2.4 16 15.8 10.5 7.9	3.5 10 3.0 1.0 2.7 h (ft) 18 17.6	4.3 1.0 3.7 1.0 3.2 20 19.4 12.9 9.7
4000 Net Soi Pres (p. 1000 1500 2000 2500	marriage ext wall marriage ext wall marriage sf) marriage marriage	2.0 1.0 1.8 1.0 1.5 N 10 10.5 7.0 5.3 4.2	2.4 1.0 2.1 1.0 1.8 Marriage V 12 12.3 8.2 6.1 4.9	2.8 1.0 2.4 1.0 2.1 Vall Oper 14 14.1 9.4 7.0 5.6	3.2 1.0 2.7 1.0 2.4 16 15.8 10.5 7.9 6.3	3.5 10 3.0 1.0 2.7 h (ft) 18 17.6 11.7	4.3 1.0 3.7 1.0 3.2 20 19.4 12.9 9.7 7.7
4000 Net Soi Pres (p 1000 1500 2000 2500 3000	marriage ext wall marriage ext wall marriage ll sf) marriage marriage marriage marriage	2.0 1.0 1.8 1.0 1.5 N 10 10.5 7.0 5.3 4.2 3.5	2.4 1.0 2.1 1.0 1.8 Marriage V 12 12.3 8.2 6.1 4.9 4.1	2.8 1.0 2.4 1.0 2.1 Vall Oper 14 14.1 9.4 7.0 5.6 4.7	3.2 1.0 2.7 1.0 2.4 105 15.8 10.5 7.9 6.3 5.3	3.5 1.0 3.0 1.0 2.7 h (ft) 18 17.6 11.7 8.8 7.0 5.9	4.3 1.0 3.7 1.0 3.2 20 19.4 12.9 9.7 7.7 6.5
4000 Net Soi Pres (p. 1000 1500 2000 2500	marriage ext wall marriage ext wall marriage sf) marriage marriage marriage marriage	2.0 1.0 1.8 1.0 1.5 N 10 10.5 7.0 5.3 4.2	2.4 1.0 2.1 1.0 1.8 Marriage V 12 12.3 8.2 6.1 4.9	2.8 1.0 2.4 1.0 2.1 Vall Oper 14 14.1 9.4 7.0 5.6	3.2 1.0 2.7 1.0 2.4 16 15.8 10.5 7.9 6.3	3.5 1.0 3.0 1.0 2.7 h (ft) 18 17.6 11.7 8.8 7.0	4.3 1.0 3.7 1.0 3.2 20 19.4 12.9 9.7 7.7



G	round S						sf
Net So	il	Tra	insverse C	birder and	Pier Spa	cing (ft)	· . · ·
Pres (p	sf)	4	5	6	7	8	10
1000	ext wall	1.8	1.8	1.8	1.8	1.8	1.8
	marriage	6.3	7.5	8.6	9.8	10.9	13.3
1500	ext wall	1.2	1.2	1.2	1.2	1.2	1.2
	marriage	4.2	5.0	5.7	6.5	7.3	8.8
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.1	3.7	4.3	4.9	5.5	6.6
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
<u>.</u>	marriage	2.5	3.0	3.4	3.9	4.4	5.3
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.1	2.5	2.9	3.3	3.6	4.4
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
· · · · ·	marriage	1.8	2.1	2.5	2.8	3.1	3.8
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
100 A	marriage	1.6	1.9	2.2	2.4	2.7	3.3
Net Soi	iI.	N	Marriage V	Wall Oper	ung Wid	th (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	10.9	12.8	14.6	16.5	18.3	20.2
1500	marriage	7.3	8.5	9:8	11.0	12.2	13.5
2000	marriage	5.5	6.4	7.3	8.2	9.2	10.1
2500	marriage	4.4	5.1	5.9	6.6	7.3	8.1
3000	marriage	3.6	4.3	4.9	5.5	6.1	-6.7
3500	marriage	3.1	3.7	4.2	4.7	5.2	5.8
4000	marriage	2.7	3.2	3.7	4.1	4.6	5.0

	E LEVER		Section dth	n l			· · · ·	Req	uired Ef	fectiv	ve Foot	ting - A	Aftg *	
		Gro	und Sn	ow: 40	0 psf			[		Gro	und Sr	10W: 5	) psf	
Net Sc	oil		ansverse			acing (ft)		Net Sc			ansverse			
Pres (p	osf)	4	5	6	7	8	10	Pres (r		4	5	6	а гист эр 7	acing (ii) 8
1000	ext wall	1.8	1.8	1.8	1.8	1.8	1.8	1000	ext wall	1.9	1.9	1.9	1.8	1.8
	marriage	6.6	7.9	9.1	10.4	11.6	14.1	· · · ·	marriage	6.9	8.3	9.6	10.9	12.3
1500	ext wall	1.2	1.2	1.2	1.2	1.2	1.2	1500	ext wall	1.2	1.2	1.2	1.2	1.2
	marriage	4.4	5.2	6.1	6.9	7.7	9.4		marriage	4.6	5.5	6.4	7.3	8.2
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	2000	ext wall	1.0	1.0	1.0	1.0	1.0
	marriage	3.3	3.9	4.6	5.2	5.8	7.0	<u> </u>	marriage	3.5	4.1	4.8	5.5	6.1
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	2500	ext wall	1.0	1.0	1.0	1.0	1.0
2000	marriage	2.6	3.1	3.6	4.1	4.6	5.6	· · · ·	marriage	2.8	3.3	3.8	4.4	4.9
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	3000	ext wall	1.0	1.0	1.0	1.0	1.0
3500	marriage	2.2	2.6	3.0	3.5	3.9	4.7	+ <b>-</b>	marriage	2.3	2.8	3.2	3.6	4.1
3300	ext wall marriage	1.0 1.9	1.0 2.2	1.0	1.0	1.0	1.0	3500	ext wall	1.0	1.0	1.0	1.0	1.0
4000	ext wall	1.9	1.0	2.6	3.0	3.3	4.0	4000	marriage		2.4	2.7	3.1	3.5
4000	marriage	1.0	2.0	2.3	2.6	1.0 2.9	1.0 3.5	4000	ext wall	1.0	1.0	1.0	1.0	1.0
Net So			Marriage				3.5	Net So	marriage	1.7	2.1	2.4	2.7	3.1
Pres (p		. 10	12	14	16	18	20	Pres (p		10	Marriage 12			
1000	marriage	11.7	13.8	15.8	17.8	19.8	21.8	1000	marriage	12.6	12	<u>14</u> 16.9	<u> </u>	18
1500	marriage	7.8	9.2	10.5	11.9	13.2	14.5	1500	marriage	8.4	9.8	11.3	19.1	14.2
2000	marriage	5.9	6.9	7.9	8.9	9.9	10.9	2000	marriage	6.3	7.4	8.5	9.5	14.2
2500	marriage	4.7	5.5	6.3	7.1	7.9	8.7	2500	marriage	5.0	5.9	6.8	7.6	8.5
3000	marriage	3.9	4.6	5.3	5.9	6.6	7.3	3000	marriage	4.2	4.9	5.6	6.4	7.1
3500	marriage	3.4	3.9	4.5	5.1	5.7	6.2	3500	marriage	3.6	4.2	4.8	5.5	6.1
4000	_ marriage	2.9	3.4	3.9	4.4	4.9	5.5	4000	marriage	3.1	3.7	4.2	4.8	5.3
		Grou	ind Sne	ow: 60	) psf	$(s,s) \in \mathbb{R}^{n \times n}$			···· · · · ·	Grou	ind Sn	ow• 70	nef	1
Net Soi	il		insverse C			cing (ft)	,	Net Soi	1	Tra	insverse C	virder and	Dier Sna	cing (ft)
Pres (ps	sf)	4	5	6	7	8	10	Pres (ps		4	5	6	7	8
1000	ext wall	1.9	1.9	1.9	1.9	1.9	1.9	1000	ext wall	1.9	1.9	1.9	1.9	1.9
	marriage	7.3	8.7	10.1	11.5	12.9	15.7		marriage	7.6	9.1	10.6	12.1	13.6
1500	ext wall	1.3	1.3	1.3	1.3	1.3	1.3	1500	ext wall	1.3	- 1.3	1.3	1.3	1.3
· .	marriage	4.8	5.8	6.7	7.7	8.6	10.5		marriage	5.1	6.1	7.1	8.0	9.0
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	2000	ext wall	1.0	1.0	1.0	1.0	1.0
	marriage	3.6	4.3	5.0	5.7	6.5	7.9		marriage	3.8	4.5	5.3	6.0	6.8
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	2500	ext wall	1.0	1.0	1.0	1.0	1.0
	marriage	2.9	3.5	4.0	4.6	5.2	6.3		marriage	3.0	3.6	4.2	4.8	5.4
3000	ext wall	1.0	1.0	1.0	. 1.0	1.0	1.0	3000	ext wall	1.0	1.0	1.0	1.0	1.0
		2.4	2.9	3.4	3.8	4.3	5.2		marriage	2.5	3.0	3.5	4.0	4.5
	marriage						1.0	2500						
3500	ext wall	1,0	1.0	1.0	1.0	0.1	1.0	3500	ext wall	1.0	1.0	1.0	1.0	1.0
	ext wall marriage	1,0 2.1	2.5	2.9	3.3	3.7	4.5		marriage	2.2	2.6	3.0	3.4	3.9
3500 4000	ext wali marriage ext wall	1.0 2.1 1.0	2.5	2.9	3.3	<u>3.7</u> 1.0	<u>4.5</u> 1.0	4000	marriage ext wall	2.2 1.0	2.6	<u> </u>	<u>3.4</u> 1.0	3.9 1.0
4000	ext wali marriage ext wall marriage	1.0 2.1 1.0 1.8	2.5 1.0 2.2	2.9 1.0 2.5	3.3 1.0 2.9	3.7 1.0 3.2	4.5	4000	marriage ext wall marriage	2.2 1.0 1.9	2.6 1.0 2.3	3.0 1.0 2.6	3.4 1.0 3.0	3.9 1.0 3.4
4000 Net Soi	ext wall marriage ext wall marriage I	1,0 2.1 1.0 1.8	2.5 1.0 2.2 Marriage V	2.9 1.0 2.5 Wall Oper	3.3 1.0 2.9 ning Widt	3.7 1.0 3.2 h (ft)	4.5 1.0 3.9	4000 Net Soi	marriage ext wall marriage l	2.2 1.0 1.9	2.6 1.0 2.3 Marriage V	3.0 1.0 2.6 Vall Oper	3.4 1.0 3.0 iing Widt	3.9 1.0 3.4 h (ft)
4000 Net Soi Pres (ps	ext wall marriage ext wall marriage l	1,0 2,1 1.0 1.8 N 10	2.5 1.0 2.2 Marriage V 12	2.9 1.0 2.5 Wall Oper 14	3.3 1.0 2.9 11ng Widt 16	3.7 1.0 3.2 h (ft) 18	4.5 1.0 3.9 20	4000 Net Soi Pres (ps	marriage ext wall marriage l	2.2 1.0 1.9 N 10	2.6 1.0 2.3 Marriage V 12	3.0 1.0 2.6 Wall Oper 14	3.4 1.0 3.0 ing Widt 16	3.9 1.0 3.4 h (ft) 18
4000 Net Soi Pres (ps 1000	ext wali marriage ext wall marriage 1 sf) marriage	1,0 2.1 1.0 1.8 N 10 13.4	2.5 1.0 2.2 Marriage V 12 15.7	2.9 1.0 2.5 Wall Oper 14 18.1	3.3 1.0 2.9 ning Widt 16 20.4	3.7 1.0 3.2 h (ft) 18 22.7	<u>4.5</u> 1.0 3.9 <u>20</u> 25.1	4000 Net Soil Pres (ps 1000	marriage ext wall marriage l f) marriage	2.2 1.0 1.9 N 10 14.2	2.6 1.0 2.3 Marriage V 12 16.7	3.0 1.0 2.6 Wall Oper 14 19.2	3.4 1.0 3.0 ing Widt 16 21.7	3.9 1.0 3.4 h (ft) 18 24.2
4000 Net Soi Pres (ps	ext wali marriage ext wall marriage i sf) marriage marriage	1,0 2,1 1.0 1.8 N 10 13,4 8,9	2.5 1.0 2.2 Marriage V 12 15.7 10.5	2.9 1.0 2.5 Vall Oper 14 18.1 12.0	3.3 1.0 2.9 ning Widt 16 20.4 13.6	3.7 1.0 3.2 h (ft) 18 22.7 15.2	4.5 1.0 3.9 20 25.1 16.7	4000 Net Soil Pres (ps 1000 1500	marriage ext wall marriage f) marriage marriage	2.2 1.0 1.9 N 10 14.2 9.5	2.6 1.0 2.3 Marriage V 12 16.7 11.1	3.0 1.0 2.6 Wall Open 14 19.2 12.8	3.4 1.0 3.0 ing Widt 16 21.7 14.5	3.9 1.0 3.4 h (ft) 18 24.2 16.1
4000 Net Soi Pres (ps 1000 1500	ext wali marriage ext wall marriage 1 sf) marriage	1,0 2.1 1.0 1.8 N 10 13.4	2.5 1.0 2.2 Marriage V 12 15.7	2.9 1.0 2.5 Wall Oper 14 18.1	3.3 1.0 2.9 10 10 2.9 10 10 20.4 13.6 10.2	3.7 1.0 3.2 h (ft) 18 22.7 15.2 11.4	4.5 1.0 3.9 20 25.1 16.7 12.5	4000 Net Soil Pres (ps 1000 1500 2000	marriage ext wall marriage f) marriage marriage marriage	2.2 1.0 1.9 N 10 14.2 9.5 7.1	2.6 1.0 2.3 Marriage V 12 16.7 11.1 8.3	3.0 1.0 2.6 Vall Oper 14 19.2 12.8 9.6	3.4 1.0 3.0 ing Widt 16 21.7 14.5 10.9	3.9 1.0 3.4 h (ft) 18 24.2 16.1 12.1
4000 Net Soi Pres (ps 1000 1500 2000 2500 3000	ext wali marriage ext wali marriage i sf) marriage marriage marriage	1,0 2,1 1.0 1.8 N 10 13.4 8.9 6.7	2.5 1.0 2.2 Marriage V 12 15.7 10.5 7.9	2.9 1.0 2.5 Vall Oper 14 18.1 12.0 9.0	3.3 1.0 2.9 ning Widt 16 20.4 13.6	3.7 1.0 3.2 h (ft) 18 22.7 15.2	4.5 1.0 3.9 20 25.1 16.7	4000 Net Soil Pres (ps 1000 1500	marriage ext wall marriage f) marriage marriage marriage marriage	2.2 1.0 1.9 N 10 14.2 9.5 7.1 5.7	2.6 1.0 2.3 Marriage V 12 16.7 11.1 8.3 6.7	3.0 1.0 2.6 Wall Open 14 19.2 12.8 9.6 7.7	3.4 1.0 3.0 ing Widt 16 21.7 14.5 10.9 8.7	3.9 1.0 3.4 h (ft) 18 24.2 16.1 12.1 9.7
4000 Net Soi Pres (ps 1000 1500 2000 2500	ext wali marriage ext wali marriage i sf) marriage marriage marriage marriage	1,0 2,1 1.0 1.8 N 10 13.4 8.9 6.7 5.3	2.5 1.0 2.2 Marriage V 12 15.7 10.5 7.9 6.3	2.9 1.0 2.5 Wall Oper 14 18.1 12.0 9.0 7.2	3.3 1.0 2.9 10 10 20.4 13.6 10.2 8.2	3.7 1.0 3.2 h (ft) 18 22.7 15.2 11.4 9.1	4.5 1.0 3.9 20 25.1 16.7 12.5 10.0	4000 Net Soil Pres (ps 1000 1500 2000 2500	marriage ext wall marriage f) marriage marriage marriage	2.2 1.0 1.9 N 10 14.2 9.5 7.1	2.6 1.0 2.3 Marriage V 12 16.7 11.1 8.3	3.0 1.0 2.6 Vall Oper 14 19.2 12.8 9.6	3.4 1.0 3.0 ing Widt 16 21.7 14.5 10.9	3.9 1.0 3.4 h (ft) 18 24.2 16.1 12.1

10 1.8 <u>14.9</u> 1.2 9.9 1.0 7.5 1.0 6.0 1.0 5.0 1.0 4.3 1.0 3.7 20 23.4 15.6 11.7 9.4 7.8 6.7 5.9

10 1.9 16.5 1.3 11.0

1.0 8.3 1.0 6.6 1.0 5.5

1.0 4.7 1.0 4.1

20 26.7 17.8 13.4 10.7 8.9 7.6 6.7

\* Minimum interior pier area is 1.0 sqft. The Exterior Footing Widths are shown in feet. The Marriage Wall Footing Areas are shown in square feet.

#### B-40

	· ·	
	A	itg
Multi-Section	E	7
Width	<b>I</b>	2
and the second second second second second second second second second second second second second second second		

	·	Grou	und Sn	ow: 80	) psf	-	
Net S	oil	Tr	ansverse (	Girder and	Pier Spa	cing (ft)	
Pres (		4	5	6	7	8	10
1000	ext wall	2.0	2.0	2.0	2.0	2.0	2.
	marriage	7.9	9.5	11.1	12.6	14.2	17.
1500	ext wall	1.3	1.3	1.3	1.3	1.3	1.
	marriage	5.3	6.3	7.4	8.4	9.5	11.
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.
	marriage	4.0	4.7	5.5	6.3	7.1	8.
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.
	marriage	3.2	3.8	4.4	5.1	5.7	6
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.
	marriage	2.6	3.2	3.7	4.2	4.7	5.
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.
•	marriage	2.3	2.7	3.2	3.6	4.1	5.
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.
	marriage	2.0	2.4	2.8	3.2	3.6	4.
Net Sc			Marriage		aing Wid	th (ft)	
Pres (		10	12	14	16	18	20
1000		15.0	17.7	20.3	23.0	25.7	28.
1500	marriage	10.0	11.8	13.6	15.3	17.1	18.
2000 .	marriage	7.5	8.8	10.2	11,5	12.8	14.
2500	marriage	6.0	7.1	8.1	9.2	10.3	11.
3000	marriage	5.0	5.9	6.8	7.7	8.6	9.
3500	marriage	4.3	5.1	5.8	6.6	7:3	8.
4000	marriage	3.8	4.4	5.1	5.8	6.4	7.
			na ono	w: 100	) pst		
	il	Tra	insverse C	W: IUC	) pst Pier Spac	cing (ft)	
Pres (p	il sf)	Тта 4	insverse C 5	irder and 6	Pier Spac 7	8	
Pres (p	il sf) ext wall	Tra 4 2.1	nsverse C 5 2.1	firder and 6 2.1	Pier Spac 7 2.1	<u>8</u> 2.1	2.0
Pres (p 1000	il esf) ext wall marriage	Tra 4 2.1 8.6	nsverse C 5 2.1 10.3	irder and 6 2.1 12.0	Pier Spac 7	<u>8</u> 2.1	2.0
Pres (p 1000	il sf) ext wall marriage ext wall	Tra 4 2.1 8.6 1.4	nsverse C 5 2.1 10.3 1.4	irder and 6 2.1 12.0 1.4	Pier Spac 7 2.1 13.8 1.4	8 2.1 15.5 1.4	2.( 19.(
Pres (p 1000 1500	il ext wall marriage ext wall marriage	Tra 4 2.1 8.6 1.4 5.7	10.3 1.4 6.9	irder and 6 2.1 12.0 1.4 8.0	Pier Spac 7 2.1 13.8 1.4 9.2	8 2.1 15.5	2.0 19.0 1.4
Pres (p 1000 1500	il sf) ext wall marriage ext wall marriage ext wall	Tra 4 2.1 8.6 1.4 5.7 1.0	nsverse C 5 2.1 10.3 1.4 6.9 1.0	iirder and 6 2.1 12.0 1.4 8.0 1.0	Pier Spac 7 2.1 13.8 1.4 9.2 1.0	8 2.1 15.5 1.4	2.0 19.0 1.4 12.7
Pres (p 1000 1500 2000	il sf) ext wall marriage ext wall marriage ext wall marriage	Tra 4 2.1 8.6 1.4 5.7 1.0 4.3	nsverse C 5 2.1 10.3 1.4 6.9 1.0 5.2	irder and 6 2.1 12.0 1.4 8.0 1.0 6.0	Pier Spac 7 2.1 13.8 1.4 9.2 1.0 6.9	8 2.1 15.5 1.4 10.3 1.0 7.8	2.0 19.0 1.4 12.7 1.0 9.4
Pres (p 1000 1500 2000	il ssf) ext wall marriage ext wall marriage ext wall marriage ext wall	Tra 4 2.1 8.6 1.4 5.7 1.0 4.3 1.0	nsverse C 5 2.1 10.3 1.4 6.9 1.0 5.2 1.0	irder and 6 2.1 12.0 1.4 8.0 1.0 6.0 1.0	Pier Spac 7 2.1 13.8 1.4 9.2 1.0 6.9 1.0	8 2.1 15.5 1.4 10.3 1.0 - 7.8 1.0	2.0 19.0 1.4 12.7 1.0 9.4
Pres (p 1000 1500 2000 2500	il ext wall marriage ext wall marriage ext wall marriage ext wall marriage	Tra 4 2.1 8.6 1.4 5.7 1.0 4.3 1.0 3.4	nsverse C 5 2.1 10.3 1.4 6.9 1.0 5.2 1.0 4.1	irder and 6 2.1 12.0 1.4 8.0 1.0 6.0 1.0 4.8	Pier Spac 7 2.1 13.8 1.4 9.2 1.0 6.9 1.0 5.5	8 2.1 15.5 1.4 10.3 1.0 -7.8 1.0 6.2	2.0 19.0 1.4 12 1.0 9.5 1.0 7.0
Pres (p 1000 1500 2000 2500	il ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall	Tra 4 2.1 8.6 1.4 5.7 1.0 4.3 1.0 3.4 1.0	ansverse C 5 2.1 10.3 1.4 6.9 1.0 5.2 1.0 4.1 1.0	irder and 6 2.1 12.0 1.4 8.0 1.0 6.0 1.0 4.8 1.0	Pier Spac 7 2.1 13.8 1.4 9.2 1.0 6.9 1.0 5.5 1.0	8 2.1 15.5 1.4 10.3 1.0 - 7.8 1.0 6.2 1.0	2.0 19.0 1.4 12.7 1.0 9.5 1.0 7.6 1.0
Pres (p 1000 1500 2000 2500 3000	il ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage	Tra 4 2.1 8.6 1.4 5.7 1.0 4.3 1.0 3.4 1.0 2.9	ansverse C 5 2.1 10.3 1.4 6.9 1.0 5.2 1.0 4.1 1.0 3.4	irder and 6 2.1 12.0 1.4 8.0 1.0 6.0 1.0 4.8 1.0 4.0	Pier Spac 7 2.1 13.8 1.4 9.2 1.0 6.9 1.0 5.5 1.0 4.6	8 2.1 15.5 1.4 10.3 1.0 7.8 1.0 6.2 1.0 5.2	2.0 19.0 1.4 12.7 1.0 9.4 1.0 7.6 1.0 6.3
Pres (p 1000 1500 2000 2500 3000	il ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall	Tra 4 2.1 8.6 1.4 5.7 1.0 4.3 1.0 3.4 1.0 2.9 1.0	msverse C 5 2.1 10.3 1.4 6.9 1.0 5.2 1.0 4.1 1.0 3.4 1.0	index         and         6         2.1         12.0         1.4         8.0         1.0         6.0         1.0         6.0         1.0         4.8         1.0         4.0         1.0         4.0         1.0 <td>Pier Spac 7 2.1 13.8 1.4 9.2 1.0 6.9 1.0 5.5 1.0 4.6 1.0</td> <td>8 2.1 15.5 1.4 10.3 1.0 7.8 1.0 6.2 1.0 5.2 1.0</td> <td>2.0 19.0 1.4 12.7 1.0 7.0 7.0 1.0 7.0 1.0 6.2</td>	Pier Spac 7 2.1 13.8 1.4 9.2 1.0 6.9 1.0 5.5 1.0 4.6 1.0	8 2.1 15.5 1.4 10.3 1.0 7.8 1.0 6.2 1.0 5.2 1.0	2.0 19.0 1.4 12.7 1.0 7.0 7.0 1.0 7.0 1.0 6.2
Pres (p 1000 1500 2000 2500 3000 3500	il sf) ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage	Tra 4 2.1 8.6 1.4 5.7 1.0 4.3 1.0 3.4 1.0 2.9 1.0 2.5	nnsverse C 5 2.1 10.3 1.4 6.9 1.0 5.2 1.0 4.1 1.0 3.4 1.0 2.9	irder and 6 2.1 12.0 1.4 8.0 1.0 6.0 1.0 4.8 1.0 4.0 1.0 3.4	Pier Spac 7 2.1 13.8 1.4 9.2 1.0 6.9 1.0 5.5 1.0 4.6 1.0 3.9	8 2.1 15.5 1.4 10.3 1.0 7.8 1.0 6.2 1.0 5.2 1.0 4.4	2.0 19.0 1.4 12.7 1.0 9.4 1.0 7.0 1.0 6.5 1.0 5.4
Pres (p 1000 1500 2000 2500 3000 3500	il ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall	Tra 4 2.1 8.6 1.4 5.7 1.0 4.3 1.0 3.4 1.0 2.9 1.0 2.5 1.0	Insverse C           5           2.1           10.3           1.4           6.9           1.0           5.2           1.0           4.1           1.0           3.4           1.0           2.9           1.0	irder and 6 2.1 12.0 1.4 8.0 1.0 6.0 4.8 1.0 4.0 1.0 3.4 1.0 3.4 1.0	Pier Spac 7 2.1 13.8 1.4 9.2 1.0 6.9 1.0 5.5 1.0 4.6 1.0 3.9 1.0	8 2.1 15.5 1.4 10.3 1.0 7.8 1.0 6.2 1.0 5.2 1.0 5.2 1.0 4.4 1.0	2.0 19.0 1.4 12.1 1.0 9.4 1.0 7.0 1.0 6.5 1.0 5.4 1.0
Pres (p 1000 1500 2000 2500 3000 3500 4000	il ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage	Tra 4 2.1 8.6 1.4 5.7 1.0 4.3 1.0 3.4 1.0 2.9 1.0 2.5 1.0 2.1	Insverse C           5           2.1           10.3           1.4           6.9           1.0           5.2           1.0           4.1           1.0           3.4           1.0           2.9           1.0           2.6	irder and 6 2.1 12.0 1.4 8.0 1.0 6.0 1.0 4.8 1.0 4.0 1.0 3.4 1.0 3.0	Pier Space 7 2.1 13.8 1.4 9.2 1.0 6.9 1.0 5.5 1.0 4.6 1.0 3.9 1.0 3.4	8 2.1 15.5 1.4 10.3 1.0 7.8 1.0 6.2 1.0 5.2 1.0 5.2 1.0 4.4 1.0 3.9	2.0 19.0 1.4 12.1 1.0 9.4 1.0 7.0 1.0 6.5 1.0 5.4 1.0
Pres (p 1000 1500 2000 2500 3000 3500 4000 Net So	il ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage il	Tra 4 2.1 8.6 1.4 5.7 1.0 4.3 1.0 3.4 1.0 2.9 1.0 2.5 1.0 2.1 N	nsverse C 5 2.1 10.3 1.4 6.9 1.0 5.2 1.0 4.1 1.0 2.9 1.0 2.6 Marriage V	irder and 6 2.1 12.0 1.4 8.0 1.0 6.0 1.0 4.8 1.0 4.0 1.0 3.4 1.0 3.0 Vall Open	Pier Space 7 2.1 13.8 1.4 9.2 1.0 6.9 1.0 5.5 1.0 4.6 1.0 3.9 1.0 3.4 ing Widt	8 2.1 15.5 1.4 10.3 1.0 7.8 1.0 6.2 1.0 5.2 1.0 5.2 1.0 4.4 1.0 3.9 h (ft)	2.0 19.0 1.4 12.7 1.0 7.0 7.0 1.0 6.5 1.0 5.4 1.0 4.7
Pres (p 1000 1500 2000 2500 3000 3500 4000 Net So Pres (p	il ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage il sf)	Tra 4 2.1 8.6 1.4 5.7 1.0 4.3 1.0 3.4 1.0 2.9 1.0 2.5 1.0 2.1 N 10 1.0 1.0 1.0 1.0 1.0 1.0 1.0	nsverse C 5 2.1 10.3 1.4 6.9 1.0 5.2 1.0 4.1 1.0 3.4 1.0 2.9 1.0 2.6 Marriage V 12	irder and 6 2.1 12.0 1.4 8.0 1.0 6.0 1.0 4.8 1.0 4.0 1.0 3.4 1.0 3.4 1.0 3.0 Vall Open 14	Pier Spac 7 2.1 13.8 1.4 9.2 1.0 6.9 1.0 5.5 1.0 4.6 1.0 3.9 1.0 3.4 ing Widt 16	8 2.1 15.5 1.4 10.3 1.0 7.8 1.0 6.2 1.0 5.2 1.0 5.2 1.0 4.4 1.0 3.9 h (ft) 18	2.0 19.0 1.4 12.7 1.0 9.5 1.0 7.6 5.4 1.0 5.4 1.0 5.4 20
Pres (p 1000 1500 2000 2500 3000 3500 4000 Net So Pres (p 1000	il ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage il sf) marriage	Tra 4 2.1 8.6 1.4 5.7 1.0 4.3 1.0 3.4 1.0 2.9 1.0 2.5 1.0 2.1 M 10 10 10 1.0 1.0 1.0 1.0 1.0 1	nsverse C 5 2.1 10.3 1.4 6.9 1.0 5.2 1.0 4.1 1.0 3.4 1.0 2.9 1.0 2.6 Marriage V 12 19.6	index and           6           2.1           12.0           1.4           8.0           1.0           6.0           1.0           4.8           1.0           4.0           1.0           3.4           1.0           3.4           1.0           3.4           1.0           3.4           1.0           3.4           1.0           3.4           1.0           3.4           1.0           3.2	Pier Spac 7 2.1 13.8 1.4 9.2 1.0 6.9 1.0 5.5 1.0 4.6 1.0 3.9 1.0 3.4 iing Widt 16 25.6	8 2.1 15.5 1.4 10.3 1.0 7.8 1.0 6.2 1.0 5.2 1.0 1.0 5.2 1.0 4.4 1.0 3.9 h (ft) 18 28.6	2.0 19.0 1.4 12.7 1.0 9.4 1.0 7.6 5.4 1.0 5.4 1.0 5.4 1.0 5.4 1.0 5.4 1.0 5.4 1.0 5.4 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0
Pres (p 1000 1500 2000 2500 3000 3500 4000 Net So Pres (p 1000 1500	il ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage il sf) marriage	Tra 4 2.1 8.6 1.4 5.7 1.0 4.3 1.0 3.4 1.0 2.9 1.0 2.5 1.0 2.1 N 10 1.0 1.0 1.0 1.0 1.0 1.0 1.0	nsverse C 5 2.1 10.3 1.4 6.9 1.0 5.2 1.0 4.1 1.0 3.4 1.0 2.9 1.0 2.6 Marriage V 12 19.6 13.1	irder and 6 2.1 12.0 1.4 8.0 1.0 6.0 1.0 4.8 1.0 4.0 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 5.1 1.4 8.0 1.4 8.0 1.4 8.0 1.4 8.0 1.0 1.0 8.0 1.0 1.0 8.0 1.0 1.0 8.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1	Pier Spac 7 2.1 13.8 1.4 9.2 1.0 6.9 1.0 5.5 1.0 4.6 1.0 3.9 1.0 3.4 ing Widt 16 25.6 17.1	8 2.1 15.5 1.4 10.3 1.0 7.8 1.0 6.2 1.0 5.2 1.0 5.2 1.0 4.4 1.0 3.9 h (ft) 18 28.6 19.1	2.0 19.0 1.4 12.7 1.0 7.0 7.0 7.0 7.0 7.0 1.0 7.0 7.0 1.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7
Pres (p 1000 1500 2000 2500 3500 3500 4000 4000 Net So Pres (p 1000 1500 2000	il ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage il sf) marriage marriage	Tra 4 2.1 8.6 1.4 5.7 1.0 4.3 1.0 3.4 1.0 2.9 1.0 2.5 1.0 2.5 1.0 2.1 N 10 1.6 1.1 8.3	ansverse C 5 2.1 10.3 1.4 6.9 1.0 5.2 1.0 4.1 1.0 3.4 1.0 2.9 1.0 2.6 Marriage V 12 19.6 13.1 9.8	irder and 6 2.1 12.0 1.4 8.0 1.0 6.0 1.0 4.8 1.0 4.8 1.0 4.0 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.1 1.0 3.4 1.1 1.0 3.4 1.1 1.0 3.4 1.1 1.0 3.4 1.1 1.0 3.4 1.1 1.0 3.4 1.0 3.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1	Pier Spac 7 2.1 13.8 1.4 9.2 1.0 6.9 1.0 5.5 1.0 4.6 1.0 3.9 1.0 3.4 ing Widt 16 25.6 17.1 12.8	8 2.1 15.5 1.4 10.3 1.0 7.8 1.0 6.2 1.0 5.2 1.0 5.2 1.0 4.4 1.0 3.9 h (ft) 18 28.6 19.1 14.3	2.0 19.0 1.4 12.7 1.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7
Pres (p 1000 1500 2000 2500 3500 3500 4000 4000 Net So Pres (p 1000 1500 2000 2500	il ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext mall marriage	Tra 4 2.1 8.6 1.4 5.7 1.0 4.3 1.0 3.4 1.0 2.9 1.0 2.5 1.0 2.1 N 10 16.6 11.1 8.3 6.7	msverse C 5 2.1 10.3 1.4 6.9 1.0 5.2 1.0 4.1 1.0 3.4 1.0 2.9 1.0 2.6 Marriage V 12 19.6 13.1 9.8 7.9	sirder and 6 2.1 12.0 1.4 8.0 1.0 6.0 1.0 4.8 1.0 4.0 1.0 4.8 1.0 4.0 1.0 3.4 1.0 3.4 1.0 3.4 1.0 5.1 1.1 1.1 9.1	Pier Space 7 2.1 13.8 1.4 9.2 1.0 6.9 1.0 5.5 1.0 4.6 1.0 3.9 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 5.5 1.0 4.6 1.0 5.5 1.0 4.6 1.0 5.5 1.0 4.6 1.0 5.5 1.0 5.5 1.0 5.5 5.5 1.0 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5	8 2.1 15.5 1.4 10.3 1.0 7.8 1.0 6.2 1.0 5.2 1.0 4.4 1.0 3.9 h (ft) 18 28.6 19.1 14.3 11.4	10 2.0 19.0 12.7 1.0 7.6 5.4 1.0 5.4 1.0 5.4 1.0 5.4 1.0 20 31.6 21.1 15.8 12.6
Pres (p 1000 1500 2000 2500 3000 3500 3500 4000 1500 1500 2500 3000	il ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage marriage marriage marriage marriage marriage marriage	Tra 4 2.1 8.6 1.4 5.7 1.0 4.3 1.0 3.4 1.0 2.9 1.0 2.5 1.0 2.1 N 10 16.6 11.1 8.3 6.7 5.5	msverse C 5 2.1 10.3 1.4 6.9 1.0 5.2 1.0 4.1 1.0 3.4 1.0 2.9 1.0 2.6 Matriage V 12 19.6 13.1 9.8 7.9 6.5	irder and 6 2.1 12.0 1.4 8.0 1.0 6.0 1.0 4.8 1.0 4.0 1.0 3.4 1.0 3.4 1.0 3.0 Vall Open 14 22.6 15.1 11.3 9.1 7.5	Pier Space 7 2.1 13.8 1.4 9.2 1.0 6.9 1.0 5.5 1.0 4.6 1.0 3.9 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.5 1.0 3.4 1.0 3.5 1.0 1.0 3.5 1.0 1.0 3.5 1.0 1.0 3.5 1.0 1.0 3.5 1.0 1.0 3.5 1.0 1.0 3.5 1.0 1.0 3.5 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	8 2.1 15.5 1.4 10.3 1.0 7.8 1.0 6.2 1.0 5.2 1.0 5.2 1.0 4.4 1.0 3.9 h (ft) 18 28.6 19.1 14.3 11.4 9.5	2.0 19.0 1.4 12.7 1.0 9.5 1.0 7.6 5.4 1.0 5.4 1.0 5.4 1.0 5.4 1.0 1.0 5.4 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0
Net So Pres (p 1000 2000 2500 3000 3500 4000 Net So Pres (p 1000 1500 2000 2500 3000 3500 4000	il ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext mall marriage	Tra 4 2.1 8.6 1.4 5.7 1.0 4.3 1.0 3.4 1.0 2.9 1.0 2.5 1.0 2.1 N 10 16.6 11.1 8.3 6.7	msverse C 5 2.1 10.3 1.4 6.9 1.0 5.2 1.0 4.1 1.0 3.4 1.0 2.9 1.0 2.6 Marriage V 12 19.6 13.1 9.8 7.9	sirder and 6 2.1 12.0 1.4 8.0 1.0 6.0 1.0 4.8 1.0 4.0 1.0 4.8 1.0 4.0 1.0 3.4 1.0 3.4 1.0 3.4 1.0 5.1 1.1 1.1 9.1	Pier Space 7 2.1 13.8 1.4 9.2 1.0 6.9 1.0 5.5 1.0 4.6 1.0 3.9 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 3.4 1.0 5.5 1.0 4.6 1.0 5.5 1.0 4.6 1.0 5.5 1.0 4.6 1.0 5.5 1.0 5.5 1.0 5.5 5.5 1.0 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5	8 2.1 15.5 1.4 10.3 1.0 7.8 1.0 6.2 1.0 5.2 1.0 4.4 1.0 3.9 h (ft) 18 28.6 19.1 14.3 11.4	2.0 19.0 1.4 12.7 1.0 9.5 9.5 1.0 7.6 6.3 1.0 6.3 1.0 5.4 1.0 4.7 20 31.6 21.1 15.8

	- ·		ind Sn								
Net So		Tra	ansverse (	Girder and	f Pier Spa	cing (ft)	_				
Pres (p	sf)	4	.5	6	7	8	10				
1000	ext wall	2.0	2.0	2.0	.2.0	2.0	2.0				
	marriage	8.3	9.9	11.6	13.2	14.9	18.2				
1500	ext wall	1.3	1.3	1.3	1.3	1.3	1.3				
	marriage	5.5	6.6	7.7	8.8	9.9	12.1				
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0				
	marriage	4.1	5.0	5.8	6.6	7.4	9.1				
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0				
	marriage	3.3	4.0	4.6	5.3	5.9	7.3				
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0				
	marriage	2.8	3.3	3.9	4.4	5.0	6.1				
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0				
	marriage	2.4	2.8	3.3	3.8	4.2	5.2				
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0				
· · ·	marriage	2.1	2.5	2.9	3.3	3.7	4.5				
Net Soi	1	N	Aarriage V	Wall Oper							
Pres (pr	sf)	10	12	14	16	18	20				
1000	marriage	15.8	18.7	21.5	24.3	27.1	30.0				
1500	marriage	10.5	12.4	14.3	16.2	18.1	20.0				
2000	marriage	7.9	9.3	10.7	12.2	13.6	15.0				
2500	marriage	6.3	7.5	8.6	9.7	10.9	12.0				
3000	marriage	5.3	6.2	7.2	8.1	9.0	10.0				
3500	marriage	4.5	5.3	6.1	6.9	7.8	8.6				
4000	marriage	4.0	4.7	5.4	6.1	6.8	7.5				

E State	ftg 57 M 4'	[ulti-S Wie	Section dth	n				Req	uired Ef	fectiv	ve Foot	ing - A	\ftg *	
			n. Roc					[	- <u></u>	Gro	und Sn	ow: 2	5 psf	
Net S	oil	Tr	ansverse (	Girder an	d Pier Spa	cing (ft)		Net Sc	oil		ansverse (			cing (ft)
Pres (	(psf)	4	5	6	. 7	8	10	Pres (		4	5	6	7	8 (11)
1000	ext wall	1.8	1.8	1.8	1.8	1.8	1.8	1000	ext wall	1.9	1.8	1.8	1.8	1.8
	marriage	6.8	8.0	9.3	10.6	11.8	14.4		marriage	6.9	8.2	9.5	10.8	12.1
-1500	ext wall	1.2	1.2	1.2	1.2	1.2	1.2	1500	ext wall	1.2	1.2	1.2	1.2	1.2
	marriage	4.5	5.3	6.2	7.0	7.9	9.6		marriage	4.6	5.5	6.3	7.2	8.1
2000	ext wall	1.0	<sup></sup> 1.0	1.0	1.0	1.0	1.0	2000	ext wall	1.0	1.0	1.0	1.0	1.0
	marriage	3.4	4.0	4.6	5.3	5.9	7.2		marriage	3.4	4.1	4.7	5.4	6.1
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	2500	ext wall	1.0	1.0	1.0	1.0	1.0
	marriage	2.7	3.2	3.7	4.2	4.7	5.7	• .	marriage	2.8	3.3	· 3.8	4.3	4.8
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	3000	ext wall	1.0	1.0	1.0	1.0	1.0
	marriage	2.3	2.7	3.1	3.5	3.9	4.8	1997 - 19	marriage	2.3	2.7	3.2	3.6	4.0
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	3500	ext wall	1.0	1.0	1.0	1.0	1.0
	marriage	1.9	2.3	2.7	3.0	3.4	4.1		marriage	2.0	2.3		3.1	3.5
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	4000	ext wall	1.0	1.0	1.0	1.0	1.0
<u> </u>	marriage	1.7	2.0	2.3	2.6	3.0	3.6		marriage	1.7	2.0	2.4	2.7	3.0
Net So	oil	N	Marriage 1	Wall Ope	ning Wid	th (ft)	· · · ·	Net So			Marriage V			th (ft)
Pres (j		10	12	14	16	18	20	Pres (p		10	12	14	16	18
1000	marriage	11.7	13.7	15.6	17.6	19.6	21.6	1000	marriage	12.0	14.1	16.1	18.2	20.2
1500	marriage	7.8	9.1	10.4	11.5	13.1	14.4	1500	marriage	8.0	9.4	10.8	12.1	13.5
2000	marriage	5.8	6.8	7.8	8.5	9.8	10.8	2000	marriage	6.0	7.0	8.1	9.1	10.1
2500	marriage	4.7	5.5	6.3	7.:	7.9	8.6	2500	marriage	4.8	5.6	6.5	7.3	8.1
3000	marriage	3.9	4.6	5.2	5.9	6.5	7.2	3000	marriage	4.0	4.7	.5.4	6.1	6.7
3500	marriage	3.3	3.9	4.5	5.0	5.6	6.2	3500	marriage	3.4	4.0	4.6	5.2	5.8
4000	marriage	2.9	3.4	3.9	4.4	. 4.9	5.4	4000	marriage	3.0	3.5	4.0	4.5	5.1
			-											
G	Fround St	now <sup>,</sup> '	30 nsf	& Mir	Root	f• 20 m	ef			Crow	nd Car			
Net Sc	vil	T			Pier Space	<u></u>	31				nd Sno			
Pres (1		4	iisveise G 5	6 nuer and	rier Spac		10	Net Soi			nsverse G			
1000	ext wall	1.9	1.9	1.9	1.9	8	<u>10</u> 1.9	Pres (p		4	5	6	7	8
1000	marriage	7.1	8.4	9.8	11.1	12.5		1000	ext wall	1.9	1.9	1.9	1.9	1.9
1500	ext wall	1.3	1.2	1.2			15.2	1600	marriage	7.5	8.9	10.4	11.8	13.3
1000	marriage	4.7	5.6	6.5	1.2 7.4	1.2	1.2	1500	ext wall	1.3	1.3	1.3	1.3	1.3
2000	ext wall	1.0	1.0	1.0	1.0	8.3	10.1	0000	marriage	5.0	5.9	6.9	7.9	8.8
2000	marriage	3.5	4.2	4.9	1.0 5.6	1.0	1.0	2000	ext wall	1.0	1.0	1.0	1.0	1.0
2500	ext wall	1.0	1.0	4.9		6.2	7.6	0.500	marriage	3.7	4.5	5.2	5.9	6.6
4000					1.0	1.0	1.0	2500	ext wall	1.0	1.0	1.0	1.0	1.0
3000	marriage	2.8	3.4	3.9	4.5	5.0	6.1		marriage	3.0	3.6	4.1	4.7	5.3
0000	ext wall		1.0 2.8	1.0	1.0	1:0	1.0	3000	ext wall	1.0	1.0	1.0	1.0	1.0
	monis		/ X .	3.3	3.7	4.2	5.1	· · · · · · · · · · · · · · · · · · ·	marriage	2.5	3.0	3.5	3.9	4.4
2500	marriage	2.4			1 .									
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	3500	ext wall	1.0	1.0	1.0	1.0	1.0
<u></u>	ext wall marriage	1.0 2.0	1.0 2.4	1.0 2.8	3.2	3.6	4.3		marriage	1.0 2.1	1.0 2.5	1.0 3.0	1.0 3.4	1.0 3.8
3500 4000	ext wall marriage ext wall	1.0 2.0 1.0	1.0 2.4 1.0	1.0 2.8 1.0	3.2	3.6	4.3	3500 4000	marriage ext wall		2.5			
4000	ext wall marriage ext wall marriage	1.0 2.0 1.0 1.8	1.0 2.4 1.0 2.1	1.0 2.8 1.0 2.4	3.2 1.0 2.8	3.6 1.0 3.1	4.3	4000	marriage ext wall marriage	2.1 1.0 1.9	2.5 1.0 2.2	3.0 1.0 2.6	3.4 1.0 3.0	3.8 1.0 3.3
4000 Net So	ext wall marriage ext wall marriage il	1.0 2.0 1.0 1.8 M	1.0 2.4 1.0 2.1 Iarriage V	1.0 2.8 1.0 2.4 Vall Oper	3.2 1.0 2.8 ning Width	3.6 1.0 3.1 h (ft)	4.3 1.0 3.8	4000 Net Soi	marriage ext wall marriage l	2.1 1.0 1.9	2.5	3.0 1.0 2.6	3.4 1.0 3.0	3.8 1.0 3.3
4000 Net So Pres (p	ext wall marriage ext wall marriage sil	1.0 2.0 1.0 1.8 N 10	1.0 2.4 1.0 2.1 Iarriage V 12	1.0 2.8 1.0 2.4 Vall Oper 14	3.2 1.0 2.8 uing Width 16	3.6 1.0 3.1 h (ft) 18	<u>4.3</u> <u>1.0</u> <u>3.8</u> <u>20</u>	4000 Net Soi Pres (ps	marriage ext wall marriage l	2.1 1.0 1.9 N 10	2.5 1.0 2.2 Marriage W 12	3.0 1.0 2.6	3.4 1.0 3.0	3.8 1.0 3.3
4000 Net So Pres (p 1000	ext wall marriage ext wall marriage oil osf) marriage	1.0 2.0 1.0 1.8 N 10 12.5	1.0 2.4 1.0 2.1 Iarriage V 12 14.6	1.0 2.8 1.0 2.4 Vall Oper 14 16.8	3.2 1.0 2.8 uing Width 16 19.0	3.6 1.0 3.1 h (ft) 18 21.1	4.3 1.0 3.8 20 23.3	4000 Net Soi Pres (ps 1000	marriage ext wall marriage l if) marriage	2.1 1.0 1.9 N 10 13.4	2.5 1.0 2.2 Marriage W 12 15.8	3.0 1.0 2.6 /all Open 14 18.1	3.4 1.0 3.0 ing Widt	3.8 1.0 3.3 h (ft) 18 22.8
4000 Net So Pres (p 1000 1500	ext wall marriage ext wall marriage wil ssf) marriage marriage	1.0 2.0 1.0 1.8 M 10 12.5 8.3	1.0 2.4 1.0 2.1 Iarriage V 12 14.6 9.8	1.0 2.8 1.0 2.4 Vall Oper 14 16.8 11.2	3.2 1.0 2.8 10 16 19.0 12.6	3.6 1.0 3.1 h (ft) 18 21.1 14.1	4.3 1.0 3.8 20 23.3 15.5	4000 Net Soi Pres (ps 1000 1500	marriage ext wall marriage if) marriage marriage	2.1 1.0 1.9 N 10 13.4 9.0	2.5 1.0 2.2 Marriage W 12 15.8 10.5	3.0 1.0 2.6 Vall Open 14 18.1 12.1	3.4 1.0 3.0 ing Widt 16	3.8 1.0 3.3 h (ft) 18
4000 Net So Pres (p 1000 1500 2000	ext wall marriage ext wall marriage marriage marriage marriage	1.0 2.0 1.0 1.8 M 10 12.5 8.3 6.2	1.0 2.4 1.0 2.1 Marriage V 12 14.6 9.8 7.3	1.0 2.8 1.0 2.4 Vall Oper 14 16.8 11.2 8.4	3.2 1.0 2.8 ning Widtl 16 19.0 12.6 9.5	3.6 1.0 3.1 h (ft) 18 21.1 14.1 10.6	4.3 1.0 3.8 20 23.3 15.5 11.6	4000 Net Soi Pres (ps 1000 1500 2000	marriage ext wall marriage if) marriage marriage marriage	2.1 1.0 1.9 N 10 13.4 9.0 6.7	2.5 1.0 2.2 Marriage W 12 15.8 10.5 7.9	3.0 1.0 2.6 (all Open 14 18.1 12.1 9.1	3.4 1.0 3.0 ing Widtl 16 20.5 13.7 10.2	3.8 1.0 3.3 h (ft) 18 22.8
4000 Net So Pres (p 1000 1500 2000 2500	ext wall marriage ext wall marriage marriage marriage marriage marriage	1.0 2.0 1.0 1.8 M 10 12:5 8.3 6.2 5.0	1.0 2.4 1.0 2.1 Iarriage V 12 14.6 9.8 7.3 5.9	1.0 2.8 1.0 2.4 Vall Oper 14 16.8 11.2 8.4 6.7	3.2 1.0 2.8 ning Width 16 19.0 12.6 9.5 7.6	3.6 1.0 3.1 h (ft) 18 21.1 14.1 10.6 8.4	4.3 1.0 3.8 20 23.3 15.5 11.6 9.3	4000 Net Soi Pres (ps 1000 1500 2000 2500	marriage ext wall marriage if) marriage marriage marriage marriage	2.1 1.0 1.9 N 10 13.4 9.0 6.7 5.4	2.5 1.0 2.2 Marriage W 12 15.8 10.5 7.9 6.3	3.0 1.0 2.6 /all Open 14 18.1 12.1 9.1 7.3	3.4 1.0 3.0 ing Widtl 16 20.5 13.7 10.2 8.2	3.8 1.0 3.3 h (ft) 18 22.8 15.2
4000 Net So Pres (p 1000 1500 2000 2500 3000	ext wall marriage ext wall marriage marriage marriage marriage marriage marriage	1.0 2.0 1.0 1.8 M 10 12.5 8.3 6.2 5.0 4.2	1.0 2.4 1.0 2.1 Iarriage V 12 14.6 9.8 7.3 5.9 4.9	1.0 2.8 1.0 2.4 Vall Oper 14 16.8 11.2 8.4 6.7 5.6	3.2 1.0 2.8 ing Widt 16 19.0 12.6 9.5 7.6 6.3	3.6 1.0 3.1 h (ft) 18 21.1 14.1 10.6 8.4 7.0	4.3 1.0 3.8 20 23.3 15.5 11.6 9.3 7.8	4000 Net Soi Pres (ps 1000 1500 2000 2500 3000	marriage ext wall marriage l if) marriage marriage marriage marriage marriage	2.1 1.0 1.9 N 10 13.4 9.0 6.7 5.4 4.5	2.5 1.0 2.2 Marriage W 12 15.8 10.5 7.9 6.3 5.3	3.0 1.0 2.6 Vall Open 14 18.1 12.1 9.1 7.3 6.0	3.4 1.0 3.0 ing Widtl 16 20.5 13.7 10.2 8.2 6.8	3.8 1.0 3.3 h (ft) 18 22.8 15.2 11.4 9.1 7.6
4000 Net So Pres (p 1000 1500 2000 2500	ext wall marriage ext wall marriage marriage marriage marriage marriage	1.0 2.0 1.0 1.8 M 10 12:5 8.3 6.2 5.0	1.0 2.4 1.0 2.1 Iarriage V 12 14.6 9.8 7.3 5.9	1.0 2.8 1.0 2.4 Vall Oper 14 16.8 11.2 8.4 6.7	3.2 1.0 2.8 ning Width 16 19.0 12.6 9.5 7.6	3.6 1.0 3.1 h (ft) 18 21.1 14.1 10.6 8.4	4.3 1.0 3.8 20 23.3 15.5 11.6 9.3	4000 Net Soi Pres (ps 1000 1500 2000 2500	marriage ext wall marriage if) marriage marriage marriage marriage	2.1 1.0 1.9 N 10 13.4 9.0 6.7 5.4	2.5 1.0 2.2 Marriage W 12 15.8 10.5 7.9 6.3	3.0 1.0 2.6 /all Open 14 18.1 12.1 9.1 7.3	3.4 1.0 3.0 ing Widtl 16 20.5 13.7 10.2 8.2	3.8 1.0 3.3 h (ft) 18 22.8 15.2 11.4 9.1

#### g - Aftg \*

10

1.8

1.2

9.8

1.0

7.4

1.0

5.9

1.0

4.9

1.0

4.2

1.0

3.7

20

22.3

14.9

11.2

8.9

7.4

6.4

5.6

10

1.9

16.1

1.3

10.8

1.0

8.1

1.0

6.5

1.0

5.4

1.0

4.6

1.0

4.0

20

25.2

16.8

12.6

10.1

8.4

7.2

6.3

14.7

Minimum interior pier area is 1.0 sqft.

The Exterior Footing Widths are shown in feet. The Marriage Wall Footing Areas are shown in square feet.

Multi-Section	Aftg E7
Width	14'

	· · ·	Grou	ind Sn	ow: 50	) psf		
Net So	il	Tra	ansverse (	Sirder and	l Pier Spa	cing (ft)	
Pres (p	osf)	4	5	6	7	8	10
1000	ext wall	2.0	2.0	2.0	2.0	2.0	2.0
	marriage	7.8	9.4	10.9	12.5	14.0	17.1
1500	ext wall	1.3	1.3	1.3	1.3	1.3	1.3
	marriage	5.2	6.3	7.3	8.3	9.3	11.4
2000	ext wall	1.0	1:0	1.0	1.0	1.0	1.0
	marriage	3.9	4.7	5.5	6.2	7.0	8.6
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.1	3.8	4.4	.5.0	5.6	6.8
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.6	3.1	3.6	4.2	4.7	5.7
3500 -	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.2	2.7	3.1	3.6	4.0	4.9
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.0	2.3	2.7	3.1	3.5	4.3
Net Soi	1	N	Aarriage V	Wall Oper	ning Widt	h (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	14.4	16.9	19.5	22.0	24.5	27.1
1500	marriage	9.6	11.3	13.0	14.7	16.4	18.1
2000	marriage	7.2	8.5	9.7	11.0	12.3	13.5
2500	marriage	5.8	6.8	7.8	8.8	9.8	10.8
3000	marriage	4.8	5.6	6.5	7.3	8.2	9.0
3500	marriage	4.1	4.8	5.6	6.3	7.0	7.7
4000	marriage	3.6	4.2	4.9	5.5	6.1	6.8

					·		<u> </u>		
·			ind Sn		) psf	·· .`			
Net So	șil 👘	Tra	Transverse Girder and Pier Spacing (ft)						
Pres (p	osf)	4	. 5	6	7	8	10		
1000	ext wall	2.1	2.1	2.1	2.1	2.1	2.0		
	marriage	8.6	10.3	12.1	13.8	15.5	19.0		
1500	ext wall	1.4	14	1.4	1.4	1.4	1.4		
	marriage	5.7	6.9	8.1	9.2	10.4	12.7		
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	4.3	5.2	6.0	6.9	7.8	9.5		
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	3.4	4.1	4:8	5.5	6.2	7.6		
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	2.9	3.4	4.0	4.6	5.2	6.3		
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	2.5	3.0	3.5	3.9	4.4	5.4		
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	2.2	2.6	3.0	3.5	3.9	4.8		
Net So	il	N	Marriage 1	Wall Oper	ning Widt	th (ft)			
Pres (p		10	12	14	16	18	20		
1000	marriage	16.3	19.2	22.2	25.1	28.0	30.9		
1500	marriage	10.9	12.8	14.8	16.7	18.7	20.6		
2000	marriage	8.2	9.6	11.1	12.5	14.0	15.5		
2500	marriage	6.5	7.7	8.9	10.0	11.2	12.4		
3000	marriage	5.4	6.4	7.4	8.4	9.3	10.3		
3500	marriage	4.7	5.5	6.3	7.2	8.0	8.8		
4000	marriage	4.1	4.8	5.5	6.3	7.0	7.7		

		Gro	und Sn	ow: 60	) psf		
Net S		Tr	ansverse (	Girder and	Pier Spa	acing (ft)	
Pres (		4	5	6	<u>7</u>	8	10
1000	ext wall	2.0	2.0	2.0	2.0	2.0	2.0
	marriage	8.2	9.9	11.5	13.1	14.8	18.1
1500	ext wall	1.3	1.3	1.3	1.3	1.3	1.3
	marriage	5.5	6.6	7.7	8.8	9.9	12.0
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	4.1	4.9	5.8	6.6	7.4	9.0
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.3	3.9	4.6	5.3	5.9	7.2
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.7	3.3	3.8	4.4	4.9	6.0
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.4	2.8	3:3	3.8	4.2	5.2
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.1	2.5	2.9	3.3	3.7	4.5
Net So		. î	Marriage V	Wall Oper	ung Widt	h (ft)	
Pres (p	osf)	10	12	14	16	18	20
1000	marriage	15.4	18.1	20.8	23.5	26.3	29.0
1500	marriage	10.2	12.1	13.9	15.7	17.5	19.3
2000	marriage	7.7	9.0	10.4	11.8	13.1	14.5
2500	marriage	6.1	7.2	8.3	9.4	10.5	11.6
3000	marriage	5.1	6.0	6.9	7.8	8.8	9.7
3500	marriage	4.4	5.2	5.9	6.7	- 7.5	8.3
4000	marriage	3.8	4.5	5.2	5.9	6.6	7.3
		Grou	nd Sno	w: 80	psf	- 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997	
Net So	il	Tra	nsverse Gi	irder and	Pier Spac	ing (ft)	
Pres (p	sf)	4	.5	6	7	8	10
1000	ext wall	2.1	2.1	2.1	2.1	2.1	2.1
	marriage	9.0	10.8	12.7	14.5	16.3	20.0
1500	ext wall	1.4	1.4	1.4	1.4	1.4	1.4
	marriage	6.0	7.2	8.4	9.7	10.9	13.3
2000	ext wall	1.1	1.1	1.1	1.1	1.0	1.0
	marriage	4.5	5.4	6.3	7.2	8.2	10.0
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.6	4.3	5.1	5.8	6.5	8.0
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
÷.,	marriage	3.0	3.6	4.2	4.8	5.4	6.7
2500		1.0	1.0	1.0		2.7	0.7

\* Minimum interior pier area is 1.0 sqft.

The Exterior Footing Widths are shown in feet. The Marriage Wall Footing Areas are shown in square feet.

3500

4000

1000

1500

2000

2500

3000

3500

4000

Net Soil

Pres (psf)

ext wall

marriage

ext wall

marriage

marriage

marriage

marriage

marriage

marriage

marriage

marriage

1.0

2.6

1.0

2.2

10

17.3

11.5

8.6

6.9

5.8

4.9

4.3

1.0

3.1

1.0

2.7

12

20.4

13.6

10.2

8.2

6.8

5.8

5.1

1.0

3.6

1.0

3.2

14

23.5

15.7

11.7

9.4

7.8

6.7

5.9

Marriage Wall Opening Width (ft)

1.0

4.1

1.0

3.6

16

26.6

17.7

13.3

10.6

8.9

7.6

6.7

1.0

4.7

1.0

4.1

18

29.7

19.8

14.9

11.9

9.9

8.5

7.4

1.0

5.7

1.0

5.0

20

32.8

21.9

16.4

13.1

Ì0.9

9.4

8.2

Aftg E7	<b>Multi-Section</b>
14'	Width

Т

1

		Grou	ind Sn	ow: 90	) psf		
Net So	il	Tra	insverse (	firder and	Pier Spa	cing (ft)	
Pres (p	osf)	4	5	6	7	8	10
1000	ext wall	2.2	2.2	2.2	2.2	2.1	2.1
	marriage	9.4	11.3	13.2	15.2	17.1	20.9
1500	ext wall	1.4	1.4	1.4	1.4	1.4	1.4
	marriage	6.3	7.5	8.8	10.1	11.4	14.0
2000	ext wall	1.1	1.1	1.1	1.1	1.1	1.1
	marriage	4.7	5.7	6.6	7.6	8.5	10.5
2500	ext wail	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.8	4.5	5.3	6.1	6.8	8.4
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
·	marriage	3.1	3.8	4.4	5.1	5.7	7.0
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.7	3.2	3.8	4.3	4.9	6.0
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.3	2.8	3.3	3.8	4.3	5.2
Net Soi	ü –	· 1	Marriage V	Vall Oper	ning Widt	h (ft)	
Pres (p	sf)	10	12	14	16	18	20
1000	marriage	18.2	21.5	24.8	28.1	31.4	34.7
1500	marriage	12.2	14.4	16.6	18.8	21.0	23.2
2000	marriage	9.1	10.8	12.4	14.1	15.7	17.4
2500	marriage	7.3	8.6	9.9	11.3	12.6	13.9
3000	marriage	6.1	7.2	8.3	9:4	10.5	11.6
3500	marriage	5.2	6.2	7.1	8.0	9.0	9.9
4000	marriage	4.6	5.4	6.2	7.0	7.9	8.7

### Required Effective Footing - Aftg \*

						•	'	
			nd Sno					
Net So	il	Тп	Transverse Girder and Pier Spacing (ft)					
Pres (p	sf)	4	5	6	7	8	10	
1000	ext wall	2.2	2.2	2.2	2.2	2.2	2.2	
· · ·	marriage	9.8	11.8	13.8	15.8	17.8	21.9	
1500	ext wall	1.5	1.5	1.5	1.5	1.5	1.5	
	marriage	6.5	7.9	9.2	10.5	11.9	14.6	
2000	ext wall	1.1	1.1	1.1	1.1	1.1	1.1	
	marriage	4.9	5.9	6.9	7.9	8.9	10.9	
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	
	marriage	3.9	4.7	5.5	6.3	7.1	8.8	
3000	ext wall	1:0	1.0	1.0	1.0	1.0	1.0	
_	marriage	3.3	. 3.9	4.6	5.3	5.9	7.3	
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	
· · · · ·	marriage	2.8	3.4	3.9	4.5	5.1	6.3	
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0	
	marriage	2.4	2.9	3.5	4.0	4.5	5.5	
Net Soi		ł	Marriage V	Wall Oper	ning Widt	h (ft)		
Pres (p:	sf)	10	12	14	16	18	20	
1000	marriage	19.2	22.7	26.2	29.7	33.2	36.7	
1500 -	marriage	12.8	15.1	17.4	19.8	22.1	24.4	
2000 -	marriage	9.6	11.3	13.1	14.8	16.6	18.3	
2500	marriage	7.7	9.1	10.5	11.9	13.3	14.7	
3000	marriage	6.4	7.6	8.7	9.9	11.1	12.2	
3500	marriage	5.5	6.5	7.5	8.5	9.5	10.5	
4000	marriage	4.8	5.7	6.5	7.4	8.3	9.2	

Multi-Section	Aftg E7
Width	-16'

			n. Roc				
Net Soi	1 .		ansverse (			cing (ft)	
Pres (ps	sf)	4	5	6	7	8	10
1000	ext wall	1.9	1.9	1.9	1.9	1.9	1.9
	marriage	7.4	8.9	10.3	11.7	13.2	16.0
1500	ext wall	1.3	1.3	1.3	1.3	1.3	1.3
	marriage	5.0	5.9	6.9	7.8	8.8	10.7
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.7	4.4	5.1	5.9	6.6	8.0
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.0	3.5	4.1	4.7	5.3	6.4
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.5	3.0	3.4	3.9	4.4	5.3
3500	ext wall	1.0	1.0	1.0	1.0	1.0	-1.0
- -	marriage	2.1	2.5	2.9	3.3	3.8	4.6
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.9	2.2	2.6	2.9	3.3	4.0
Net Soil			Marriage				
Pres (ps		10	12	14	16	18	20
1000	marriage	13.0	15.2	17.5	19.7	22.0	24.2
1500	marriage	8.7	10.2	11.7	13.2	14.7	16.2
2000	marriage	6.5	7.6	8.7	9.9	11.0	12.1
2500	marriage	5.2	6.1	7.0	7.9	8.8	9.7
3000	Ξ.		5.1		6.6	7.3	8.1
2000	marriage	4.3		3.6			
	marriage marriage	4.3 3.7		5.8 5.0			
3500 4000	marriage marriage	3.7 3.2	4.4 3.8	5.0 4.4	5.6 4.9	6.3 5.5	6.9 6.1
3500 4000 Gr Net Soil	marriage marriage cound Si	3.7 3.2 now: Tra	4.4 3.8 30 psf	5.0 4.4 & Mir	5.6 4.9 1. Rooi	6.3 5.5 f: 20 ps	6.9 6.1
3500 4000 Gr Net Soil Pres (ps	marriage marriage round Si	3.7 3.2 now: Tra 4	4.4 3.8 30 psf nsverse C 5	5.0 4.4 & Mir irder and 6	5.6 4.9 1. Root Pier Spac 7	6.3 5.5 f: 20 ps ring (ft) 8	6.9 6.1 sf 10
3500 4000 Gr Net Soil Pres (ps	marriage marriage cound Si f) ext wall	3.7 3.2 now: Tra 4 2.0	4.4 3.8 30 psf insverse C 5 2.0	5.0 4.4 & Mir irder and 6 2.0	5.6 4.9 1. Root Pier Spac 7 2.0	6.3 5.5 f: 20 ps ting (ft)	6.9 6.1
3500 4000 Gr Net Soil Pres (ps 1000	marriage marriage COUND SI f) ext wall marriage	3.7 3.2 now: Tra 4 2.0 7.8	4.4 3.8 30 psf nsverse C 5 2.0 9.3	5.0 4.4 & Mir irder and 6 2.0 10.9	5.6 4.9 1. Root Pier Spac 7 2.0 12.4	6.3 5.5 f: 20 ps ting (ft) 8 1.9 13.9	6.9 6.1 sf 10
3500 4000 Gr Net Soil Pres (ps 1000	marriage marriage round Si f) ext wall marriage ext wall	3.7 3.2 now: Tra 4 2.0 7.8 1.3	4.4 3.8 30 psf nsverse C 5 2.0 9.3 1.3	5.0 $4.4$ $& Mir$ irder and $6$ $2.0$ $10.9$ $1.3$	5.6 4.9 1. Root Pier Spac 7 2.0 12.4 1.3	6.3 5.5 f: 20 ps sing (ft) 8 1.9 13.9 1.3	6.9 6.1 sf <u>10</u> 1.9
3500 4000 Gr Net Soil Pres (ps 1000	marriage marriage ound Si f) ext wall marriage ext wall marriage	3.7 3.2 now: Tra 4 2.0 7.8 1.3 5.2	4.4 3.8 30 psf nsverse C 5 2.0 9.3 1.3 6.2	5.0 4.4 <b>&amp; Min</b> irder and 6 2.0 10.9 1.3 7.2	5.6 4.9 1. Root Pier Spac 7 2.0 12.4 1.3 8.2	6.3 5.5 f: 20 ps sing (ft) 8 1.9 13.9 1.3 9.3	6.9 6.1 sf 10 1.9 16.9
3500 4000 Gr Net Soil Pres (ps 1000	marriage marriage ound Si f) ext wall marriage ext wall marriage ext wall	3.7 3.2 now: Tra 4 2.0 7.8 1.3 5.2 1.0	4.4 3.8 30 psf nsverse C 5 2.0 9.3 1.3 6.2 1.0	5.0 4.4 & Mir irder and 6 2.0 10.9 1.3 7.2 1.0	5.6 4.9 1. Root Pier Spac 7 2.0 12.4 1.3 8.2 1.0	6.3 5.5 f: 20 ps sing (ft) 8 1.9 13.9 1.3 9.3 1.0	6.9 6.1 5f 10 1.9 16.9 1.3 11.3 1.0
3500 4000 Met Soil Pres (ps 1000 1500	marriage marriage ound Si f) ext wall marriage ext wall marriage ext wall marriage	3.7 3.2 now: Tra 4 2.0 7.8 1.3 5.2 1.0 3.9	4.4 3.8 30 psf sverse C 5 2.0 9.3 1.3 6.2 1.0 4.7	5.0 4.4 & Mir irder and 6 2.0 10.9 1.3 7.2 1.0 5.4	5.6 4.9 1. Root 7 2.0 12.4 1.3 8.2 1.0 6.2	6.3 5.5 f: 20 ps ing (ft) 8 1.9 13.9 1.3 9.3 1.0 6.9	6.9 6.1 10 1.9 16.9 1.3 11.3 1.0 8.5
3500 4000 Met Soil Pres (ps 1000 1500	marriage marriage cound Si f) ext wall marriage ext wall marriage ext wall marriage ext wall	3.7 3.2 now: Tra 4 2.0 7.8 1.3 5.2 1.0 3.9 1.0	4.4 3.8 30 psf 1.0 9.3 1.3 6.2 1.0 4.7 1.0	$5.0 \\ 4.4 \\ & Min \\ \hline & Mir \\ \hline & 100 \\ \hline & $	5.6 4.9 <b>Pier Space</b> 7 2.0 12.4 1.3 8.2 1.0 6.2 1.0	6.3 5.5 f: 20 ps ing (ft) 8 1.9 13.9 1.3 9.3 1.0 6.9 1.0	6.9 6.1 10 1.9 16.9 1.3 11.3 1.0 8.5 1.0
3500 4000 Met Soil Pres (ps 1000 1500 2000 2500	marriage marriage Tound Si f) ext wall marriage ext wall marriage ext wall marriage ext wall marriage	3.7 3.2 now: Tra 4 2.0 7.8 1.3 5.2 1.0 3.9 1.0 3.1	4.4 3.8 30 psf 1.0 9.3 1.3 6.2 1.0 4.7 1.0 3.7	$5.0 \\ 4.4 \\ & \text{Mir} \\ \hline \\ \hline \\ & \text{ & Mir} \\ \hline \\ & \text{ & Iof} \\ \hline \\ & 1.0 \\ \hline \\ & 1.0 \\ \hline \\ & 5.4 \\ \hline \\ & 1.0 \\ \hline \\ & 4.3 \\ \hline \\ \hline \\ \end{array}$	5.6 4.9 Pier Space 7 2.0 12.4 1.3 8.2 1.0 6.2 1.0 4.9	6.3 5.5 f: 20 ps ing (ft) 8 1.9 13.9 1.3 9.3 1.0 6.9 1.0 5.6	6.9 6.1 10 1.9 16.9 1.3 11.3 1.0 8.5 1.0 6.8
3500 4000 Net Soil Pres (ps 1000 1500 2000 2500	marriage marriage cound Si f) ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall	3.7 3.2 now: 4 2.0 7.8 1.3 5.2 1.0 3.9 1.0 3.1 1.0	4.4 3.8 30 psf 1.0 9.3 1.3 6.2 1.0 4.7 1.0 3.7 1.0	$5.0 \\ 4.4 \\ & Mir \\ \hline & Mir \\ \hline & 100 \\ \hline & $	5.6 4.9 <b>Pier Space</b> 7 2.0 12.4 1.3 8.2 1.0 6.2 1.0 4.9 1.0	6.3 5.5 f: 20 ps ing (ft) 8 1.9 1.3 9.3 1.0 6.9 1.0 5.6 1.0	6.9 6.1 10 1.9 16.9 1.3 11.3 1.0 8.5 1.0 6.8 1.0
3500 4000 Net Soil Pres (ps 1000 1500 2000 2500 3000	marriage marriage cound Si f) ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage	3.7 3.2 <b>now:</b> 4 2.0 7.8 1.3 5.2 1.0 3.9 1.0 3.1 1.0 2.6	4.4 3.8 30 psf nsverse C 5 2.0 9.3 1.3 6.2 1.0 4.7 1.0 3.7 1.0 3.1	$\begin{array}{r} 5.0 \\ 4.4 \\ \hline \\ \& Mit \\ irder and \\ \hline \\ 6 \\ 2.0 \\ 1.0 \\ 1.0 \\ 7.2 \\ \hline \\ 1.0 \\ 5.4 \\ 1.0 \\ 4.3 \\ 1.0 \\ 3.6 \\ \end{array}$	5.6 4.9 Pier Space 7 2.0 12.4 1.3 8.2 1.0 6.2 1.0 4.9 1.0 4.1	6.3 5.5 f: 20 ps ing (ft) 8 1.9 1.3 9.3 1.0 6.9 1.0 5.6 1.0 4.6	6.9 6.1 isf 10 1.9 16.9 1.3 11.3 11.0 8.5 1.0 6.8 1.0 5.6
3500 4000 Net Soil Pres (ps 1000 1500 2000 2500 3000	marriage marriage cound Si f) ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall	3.7 3.2 <b>now:</b> 4 2.0 7.8 1.3 5.2 1.0 3.9 1.0 3.1 1.0 2.6 1.0	4.4 3.8 30 psf nsverse C 5 2.0 9.3 1.3 6.2 1.0 4.7 1.0 3.7 1.0 3.1 1.0	$\begin{array}{r} 5.0 \\ 4.4 \\ \hline \\ \& Mit \\ irder and \\ \hline \\ 6 \\ 2.0 \\ 1.0 \\ \hline \\ 7.2 \\ 1.0 \\ 5.4 \\ \hline \\ 1.0 \\ 4.3 \\ 1.0 \\ 3.6 \\ \hline \\ 1.0 \\ \hline \end{array}$	5.6 4.9 Pier Space 7 2.0 12.4 1.3 8.2 1.0 6.2 1.0 4.9 1.0 4.1 1.0	6.3 5.5 f: 20 ps ing (ft) 8 1.9 13.9 1.3 9.3 1.0 6.9 1.0 5.6 1.0 4.6 1.0	6.9 6.1 10 1.9 16.9 1.3 11.3 10.0 8.5 1.0 6.8 1.0 5.6 1.0
3500 4000 Net Soil Pres (ps 1000 1500 2000 2500 3000 3500	marriage marriage cound Si f) ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage	3.7 3.2 <b>now:</b> <b>Tra</b> 4 2.0 7.8 1.3 5.2 1.0 3.9 1.0 3.1 1.0 2.6 1.0 2.2	4.4 3.8 30 psf nsverse C 5 2.0 9.3 1.3 6.2 1.0 4.7 1.0 3.7 1.0 3.1 1.0 2.7	$\begin{array}{r} 5.0 \\ 4.4 \\ \hline \\ \& Mit \\ irder and \\ \hline \\ 6 \\ 2.0 \\ 1.0 \\ \hline \\ 7.2 \\ 1.0 \\ 5.4 \\ \hline \\ 1.0 \\ 3.6 \\ 1.0 \\ 3.1 \\ \end{array}$	5.6 4.9 1. Root Pier Spac 7 2.0 12.4 1.3 8.2 1.0 6.2 1.0 4.9 1.0 4.1 1.0 3.5	6.3 5.5 f: 20 ps ing (ft) 8 1.9 1.3 9.3 1.0 6.9 1.0 5.6 1.0 4.6 1.0 4.0	6.9 6.1 10 1.9 16.9 1.3 11.3 1.0 8.5 1.0 6.8 1.0 5.6 1.0 4.8
3500 4000 Net Soil Pres (ps 1000 1500 2000 2000 3000 3500	marriage marriage cound Si f) ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall	3.7 3.2 <b>NOW:</b> <b>Tra</b> 4 2.0 7.8 1.3 5.2 1.0 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0	4.4 3.8 30 psf nsverse C 5 2.0 9.3 1.3 6.2 1.0 4.7 1.0 3.7 1.0 3.1 1.0 2.7 1.0	$\begin{array}{r} 5.0 \\ 4.4 \\ \hline \\ \& Mit \\ irder and \\ \hline \\ 6 \\ 2.0 \\ 1.0 \\ \hline \\ 7.2 \\ 1.0 \\ 5.4 \\ \hline \\ 1.0 \\ 3.6 \\ \hline \\ 1.0 \\ 3.1 \\ 1.0 \\ \hline \end{array}$	5.6 4.9 1. Root 7 2.0 12.4 1.3 8.2 1.0 6.2 1.0 4.9 1.0 4.1 1.0 3.5 1.0	6.3 5.5 f: 20 ps ing (ft) 8 1.9 1.3 9.3 1.0 6.9 1.0 5.6 1.0 4.6 1.0 4.0 1.0	6.9 6.1 10 1.9 16.9 1.3 11.3 1.0 8.5 1.0 6.8 5.6 1.0 4.8 1.0
3500 4000 Gr Net Soil Pres (ps 1000 1500 2000 2500 3000 3500 4000	marriage marriage ound Si f) ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage	3.7 3.2 now: Tra 4 2.0 7.8 1.3 5.2 1.0 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0 2.2	4.4 3.8 30 psf nsverse C 5 2.0 9.3 1.3 6.2 1.0 4.7 1.0 3.7 1.0 3.1 1.0 2.7 1.0 2.3	$5.0 \\ 4.4 \\ \hline \\ & \hline \\ \\ & \hline \\ & \hline \\ \\ & \hline \\ \\ & \hline \\ \\ & \hline \\ \\ \\ & \hline \\ \\ \\ & \hline \\ \\ \\ \\$	5.6 4.9 Pier Space 7 2.0 12.4 1.3 8.2 1.0 6.2 1.0 4.9 1.0 4.1 1.0 3.5 1.0 3.1	6.3 5.5 f: 20 ps ing (ft) 8 1.9 1.3 9.3 1.0 6.9 1.0 5.6 1.0 4.6 1.0 4.0 1.0 3.5	6.9 6.1 10 1.9 16.9 1.3 11.3 1.0 8.5 1.0 6.8 1.0 5.6 1.0 4.8
3500 4000 Gr Net Soil Pres (ps 1000 1500 2000 2500 3000 3500 4000 Net Soil	marriage marriage ound Si f) ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage	3.7 3.2 now: Tra 4 2.0 7.8 1.3 5.2 1.0 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0 2.2 1.0 2.0 N	4.4 3.8 30 psf nsverse C 5 2.0 9.3 1.3 6.2 1.0 4.7 1.0 3.1 1.0 2.7 1.0 2.3 Marriage V	$5.0 \\ 4.4 \\ \hline \\ & \hline \\ \\ & \hline \\ & \hline \\ \\ & \hline \\ \\ & \hline \\ \\ & \hline \\ \\ & \hline \\ \\ & \hline \\ \\ \\ & \hline \\ \\ \\ \\$	5.6 4.9 1. Root 7 2.0 12.4 1.3 8.2 1.0 6.2 1.0 4.9 1.0 4.1 1.0 3.5 1.0 3.1 wing Widt	6.3 5.5 f: 20 ps ing (ft) 8 1.9 1.3 9.3 1.0 6.9 1.0 5.6 1.0 4.6 1.0 4.6 1.0 4.6 1.0 4.6 1.0 4.6 1.0 4.6 1.0 5.5	6.9 6.1 10 1.9 16.9 1.3 11.3 10 8.5 1.0 6.8 1.0 5.6 1.0 5.6 1.0 4.8 1.0 4.2
3500 4000 Gri Net Soil Pres (ps 1000 1500 2000 2500 3000 3500 4000 Net Soil Pres (ps	marriage marriage ound Si f) ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage f)	3.7 3.2 now: Tra 4 2.0 7.8 1.3 5.2 1.0 3.9 1.0 3.1 1.0 3.1 1.0 2.6 1.0 2.2 1.0 2.2 1.0 2.0 N	4.4 3.8 30 psf insverse C 5 2.0 9.3 1.3 6.2 1.0 4.7 1.0 3.7 1.0 3.1 1.0 2.7 1.0 2.3 Marriage V 12	$5.0 \\ 4.4 \\ \hline \\ & Mir \\ \hline \\ & Mir \\ \hline \\ & 2.0 \\ 1.0 \\ 9 \\ 1.3 \\ 7.2 \\ 1.0 \\ 5.4 \\ 1.0 \\ 5.4 \\ 1.0 \\ 3.6 \\ 1.0 \\ 3.1 \\ 1.0 \\ 2.7 \\ \hline \\ & Vall Oper \\ 14 \\ \hline \\ \\ \end{matrix}$	5.6 4.9 Pier Spac 7 2.0 12.4 1.3 8.2 1.0 6.2 1.0 4.9 1.0 4.1 1.0 3.5 1.0 3.1 uing Widt 16	6.3 5.5 f: 20 ps ing (ft) 8 1.9 13.9 1.3 9.3 1.0 6.9 1.0 5.6 1.0 4.6 1.0 4.6 1.0 4.6 1.0 4.6 1.0 8.5 1.0 1.0 5.6 1.0 5.6 1.0 5.6	6.9 6.1 10 1.9 16.9 1.3 11.3 1.0 8.5 1.0 6.8 1.0 5.6 1.0 5.6 1.0 4.2 20
3500 4000 Gri Net Soil Pres (ps 1000 1500 2000 2500 3000 3500 4000 Net Soil Pres (ps 1000	marriage marriage ound Si f) ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage f) marriage	3.7 3.2 now: Tra 4 2.0 7.8 1.3 5.2 1.0 3.9 1.0 3.1 1.0 3.1 1.0 2.6 1.0 2.2 1.0 2.2 1.0 2.0 N 10 13.9	4.4 3.8 30 psf insverse C 5 2.0 9.3 1.3 6.2 1.0 4.7 1.0 3.7 1.0 3.1 1.0 2.7 1.0 2.3 Marriage V 12 16.3	$5.0 \\ 4.4 \\ \hline \\ & Min \\ \hline \\ \\ & Min \\ \hline \\ \\ \\ & Min \\ \hline \\ \\ & Min \\ \hline \\ \\ & $	5.6 4.9 Pier Spac 7 2.0 12.4 1.3 8.2 1.0 6.2 1.0 4.9 1.0 4.1 1.0 3.5 1.0 3.1 iing Widt 16 21.2	6.3 5.5 f: 20 ps ing (ft) 8 1.9 1.3 9.3 1.0 6.9 1.0 5.6 1.0 4.6 1.0 4.6 1.0 4.0 1.0 3.5 h (ft) 18 23.7	6.9 6.1 10 1.9 16.9 1.3 11.3 1.0 8.5 1.0 6.8 1.0 5.6 1.0 5.6 1.0 4.8 1.0 20 26.1
3500 4000 Gri Net Soil Pres (ps 1000 1500 2000 2500 3500 3500 4000 Net Soil Pres (ps 1000 1500	marriage marriage ound Si f) ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage f) marriage	3.7 3.2 now: Tra 4 2.0 7.8 1.3 5.2 1.0 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0 2.0 N 10 13.9 9.3	4.4 3.8 30 psf nsverse C 5 2.0 9.3 1.3 6.2 1.0 4.7 1.0 3.7 1.0 3.7 1.0 2.7 1.0 2.3 Marriage V 12 16.3 10.9	$\begin{array}{c} 5.0 \\ 4.4 \\ \hline \\ & \\ & \\ & \\ & \\ & \\ & \\ & \\ & \\ &$	5.6 4.9 Pier Spac 7 2.0 12.4 1.3 8.2 1.0 6.2 1.0 4.9 1.0 4.1 1.0 3.5 1.0 3.1 iing Widt 16 21.2 14.1	6.3 5.5 f: 20 ps ing (ft) 8 1.9 13.9 1.3 9.3 1.0 6.9 1.0 5.6 1.0 4.6 1.0 4.6 1.0 4.6 1.0 3.5 h (ft) 18 23.7 15.8	6.9 6.1 10 1.9 16.9 1.3 11.3 1.0 8.5 1.0 6.8 1.0 5.6 1.0 5.6 1.0 5.6 1.0 5.6 1.0 2.0 2.0 17.4
3500 4000 Gri Net Soil Pres (ps 1000 1500 2000 2500 3500 4000 Net Soil Pres (ps 1000 1500 2000	marriage marriage ound Si f) ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage f) marriage marriage	3.7 3.2 now: Tra 4 2.0 7.8 1.3 5.2 1.0 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0 2.2 1.0 2.0 N 10 13.9 9.3 7.0	4.4 3.8 30 psf insverse C 5 2.0 9.3 1.3 6.2 1.0 4.7 1.0 3.7 1.0 3.1 1.0 2.7 1.0 2.3 Marriage V 12 16.3 10.9 8.2	$\begin{array}{c} 5.0 \\ 4.4 \\ \hline \\ & 4 \\ \hline \\ & 4 \\ \hline \\ & 4 \\ \hline \\ & 6 \\ \hline \\ & 1.0 \\ \hline \\ & 1.0 \\ \hline \\ & 7.2 \\ \hline \\ & 1.0 \\ \hline \\ & 5.4 \\ \hline \\ & 1.0 \\ \hline \\ & 5.4 \\ \hline \\ & 1.0 \\ \hline \\ & 3.1 \\ \hline \\ & 1.0 \\ \hline \\ & 3.1 \\ \hline \\ & 1.0 \\ \hline \\ & 2.7 \\ \hline \\ & Vall Oper \\ \hline \\ & 18.8 \\ \hline \\ & 12.5 \\ \hline \\ & 9.4 \\ \end{array}$	5.6 4.9 Pier Space 7 2.0 12.4 1.3 8.2 1.0 6.2 1.0 4.9 1.0 4.1 1.0 3.5 1.0 3.1 ing Widt 16 21.2 14.1 10.6	6.3 5.5 f: 20 ps ing (ft) 8 1.9 13.9 1.3 9.3 1.0 6.9 1.0 5.6 1.0 4.6 1.0 4.6 1.0 4.6 1.0 3.5 h (ft) 18 23.7 15.8 11.8	6.9 6.1 10 1.9 16.9 1.3 11.3 1.0 8.5 1.0 6.8 1.0 5.6 1.0 5.6 1.0 5.6 1.0 4.8 1.0 5.6 1.0 20 26.1 17.4 13.0
3500 4000 Invet Soil Pres (ps 1000 1500 2000 2500 3500 4000 Net Soil Pres (ps 1000 1500 2500 2500	marriage marriage cound Si f) ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage f) marriage marriage marriage marriage	3.7 3.2 now: Tra 4 2.0 7.8 1.3 5.2 1.0 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0 2.2 1.0 2.2 1.0 3.1 1.0 3.1 1.0 2.6 1.0 2.2 1.0 3.1 1.0 3.1 1.0 3.1 1.0 3.1 1.0 3.1 1.0 3.5 2 1.0 3.9 1.0 3.1 1.0 3.1 1.0 3.1 1.0 3.1 1.0 3.1 1.0 3.5 2 1.0 3.5 2 1.0 3.1 1.0 3.5 2 1.0 3.5 2 1.0 3.5 2 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 2 1.0 3.5 2 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 1.0 3.5 7.0 5.2 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 2 1.0 3.5 2 1.0 3.5 2 1.0 3.5 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5	4.4 3.8 30 psf 1.0 9.3 1.3 6.2 1.0 4.7 1.0 3.7 1.0 3.1 1.0 2.7 1.0 2.3 Marriage V 12 16.3 10.9 8.2 6.5	$5.0 \\ 4.4 \\ \hline 5.0 \\ 4.4 \\ \hline 5.0 \\ \hline 6 \\ 1.0 \\ \hline 1.0 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 3.6 \\ \hline 1.0 \\ 3.6 \\ \hline 1.0 \\ 3.6 \\ \hline 1.0 \\ 3.1 \\ \hline 1.0 \\ 3.6 \\ \hline 1.0 \\ 3.1 \\ \hline 1.0 \\ 3.7 \\ \hline 5.4 \\ \hline 1.0 \\ 3.7 \\ \hline 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ \hline 5.4 \\ \hline 5.$	5.6 4.9 Pier Space 7 2.0 12.4 1.3 8.2 1.0 6.2 1.0 4.9 1.0 4.1 1.0 3.5 1.0 3.1 iing Widt 16 21.2 14.1 10.6 8.5	6.3 5.5 f: 20 ps ing (ft) 8 1.9 13.9 1.3 9.3 1.0 6.9 1.0 5.6 1.0 4.6 1.0 4.6 1.0 4.6 1.0 3.5 h (ft) 15.8 11.8 9.5	6.9 6.1 10 1.9 16.9 1.3 11.3 1.0 8.5 1.0 6.8 1.0 5.6 1.0 5.6 1.0 4.8 1.0 5.6 1.0 2.0 2.6 1 17.4 13.0 10.4
3500 4000 Invet Soil Pres (ps 1000 2000 2000 2500 3500 4000 Net Soil Pres (ps 1000 2500 2000 2500 3000	marriage marriage cound Si f) ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage marriage marriage marriage marriage marriage	3.7 3.2 now: 7.8 1.3 5.2 1.0 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0 2.0 N 10 13.9 9.3 7.0 5.6 4.6	4.4 3.8 30 psf 1.0 9.3 1.3 6.2 1.0 4.7 1.0 3.7 1.0 3.1 1.0 2.7 1.0 3.1 1.0 2.7 1.0 3.1 1.0 2.7 1.0 3.1 1.0 2.7 1.0 3.1 1.0 2.7 1.0 3.1 1.0 2.7 1.0 3.1 1.0 2.7 1.0 3.1 1.0 2.7 1.0 3.1 1.0 2.7 1.0 3.1 1.0 2.7 1.0 3.1 1.0 2.7 1.0 3.1 1.0 2.7 1.0 3.1 1.0 2.7 1.0 3.1 1.0 2.7 1.0 3.1 1.0 2.7 1.0 3.1 1.0 2.5 5. 1.0 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.	$\begin{array}{c} 5.0 \\ 4.4 \\ \hline \\ & 4 \\ \hline \\ & 4 \\ \hline \\ & 4 \\ \hline \\ & 6 \\ \hline \\ & 1.0 \\ \hline \\ & 1.0 \\ \hline \\ & 1.0 \\ \hline \\ & 5.4 \\ \hline \\ & 1.0 \\ \hline \\ & 5.4 \\ \hline \\ & 1.0 \\ \hline \\ & 3.6 \\ \hline \\ & 1.0 \\ \hline \\ & 1$	5.6 4.9 7 2.0 12.4 1.3 8.2 1.0 6.2 1.0 4.1 1.0 4.9 1.0 4.1 1.0 3.5 1.0 3.1 1.0 3.1 1.0 3.5 1.0 3.1 1.0 8.5 7.1	$\begin{array}{c} 6.3 \\ 5.5 \\ \hline \\ \hline \\ 1.20 \text{ ps} \\ \hline \\ 1.9 \\ 13.9 \\ 1.3 \\ 9.3 \\ 1.0 \\ 6.9 \\ 1.0 \\ 5.6 \\ 1.0 \\ 4.6 \\ 1.0 \\ 4.6 \\ 1.0 \\ 4.6 \\ 1.0 \\ 4.6 \\ 1.0 \\ 4.5 \\ 1.8 \\ 1.8 \\ 23.7 \\ 15.8 \\ 11.8 \\ 9.5 \\ 7.9 \end{array}$	6.9 6.1 10 1.9 16.9 1.3 11.3 1.0 8.5 1.0 8.5 1.0 6.8 1.0 5.6 1.0 5.6 1.0 4.8 1.0 4.2 20 26.1 17.4 13.0 10.4 8.7
3500 4000 Net Soil Pres (ps 1000 1500 2000 2500	marriage marriage cound Si f) ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage ext wall marriage f) marriage marriage marriage marriage	3.7 3.2 now: Tra 4 2.0 7.8 1.3 5.2 1.0 3.9 1.0 3.1 1.0 2.6 1.0 2.2 1.0 2.2 1.0 2.2 1.0 3.1 1.0 3.1 1.0 2.6 1.0 2.2 1.0 3.1 1.0 3.1 1.0 3.1 1.0 3.1 1.0 3.1 1.0 3.5 2 1.0 3.9 1.0 3.1 1.0 3.1 1.0 3.1 1.0 3.1 1.0 3.1 1.0 3.5 2 1.0 3.5 2 1.0 3.1 1.0 3.5 2 1.0 3.5 2 1.0 3.5 2 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 2 1.0 3.5 2 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 1.0 3.5 7.0 5.2 1.0 3.5 1.0 3.5 1.0 3.5 1.0 3.5 2 1.0 3.5 2 1.0 3.5 2 1.0 3.5 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 3.5 2 1.0 3.5 1.0 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5	4.4 3.8 30 psf 1.0 9.3 1.3 6.2 1.0 4.7 1.0 3.7 1.0 3.1 1.0 2.7 1.0 2.3 Marriage V 12 16.3 10.9 8.2 6.5	$5.0 \\ 4.4 \\ \hline 5.0 \\ 4.4 \\ \hline 5.0 \\ \hline 6 \\ 1.0 \\ \hline 1.0 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 3.6 \\ \hline 1.0 \\ 3.6 \\ \hline 1.0 \\ 3.6 \\ \hline 1.0 \\ 3.1 \\ \hline 1.0 \\ 3.6 \\ \hline 1.0 \\ 3.1 \\ \hline 1.0 \\ 3.7 \\ \hline 5.4 \\ \hline 1.0 \\ 3.7 \\ \hline 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ 5.4 \\ \hline 1.0 \\ \hline 5.4 \\ \hline 5.$	5.6 4.9 Pier Space 7 2.0 12.4 1.3 8.2 1.0 6.2 1.0 4.9 1.0 4.9 1.0 4.1 1.0 3.5 1.0 3.1 iing Widt 16 21.2 14.1 10.6 8.5	6.3 5.5 f: 20 ps ing (ft) 8 1.9 13.9 1.3 9.3 1.0 6.9 1.0 5.6 1.0 4.6 1.0 4.6 1.0 4.6 1.0 3.5 h (ft) 15.8 11.8 9.5	6.9 6.1 10 1.9 16.9 1.3 11.3 1.0 8.5 1.0 6.8 1.0 5.6 1.0 5.6 1.0 4.8 1.0 5.6 1.0 2.0 2.6 1 17.4 13.0 10.4

		Grou	ind Sn	ow: 25	5 psf		
Net Soi	1		insverse C			cing (ft)	
Pres (ps	f)	4	5	6	7	8	10
1000	ext wall	1.9	1.9	1.9	1.9	1.9	1.9
_	marriage	7.6	9.1	10.5	12.0	13.5	16.4
1500	ext wall	1.3	1.3	1.3	1.3	1.3	1.3
· · ·	marriage	5.1	6.0	7.0	8.0	9.0	. 10.9
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.8	4.5	5.3	6.0	6.7	8.2
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
1.1	marriage	3.0	3.6	4.2	4.8	5.4	6.6
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.5	3.0	3.5	4.0	4.5	5.5
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.2	2.6	3.0	3.4	3.8	4.7
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	1.9	2.3	2.6	3.0	3.4	4.1
Net Soil		۱	Marriage V	Vall Oper	ning Widt	h (ft)	
Pres (ps	f)	10	12	14	16	18	20
1000	marriage	13.4	15.7	18.0	20.3	22.7	25.0
1500	marriage	8.9	10.5	12.0	13.6	15.1	16.7
2000	marriage	6.7	7.8	9.0	10.2	11.3	12.5
2500	marriage	5.3	6.3	7.2	8.1	9.1	10.0
3000	marriage	4.5	5.2	6.0	6.8	7.6	8.3
3500	marriage	3.8	4.5	5.1	5.8	6.5	7.1
4000	marriage	3.3	3.9	4.5	5.1	5.7	6.3

		Grou	nd Sn	ow: 4(	) psf	· · ·				
Net So	il	Tra	Transverse Girder and Pier Spacing (ft)							
Pres (p	sf)	4	5	6	7	8	. 10			
1000	ext wall	2.0	2.0	2.0	2.0	2.0	2.0			
	marriage	8.2	9.9	11.5	13.1	14.8	18.0			
1500	ext wall	1.3	1.3	1.3	1.3	1.3	1.3			
	marriage	5.5	6.6	7.7	8.8	9.8	12.0			
2000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0			
	marriage	4.1	4.9	5.8	6.6	7.4	9.0			
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0			
	marriage	3.3	3.9	4.6	5.3	5.9	7.2			
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0			
	marriage	2.7	3.3	3.8	44	- 4.9	6.0			
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0			
	marriage	2.4	2.8	3.3	3.8	4.2	5.2			
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0			
1. 	marriage	2.1	2.5	2.9	3.3	3.7	4.5			
Net So	i]	· · · N	/arriage V	Wall Ope	ning Wid	th (ft)				
Pres (p	sf)	10	12	14	16	18	20			
1000	marriage	15.0	17.7	20.3	23.0	25.6	28.3			
1500	marriage	10.0	11.8	13.5	15.3	17.1	18.8			
2000	marriage	7.5	8.8	10.2	11.5	12.8	14.1			
2500	marriage	6.0	7.1	8.1	9.2	10.2	11.3			
3000	marriage	5.0	5.9	6.8	7.7	8.5	9.4			
3500	marriage	4.3	5.0	5.8	6.6	7.3	8.1			
4000	marriage	3.8	4.4	5.1	5.7	6.4	7.1			

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Aftg F7	Multi-Section
16'	Width

1 · ·		Grou	and Sn	AUX: 50	) mof		
Not Se	:1			<u>ow: 5(</u>			
Net So					l Pier Spa		
Pres (p	· · · · · · · · · · · · · · · · · · ·		5	6	7	8	10
1000	ext wall	2.1	2.1	2.1	2.1	2.1	. 2.
	marriage	8.7	10.4	12.2	13.9	15.6	19.
1500	ext wall	1.4	1.4	1.4	1.4	1.4	1.4
	marriage	5.8	6.9	8.1	9.3	10.4	12.1
2000	ext wall	1.0	1.0	1.0	1.0	1.0	Ĭ.
-	marriage	4.3	5.2	6.1	6.9	7.8	9.0
2500	ext wall	1.0	· 1.0	1.0	1.0	1.0	1.0
	marriage	3.5	4.2	4.9	5.6	6.3	7.
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.9	3.5	4.1	4.6	5.2	6.4
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1,(
	marriage	2.5	3.0	3.5	4.0	4.5	5.5
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.2	2.6	3.0	3.5	3.9	4.8
Net Soi	1	· N	Iarriage	Wall Oper	ning Widt	th (ft)	· ·
Pres (ps	sf)	10	. 12	14	16	18	20
1000	marriage	16.1	19.0	21.8	24.7	27.6	30.4
1500	marriage	10.7	12.6	14.5	16.5	18.4	20.3
2000	marriage	8.0	9.5	10.9	12,3	.13.8	15.2
2500	marriage	6.4	7.6	8.7	9.9	11.0	12.2
3000 -	marriage	5.4	6.3	7.3	8.2	9.2	10.1
3500	marriage	4.6	5.4	6.2	7.1	7.9	8.7
4000	marriage	4.0	4.7	5.5	6.2	6.9	7.6

	· · ·	Grou	ind Sn	ow: 70	) psf		
Net So	il .	Tra	insverse	Girder and	I Pier Spa	cing (ft)	
Pres (p	sf)	4	5	6	. 7	8	· 10
1000	ext wall	2.2	2.2	2.2	2.2	2.2	2.2
	marriage	9.5	11.5	13.5	15.4	17.4	21.3
1500	ext wall	1.5	1.5	1.4	1.4	1.4	14
	marriage	6.4	7.7	9.0	10.3	11.6	14.2
2000	ext wall	1.1	1.1	1.1	1.1	1.1	1.1
	marriage	4.8	5.7	6.7	7.7	8.7	10.6
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.8	4.6	5.4	6.2	6.9	8.5
3000	ext wall	1.0	1.0	1.0	1.0	10	10
	marriage	3.2	3.8	4.5	5.1	5.8	7.1
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.7	3.3	3.8	4.4	5.0	6.1
4000	ext wall	1.0	1.0	1.0	1.0	1:0	1.0
	marriage	2.4	2.9	3.4	3.9	4.3	5.3
Net Soi	1	N	Marriage	Wall Oper	ning Widi	h (ft)	
Pres (ps	sf)	10	12	14	16	18	20
1000	marriage	18.3	21.6	24.9	28.2	31.5	34.8
1500	marriage	12.2	14.4	16.6	18.8	21.0	. 23.2
2000	marriage	91	10.8	12.4	14.1	15.7	17.4
2500	marriage	7.3	8.6	9.9	11.3	12.6	13.9
3000	marriage	6.1	7.2	8.3	9.4	- 10.5	116
3500	marriage	5.2	6.2	7.1	8.0	9.0	9.9
4000	marriage	4.6	5.4	6.2	7.0	7.9	8.7

LNet Sc		Gro	und Sn	ow 6	) nef				
Ground Snow: 60 psf           Net Soil         Transverse Girder and Pier Spacing (ft)									
Pres (		4	ansverse v 5				10		
1000	ext wall	2.1	2.1	<u>6</u> 2.1	2.1	2.1	10		
1000	marriage	9.1	11.0	12.8	14.7	16.5	2.1		
1500	ext wall	1.4	1.4	12.8	14.7	10.5	20.2		
1500	marriage	6.1	7.3	8.5	1.4 9.8	1.4 11.0	1.4		
2000	ext wall	1.1	1.1	1.1	1.1	1.1	13.5		
2000	marriage	4.6	5.5	6.4	7.3	8.3	1.1 10.1		
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	3.6	4.4	5.1	5.9	6.6	8.1		
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	3.0	3.7	4.3	4.9	5.5	6.7		
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
	marriage	2.6	3.1	3.7	4.2	4.7	5.8		
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0		
<u> </u>	marriage	2.3	2.7	3.2	3.7	4.1	5.0		
Net So	il	. ]	Marriage 1	Wall Oper	ning Wid		<u> </u>		
Pres (p	sf)	10	.12	14	16	18	20		
1000	marriage	17.2	20.3	23.3	26.4	29.5	32.6		
1500	marriage	11.4	13.5	15.6	17.6	19.7	21.7		
2000	marriage	8.6	10.1	11.7	13.2	14.8	16.3		
2500	marriage	6.9	8.1	9.3	10.6	11.8	13.0		
3000	marriage	5.7	6.8	7.8	8.8	9.8	10.9		
3500	marriage	4.9	5.8	6.7	.7.6	8.4	9.3		
4000	marriage	4.3	5.1	5.8	6.6	7.4	8.1		
	· · · · ·								
			nd Sno						
Net So		Tra	nsverse G	irder and	Pier Space	ing (ft)			
Pres (p	sf)	4	5 .	6	7	8	10		
1000	ext wall	2.2	2.2	2.2	2.2	2.2	2.2		
	marriage		12.0	.14.1	16.2	18.2	22.4		
1500	ext wall	1.5	1.5	1.5	1.5	1.5	1.5		
	marriage	6.7	8.0	9.4	10.8	12.2	14.9		
2000	ext wall	1.1	1.1	1.1	1.1	1.1	1.1		
<u> </u>	marriage	5.0	6.0	7.1	8.1	9.1	11.2		
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1 0		
							1.0		
	marriage	4.0	4.8	5.6	6.5	7.3	1.0 8.9		
3000	ext wall	4.0	1.0	<u>5.6</u> 1.0	<u>6.5</u> 1.0	7.3 1.0	8.9 1.0		
· .	ext wall marriage	4.0 1.0 3.3	1.0 4.0	5.6 1.0 4.7	6.5 1.0 5.4	7.3 1.0 6.1	8.9 1.0 7.5		
3000 3500	ext wall marriage ext wall	4.0 1.0 3.3 1.0	1.0 4.0 1.0	5.6 1.0 4.7 1.0	6.5 1.0 5.4 1.0	7.3 1.0 6.1 1.0	8.9 1.0 7.5 1.0		
3500	ext wall marriage ext wall marriage	4.0 1.0 3.3 1.0 2.9	1.0 4.0 1.0 3.4	5.6 1.0 4.7 1.0 4.0	6.5 1.0 5.4 1.0 4.6	7.3 1.0 6.1 1.0 5.2	8.9 1.0 7.5 1.0 6.4		
· .	ext wall marriage ext wall marriage ext wall	4.0 1.0 3.3 1.0 2.9 1.0	1.0 4.0 1.0 3.4 1.0	5.6 1.0 4.7 1.0 4.0 1.0	6.5 1.0 5.4 1.0 4.6 1.0	7.3 1.0 6.1 1.0 5.2 1.0	8.9 1.0 7.5 1.0 6.4 1.0		
3500 4000	ext wall marriage ext wall marriage ext wall marriage	4.0 1.0 3.3 1.0 2.9 1.0 2.5	1.0 4.0 1.0 3.4 1.0 3.0	5.6 1.0 4.7 1.0 4.0 1.0 3.5	6.5 1.0 5.4 1.0 4.6 1.0 4.0	7.3 1.0 6.1 1.0 5.2 1.0 4.6	8.9 1.0 7.5 1.0 6.4		
3500 4000 Net Soi	ext wall marriage ext wall marriage ext wall marriage l	4.0 1.0 3.3 1.0 2.9 1.0 2.5 N	1.0 4.0 1.0 3.4 1.0 3.0 farriage V	5.6 1.0 4.7 1.0 4.0 1.0 3.5 Vall Open	6.5 1.0 5.4 1.0 4.6 1.0 4.0 ing Widtl	7.3 1.0 6.1 1.0 5.2 1.0 4.6 n (ft)	8.9 1.0 7.5 1.0 6.4 1.0 5.6		
3500 4000 Net Soi Pres (ps	ext wall marriage ext wall marriage ext wall marriage l	4.0 1.0 3.3 1.0 2.9 1.0 2.5 M 10	1.0 4.0 1.0 3.4 1.0 3.0 1arriage V 12	5.6 1.0 4.7 1.0 4.0 1.0 3.5 Vall Open 14	6.5 1.0 5.4 1.0 4.6 1.0 4.0 ing Widtl 16	7.3 1.0 6.1 1.0 5.2 1.0 4.6 1 (ft) 18	8.9 1.0 7.5 1.0 6.4 1.0 5.6 20		
3500 4000 Net Soi Pres (ps 1000	ext wall marriage ext wall marriage ext wall marriage l sf) marriage	4.0 1.0 3.3 1.0 2.9 1.0 2.5 N 10 19.3	1.0 4.0 1.0 3.4 1.0 3.0 farriage V 12 22.9	5.6 1.0 4.7 1.0 4.0 1.0 3.5 Vall Open 14 26.4	6.5 1.0 5.4 1.0 4.6 1.0 4.0 10 4.0 10 10 29.9	7.3 1.0 6.1 1.0 5.2 1.0 4.6 n (ft) 18 33.4	8.9 1.0 7.5 1.0 6.4 1.0 5.6 20 36.9		
3500 4000 Net Soi Pres (ps 1000 1500	ext wall marriage ext wall marriage ext wall marriage i sf) marriage marriage	4.0 1.0 3.3 1.0 2.9 1.0 2.5 N 10 19.3 12.9	1.0 4.0 1.0 3.4 1.0 3.0 farriage V 12 22.9 15.2	5.6 1.0 4.7 1.0 4.0 1.0 3.5 Vall Open 14 26.4 17.6	6.5 1.0 5.4 1.0 4.6 1.0 4.0 10 4.0 10 10 29.9 19.9	7.3 1.0 6.1 1.0 5.2 1.0 4.6 1 (ft) 18 33.4 22.3	8.9 1.0 7.5 1.0 6.4 1.0 5.6 20 36.9 24.6		
3500 4000 Net Soi Pres (ps 1000 1500 2000	ext wall marriage ext wall marriage ext wall marriage i sf) marriage marriage marriage	4.0 1.0 3.3 1.0 2.9 1.0 2.5 M 10 19.3 12.9 9.7	1.0 4.0 1.0 3.4 1.0 3.0 farriage V 12 22.9 15.2 11.4	5.6 1.0 4.7 1.0 4.0 1.0 3.5 Vall Open 14 26.4 17.6 13.2	6.5 1.0 5.4 1.0 4.6 1.0 4.0 1.0 1.0 4.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1	7.3 1.0 6.1 1.0 5.2 1.0 4.6 1 (ft) 18 33.4 22.3 16.7	8.9 1.0 7.5 1.0 6.4 1.0 5.6 20 36.9 24.6 18.5		
3500 4000 Net Soi Pres (ps 1000 1500 2000 2500	ext wall marriage ext wall marriage ext wall marriage f) marriage marriage marriage marriage	4.0 1.0 3.3 1.0 2.9 1.0 2.5 M 10 19.3 12.9 9.7 7.7	1.0 4.0 1.0 3.4 1.0 3.0 farriage V 12 22.9 15.2 11.4 9.1	5.6 1.0 4.7 1.0 4.0 1.0 3.5 Vall Open 14 26.4 17.6 13.2 10.6	6.5 1.0 5.4 1.0 4.6 1.0 4.0 ing Widtl 16 29.9 19.9 14.9 12.0	7.3 1.0 6.1 1.0 5.2 1.0 4.6 1(ft) 18 33.4 22.3 16.7 13.4	8.9 1.0 7.5 1.0 6.4 1.0 5.6 20 36.9 24.6 18.5 14.8		
3500 4000 Pres (ps 1000 1500 2000 2500 3000	ext wall marriage ext wall marriage ext wall marriage f) marriage marriage marriage marriage marriage	4.0 1.0 3.3 1.0 2.9 1.0 2.5 N 10 19.3 12.9 9.7 7.7 6.4	1.0 4.0 1.0 3.4 1.0 3.0 farriage V 12 22.9 15.2 11.4 9.1 7.6	5.6 1.0 4.7 1.0 4.0 1.0 3.5 Vall Open 14 26.4 17.6 13.2 10.6 8.8	6.5 1.0 5.4 1.0 4.6 1.0 4.0 ing Widtl 16 29.9 19.9 14.9 12.0 10.0	7.3 1.0 6.1 1.0 5.2 1.0 4.6 1 (ft) 18 33.4 22.3 16.7 13.4 11.1	8.9 1.0 7.5 1.0 6.4 1.0 5.6 20 36.9 24.6 18.5 14.8 12.3		
3500 4000 Net Soi Pres (ps 1000 1500 2000 2500	ext wall marriage ext wall marriage ext wall marriage f) marriage marriage marriage marriage	4.0 1.0 3.3 1.0 2.9 1.0 2.5 M 10 19.3 12.9 9.7 7.7	1.0 4.0 1.0 3.4 1.0 3.0 farriage V 12 22.9 15.2 11.4 9.1	5.6 1.0 4.7 1.0 4.0 1.0 3.5 Vall Open 14 26.4 17.6 13.2 10.6	6.5 1.0 5.4 1.0 4.6 1.0 4.0 ing Widtl 16 29.9 19.9 14.9 12.0	7.3 1.0 6.1 1.0 5.2 1.0 4.6 1(ft) 18 33.4 22.3 16.7 13.4	8.9 1.0 7.5 1.0 6.4 1.0 5.6 20 36.9 24.6 18.5 14.8		

Multi-Section	Aftg E7
Width	16'

		_					
		Grou	ind Sn	ow: 90	) psf		
Net So	il			Firder and		cing (ft)	
Pres (p	isf)	4	5	6	7	8	10
1000	ext wall	2.3	2.3	2.3	2.3	2,3	2.3
	marriage	10.4	12.6	14.8	16.9	19.1	23.5
1500	ext wall	1.5	1:5	1.5	1.5	1.5	1.5
	marriage	6.9	8.4	9.8	11.3	12.7	15.6
2000	ext wall	1.1	1.1	1.1	1.1	1.1	1.1
	marriage	5.2	6.3	7.4	8.5	9.6	.11.7
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	4.2	5.0	5.9	6.8	7.6	9.4
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
•	marriage	3.5	4.2	4.9	5.6	6.4	7.8
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.0	3.6	4.2	4.8	5.5	6.7
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
•	marriage	2.6	3.1	3.7	4.2	4.8	5.9
Net Soi		1	Marriage V	Wall Oper			
Pres (p:	sf)	10	12	14	16	18	20
1000	marriage	20.4	24.2	27.9	31.6	35.4	39.1
1500	marriage	13.6	16.1	18.6	21.1	23.6	26.1
2000	marriage	10.2	12.1	13.9	15.8	17.7	19.6
2500	marriage	8.2	9.7	11.2	12.7	14.1	15.6
3000	marriage	6.8	8.1	9.3	10.5	11.8	13.0
3500	marriage	5.8	6.9	8.0	9.0	10.1	11.2
4000	marriage	5.1	6.0	7.0	7.9	8.8	9.8

	:	Grou	nd Sno	w: 10	0 psf		
Net So	il ····	Tr	ansverse (	Girder and	l Pier Spa	cing (ft)	
Pres (p	sf)	4	5	6	7	8	10
1000	ext wall	2.3	2.3	2.3	2.3	2.3	2.3
	marriage	10.8	13.1	15.4	17.7	20.0	24.5
1500	ext wall	1.6	1.6	1.6	1.6	1.6	1.5
	marriage	7.2	8.8	10.3	11.8	13.3	16.4
2000	ext wall	1.2	1.2	1.2	1.2	1.2	1.2
	marriage	5.4	6.6	7.7	8.8	10.0	12.3
2500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	4.3	5.3	6.2	7.1	8.0	9.8
3000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.6	4.4	5.1	5.9	6.7	8.2
3500	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	3.1	3.8	4.4	5.1	5.7	7.0
4000	ext wall	1.0	1.0	1.0	1.0	1.0	1.0
	marriage	2.7	3.3	3.9	4.4	5.0	6.1
Net Soi	il <sup>.</sup>	N	Aarriage V	Wall Oper	ning Widt	h (ft)	
Pres (p.	sf)	10	12	14	16	18	20
1000	marriage	21.5	25.5	29.4	33.4	37.3	41.3
1500	marriage	14.3	17.0	19.6	22.2	24.9	27.5
2000	marriage	10.8	12.7	14.7	16.7	18.7	20.6
2500	marriage	. 8.6	10.2	11.8	13.3	14.9	16.5
3000	marriage	7.2	8.5	9.8	11.1	12.4	13.8
3500	marriage	6.1	7.3	8.4	9.5	10.7	11.8
4000	marriage	5.4	6.4	7.4	8.3	9.3	10.3

Minimum interior pier area is 1.0 sqft. The Exterior Footing Widths are shown in feet. The Marriage Wall Footing Areas are shown in square feet.

Г

Part 2	1 · .	
Required Vertical Anchorage -	·A	V

### **Single-Section C**

Required Vertical Anchorage - Av (lbs)

<b>Ay</b>	Single-Section
C.	Width
	Est.

J

 $\square$ 

Single-Section

Width

pivot

Av C

14'

•	Wind S	Speed		. ]				
÷	(mp	h)	4	5	6	7	8	10
	Inland	80	970	1210	1450	1700	1940	2420
	1	90	1360	1710	2050	2390	2730	3410
	1.	100	1810	2260	2710	3160	3610	4510
		110	2290	2870	3440	4010	4580	5730
	Coastal	80	1120	1400	1680	1960	2240	2810
	·	90	1560	1950	2340	2720	. 3110	3890
	14	-100	2040	2550	3060	3580	<b>40</b> 90	5110
		110	2580	3220	3870	4510	5160	6450

### Required Vertical Anchorage - Av (lbs)

Wind S	Speed		. ]				
(mp	h)	4	5	6	· 7	. 8	10
Inland	80	960	1200	1450	1690	1930	2410
	90	1370	1710	2060	2400	2740	3430
	100	1830	2280	2740	3200	3660	4570
	110	2330	2910	3500	4080	4660	5830
Coastal	80	1120	1400	1680	1960	2240	2800
	90	1570	1960	2360	2750	3140	3930
	100	2070	2590	3110	3630	4150	5180
	110	2630	3290	3940	4600	5260	6570

### Av C Single-Section 16' Width

Wind S	Speed		J	Pier Spac	ing (ft)		
(mp	h)	4	5	6	7	8	10
Inland	80	900	1130	1360	1580	1810	2260
	90	1310	1640	1960	2290	2620	3270
	100	1760	2210	2650	3090	3530	4410
	110	2270	2830	3400	3970	4530	5670
Coastal	80	1060	1330	1590	1860	2120	2650
	90	1510	1890	2260	2640	3020	3770
	100	2010	2510	3010	3520	4020	5020
NJ 1	110	2560	3200	3840	4480	5130	6410

### **Single-Section C1**

Required Vertical Anchorage - Av (lbs)

Wind S	Speed	lbs/ft	Anchor Spacing (ft)						
(mph)			4	5	6	7	8	10	
Inland	80	170	680	850	1020	1190	1360	1700	
	90	240	960	1190	1430	1670	1910	2390	
	100	320	1260	1580	1900	2210	2530	3160	
	110	400	1610	2010	2410	2810	3210	4020	
Coastal	80	200	790	980	1180	1380	1570	1970	
	90	270	1090	1360	1640	1910	2180	2730	
	100	360	1430	1790	2150	2510	2860	3580	
	110	450	1810	2260	2710	3160	3620	4520	

#### Required Vertical Anchorage - Av (lbs)

Wind Speed lbs/ft (mph)			1.11					
			4	5	6	7	. 8	10
Inland	80	160	640	800	960	1120	1280	1610
	. 90	230	910	1140	1370	1600	1830	2290
	100	300	1220	1520	1830	2130	2440	3050
	110	390	1550	1940	2330	2720	3110	3890
Coastal	80	190	750	930	1120	1310	1490	1870
	90	260	1050	1310	1570	1830	2090	2620
	100	350	1380	1730	2070	2420	2760	3460
	110	440	1750	2190	2630	3070	3510	4380
		-					•	

Wind S	Speed	lbs/ft	Anchor Spacing (ft)					
(mph)			4	5	6	7	8	10
Inland	80	150	610	770	920	1070	1230	1530
	90	220	890	1110	1330	1560	1780	2220
	100	300	1200	1500	1800	2090	2390	2990
	110	380	1540	1920	2310	2690	3080	3840
Coastal	80	180	720	900	1080	1260	1440	1800
	90	260	1020	1280	1540	1790	2050	2560
	100	340	1360	1700	2040	2390	2730	3410
	110	430	1740	2170	2610	3040	3480	4350







$\square$	Av
Single-Section	C1
Width	16'

### **Single-Section E**





lbs/ft

120

190

260

340

150

220

300

390

Wind Speed

(mph)

80

90

100

110

80

90

100

110

Inland

Coastal

pivot P	I

**14'** 

	⊑ <u></u> ∓ ≫	
•		· · · · · · · · · · · · · · · · · · ·
Av		Red
E	Single-Section	

Width

#### Required Vertical Anchorage - Av (lbs/ft)

Wind		lbs/ft		· · ·				and the second second
(mj	oh)							
Inland	80	120		· ·		11		
	90	190					÷	
	100	270	÷.,		- <u>-</u>	· · ·		
	110	350	· ·		·		. • .	
Coastal	80	. 150	1.			, i i		
	90	220	· · ·		•		<i>v</i>	
	100	310				<u>.</u>		
	110	410	· .					

Av	$\square$
E	Single-Section
16'	Width

Wind S (mp		lbs/ft	· ·	· .		
Inland	80	120		÷.,		
	90	200				
	100	280	· .			
	110	370				
Coastal	80	150	÷.			
	.90	230				
	100	320		÷	1.1	
	110	420				

**Single-Section E3** 

Required Vertical Anchorage - Av (lbs)

Wind Speed Exterior (mph) (lbs/ft)			• •	Interior Pier Spacing (ft)					
		<u> </u>	4	5	6	7	8	10	
Inland	80	80	230	290	350	410	470	590	
	90	120	360	450	540	630	730	910	
	100	160 🗄	510	630	760	890	1010	1270	
	110	220	660	830	1000	1160	1330	1660	
Coastal	80	90	280	350	430	500	570	710	
	90	140	430	530	: 640	740	850	1060	
	100	190	580	730	880	1020	1170	1460	
. <u> </u>	110	250	760	950	1140	1330	1520	1900	
		· · · ·							

### Required Vertical Anchorage - Av (lbs)

Wind (mr	-	Exterior (lbs/ft)		·				
		<u> </u>	4	5	6	7	8	10
Inland	80	80	230	290	350	400	460	580
	90	120	360	460	550	640	730	910
	100	170	510	640	770	900	1030	1290
	110	. 230	680	850	1020	1190	1360	1700
Coastal	80	90	280	350	420	490	560	710
	90	140	430	540	. 650	750	860	1080
	100	200	600	740	890	1040	1190	1490
	110	260	780	970	1170	1360	1560	1950

Wind S (mp	•	Exterior (lbs/ft)									
			. 4	5	6	7	8	10			
Inland	80	80	230	290	350	410	470	590			
	90	120	380	470	570	660	750	940			
	100	180	540	670	810	940	1070	1340			
	110	240	710	890	1070	1250	1430	1780			
Coastal	80	100	290	360	430	510	580	720			
	90	150	450	560	670	780	890	1120			
	100	210	620	780	930	1090	1250	1560			
	110	270	820	1020	1220	1430	1630	2040			







Single-Section	Av E3
Width	16

Av I Single-Section 12' Width



# Single-Section I

Required Vertical Anchorage - Av (lbs)

Wind S	Speed		Pier Spacing (ft)						
(mp		4	5	6	7	8	10		
Inland	80	630	790	950	1100	1260	1580		
	90	980	1220	1460	1710	1950	2440		
	100	1360	1700	2040	2380	2720	3400		
	110	1790	2230	2680	3130	3570	4470		
Coastal	80	760	950	1140	1340	1530	1910		
	90	1140	1430	1720	2000	2290	2860		
	100	1570	1960	2350	2740	3140	3920		
	110	2040	2550	3060	3570	4080	5100		

e

Av	$\square$
1	Single-Section
14'	Width

### Required Vertical Anchorage - Av (lbs)

Wind Speed		Pier Spacing (ft)						
(mp	- <b>.</b>	4	5	6	7	8	10	
Inland	80	640	800	960	1120	1280	1600	
	90	1010	1270	1520	1770	2030	2530	
	100	1430	1790	2150	2500	2860	3580	
	110	1890	2360	2840	3310	3780	4730	
Coastal	80	780	980	1180	1370	1570	1960	
	90	1200	1490	1790	2090	2390	2990	
	100	1660	2070	2480	2900	3310	4140	
	110	2160	2700	3240	3790	4330	5410	



Wind Speed							
(mp		4	5	6	7	8	10
Inland	80	650	810	970	1130	1290	1610
	90	1040	1300	1550	1810	2070	2590
	100	1470	1840	2210	2580	2950	3680
	110	1960	2450	2940	3430	3910	4890
Coastal	80	800	1000	1190	1390	1590	1990
	90	1230	1530	1840	2150	2460	3070
	100	1710	2140	2560	2990	3420	4270
	110	2240	2800	3360	3920	4490	5610

### **Multi-Section C**

Required Vertical Anchorage - Av (lbs)

Wind S	Speed	Pier Spacing (ft)							
<u>(mp</u>	oh)	4	5	6	7	8	10		
Inland	80	570	710	860	1000	1140	1430		
	90	990	1230	1480	1730	1980	2470		
	100	1450	1820	2180	2540	2910	3630		
	110	1970	2460	2950	3440	3930	4920		
Coastal	80	730	910	1100	1280	1460	1830		
	90	1190	1490	1790	2080	2380	2980		
	100	1700	2130	2560	2980	3410	4260		
	110	2270	2840	3410	3970	4540	5680		

### Required Vertical Anchorage - Av (lbs)

Wind S	Speed		Pier Spacing (ft)						
(mp	h)	4	5	6	7	8	10		
Inland	80	640	800	960	1120	1280	1600		
	90	1110	1380	1660	1930	2210	2760		
	100	1630	2030	2440	2840	3250	4060		
	110	2200	2750	3300	3850	4400	5500		
Coastal	80	820	1020	1230	1430	1640	2050		
	90	1330	1670	2000	2330	2670	3330		
	100	1910	2380	2860	3340	3810	4770		
	110	2540	3180	3810	4450	5080	6350		
· · · · · ·					· · · ·				

Wind S	Speed		Ē	Pier Spac	ing (ft)		
) (mp	h)	4	5	6	7	- 8	10
Inland	80	700	880	1050	1230	1400	1750
	90	1210	1510	1820	2120	2420	3030
	100	1780	2230	2670	3120	3560	4450
	110	2410	3010	3620	4220	4820	6030
Coastal	80	900	1120	1350	1570	1790	2240
	90	1460	1820	2190	2550	2920	3650
	100	2090	2610	3130	3650	4180	5220
	110	2780	3480	4180	4870	5570	6960





Multi-Section	Av
Width	16'
Tiedowns	2





Wind S	Speed	Pier Spacing (ft)						
(mp	nĥ)	4	5	6	7	8	10	
Inland	80	370	460	550	650	740	920	
	.90	640	800	960	1120	1280	1600	
	1 <b>0</b> 0	940	1180	1410	1650	1880	2350	
	110	1270	1590	1910	2230	2550	3180	
Coastal	80	470	590	710	830	950	1180	
	<b>9</b> 0	770	960	1160	1350	1540	1930	
	100	1100	1380	1650	1930	2210	2760	
	110	1470	1840	2210	2570	2940	3680	

#### Required Vertical Anchorage - Av (lbs)

Wind S	Speed		1	Pier Space	ing (ft)		
(mp	n)	4	5	6	7	8	10
Inland	80	410	510	620	720	820	1030
	90	710	890	1070	1240	1420	1780
	100	1050	1310	1570	1830	2090	2610
	110	1410	1770	2120	2480	2830	3540
Coastal	80	530	660	790	920	1050	1320
	90	860	1070	1290	1500	1710	2140
	100	1230	1530	1840	2140	2450	3060
	110	1630	2040	2450	2860	3270	4080
						1.97	·····

.....

Av	
C	<b>Multi-Section</b>
16'	Width
424	Tiedowns

Av C

12' 4

pivot

Ay C

14'

4

Multi-Section Width

Tiedowns

G

₽

J

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**Multi-Section** 

Width

Tiedowns

4 tiedowns

P

#### Required Vertical Anchorage - Av (lbs)

Wind	Speed		.:				
(m	oĥ)	4	: 5	6	7	8	10
Inland	80	450	560	680	790	900	1130
	90	780	980	1170	1370	1560	1950
	100	1150	1430	1720	2010	2300	2870
	110	1550	1940	2330	2720	3110	3880
Coastal	80	580	720	870	1010	1160	1450
	90	940	1180	1410	1650	1880	2350
	100	1350	1680	2020	2360	2690	3370
	110	1790	2240	2690	3140	3590	4480

.

### **Multi-Section E**

#### Required Vertical Anchorage - Av (lbs/ft)

Wind S	Wind Speed (mph)	
(mp		
Inland	. 80	110
	90	210
	100	310
	110	430
Coastal	80	150
	90	250
	100	370
	110	500



### Required Vertical Anchorage - Av (lbs/ft)

Wind S	-	Exterior (lbs/ft)
Inland	80	130
	90	240
÷	100	360
	110	490
Coastal	80	170
	90	290
	100	420
	110	570

	Wind Speed (mph)		;		et de la composition de la composition de la composition de la composition de la composition de la composition
Inland	80	(lbs/ft) 150	-		
	90	270			
	100	400			
	110	550			1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -
Coastal	80	190			
	90	.330			
	100	480			
	110	640		· .	
				 · .	









### **Multi-Section** E

Required Vertical Anchorage - Av (lbs)





**Multi-Section** 

Width Tiedowns

Av E

14'

4

Wind Speed Exterior (mph) (lbs/ft)		Exterior			Inter	ior		
			Pier Spacing (ft)					
			- 4	5	6	7	8	10
Inland	80	70	180	230	270	320	360	450
	90	140	330	420	500	590	670	840
	100	210	510	630	760	890	1020	1270
	110	280	700	870	1050	1220	1400	1750
Coastal	80	100	240	300	360	420	480	600
	90	170	410	510	620	720	820	1030
	100	240	600	750	900	1050	1200	1500
	110	330	810	1010	1220	1420	1620	2030

#### Required Vertical Anchorage - Av (lbs)

				IOI Opus	ing (ft)	•	
		4	5	.6	. 7	8	10
80	80	210	270	320	370	420	530
90	160	390	490	580	680	780	970
00	230	590	730	880	1030	1170	1470
10	320	810	1010	1210	1410	1610	2010
80	110	280	350	420	490	560	700
90	190	480	590	710	830	950	1190
00	280	690	870	1040	1210	1390	1730
10	370	930	1170	1400	1640	1870	2340
	90 00 10 80 90 00	90         160           00         230           10         320           80         110           90         190           00         280	90         160         390           00         230         590           10         320         810           80         110         280           90         190         480           00         280         690	90         160         390         490           00         230         590         730           10         320         810         1010           80         110         280         350           90         190         480         590           00         280         690         870	9016039049058000230590730880103208101010121080110280350420901904805907100028069087010401037093011701400	90160390490580680002305907308801030103208101010121014108011028035042049090190480590710830002806908701040121010370930117014001640	901603904905806807800023059073088010301170103208101010121014101610801102803504204905609019048059071083095000280690870104012101390103709301170140016401870

Wind Speed (mph)		Exterior (lbs/ft)		I	Inter Pier Spac			
	· .	, i	4	5 -	6	7	8	10
Inland	80	100	240	300	360	420	480	600
	90.	180	440	540	650	760	870	1090
	100	260	650	820	980	1150	1310	1640
	110	360	900	1120	1340	1570	1790	2240
Coastal	80	130	320	390	470	550	630	790
	90	210	530	660	800	930	1060	1330
	100	310	770	970	1160	1350	1540	1930
	110	420	1040	1300	1560	1820	2080	2600

Av	
E	<b>Multi-Section</b>
16'	Width
4	Tiedowns

Required Vertical Anchorage - Av (lbs)								
Wind S (mp	•	Exterior (lbs/ft)		І	Inter Pier Spac			
			4	. 5 .	6	7	8	10
Inland	80	50	170	210	260	300	340	430
	90	90	320	400	480	560	640	800
	100	140	480	600	720	840	970	1210
	110	190	660	830	1000	1160	1330	1660
Coastal	80	60	230	290	340	400	460	570
	90	110	390	490	590	680	780	980
	100	160	570	710	860	1000	1140	1430
·	110	220	770	960	1160	1350	1540	1930

**Multi-Section E3** 

### Required Vertical Anchorage - Av (lbs)

Wind (mj	Speed ph)	Exterior (lbs/ft)	· · ·	]	Inter Pier Spac		· .	
			. 4	5	6	7	8	10
Inland	80	60	200	250	300	350	400	490
	90	100	360	450	540	640	730	910
	100	160	550	680	820	960	1100	1370
	110	210	750	940	1130	1320	1500	1880
Coastal	80	70	260	330	390	460	520	650
1	-90	130	440	550	670	780	890	1110
	100	180	650	810	970	1130	1290	1620
	110	250	870	1090	1310	1530	1740	2180

#### Required Vertical Anchorage - Av (lbs)

Wind Speed (mph)		Exterior (lbs/ft)	Interior Pier Spacing (ft)						
× 1		<b>()</b>	4	5	6	. 7	8	- 10	
Inland	80	60	230	280	340	400	450	560	
	90	120	410	510	610	720	820	1020	
	100	170	610	770	920	1080	1230	1540	
	110	240	840	1050	1260	1470	1680	2100	
Coastal	80	80	300	370	450	520	590	740	
	90	140	500	620	750	870	1000	1250	
	100	210	730	910	1090	1270	1450	1810	
	110	280	980	1220	1460	1710	1950	2440	







		Av
	<b>Multi-Section</b>	E3
•	Width	16'
	Tiedowns	6

#### B-57

### **Multi-Section I**

Required Vertical Anchorage - Av (lbs)

Wind	Speed		Pier Spacing (ft)								
(mp	oh)	4	5	6	7	8	10				
Inland	80	510	630	760	890	1010	1260				
	90	940	1170	1410	1640	1880	2350				
	100	1420	1780	2140	2490	2850	3560				
	110	1960	2450	2940	3430	3920	4900				
Coastal	80	670	840	1010	1180	1350	1680				
	90	1150	1440	1730	2010	2300	2880				
	100	1690	2110	2530	2950	3370	4210				
	110	2280	2840	3410	3980	4550	5690				
				•		•					

#### Required Vertical Anchorage - Av (lbs)

Required Vertical Anchorage - Av (lbs)

Wind	Speed		Pier Spacing (ft)							
<u>(m</u>	ph)	4	5	6	7	8	10			
Inland	80	590	740	890	1040	1190	1480			
	90	1090	1360	1630	1910	2180	2720			
	100	1640	2050	2460	2880	3290	4110			
	110	2260	2820	3380	3950	4510	5640			
Coastal	80	780	980	1180	1370	1570	1960			
	90	1330	1660	2000	2330	2660	3330			
	100	1940	2430	2910	3400	3880	4860			
	110	2620	3270	3930	4580	5230	6540			
							00 10			

<b>Julti-Section</b>
XWAVA DOUGUI
Width
Tiedowns

Av I

12'

pivot 🚺

Av

Ι

14'

2 tiedowns

 $\square$ 

**Multi-Section** 

Width

Tiedowns

**Multi-Section** 

Width

Tiedowns

#### Wind Speed Pier Spacing (ft) (mph) Inland Coastal

					M	ulti-	Secti	ion I		
Requir	ed Ver	tical Ai	nchorag	ge - Av	(lbs)	4 		· ·		
Wind S	Speed		Pier Spacing (ft)							
(mp	(mph)		4 5		7	8	10			
Inland	80	300	380	450	530	600	760	÷.,		
	90	560	700	840	980	1120	1400			
	100	850	1060	1280	1490	1700	2130			
	110	1170	1460	1760	2050	2340	2930			
Coastal	80	400	500	600	700	800	1010			
· · ·	90	690	860	1030	1200	1380	1720			
· · · ·	100	1010	1260	1510	1760	2020	2520			
:. <u>.</u>	110	1360	1700	2040	2380	2720	3400			
	÷.		·		· ·					

### Required Vertical Anchorage - Av (lbs)

Wind	Speed		Pier Spacing (ft)										
(m_	oh)	4	5	6	7	8	10						
Inland	80	350	440	530	610	700	880						
	90	640	800	960	1130	1290	1610						
	100	970	1210	1460	1700	1940	2430						
	110	1330	1660	2000	2330	2660	3330						
Coastal	80	460	580	700	810	930	1160						
	90	790	980	1180	1380	1570	1960						
	100	1150	1430	1720	2010	2290	2870						
	110	1540	1930	2320	2700	3090	3860						
1. A.													
	1			17.5 1919	1. A.								

Wind S	Speed	·	Pier Spacing (ft)									
(mp	h)	. 4	5	- 6	7	. 8	10					
Inland	80	400	500	600	700	800	1000					
	90	720	910	1090	1270	1450	1810					
	100	1090	1360	1630	1900	2170	2720					
	110	1490	1860	2230	2610	2980	3720					
Coastal	80	520	660	790	920	1050	1310					
	90	880	1100	1320	1550	1770	2210					
	100	1280	1600	1920	2250	2570	3210					
	110	1730	2160	2590	3020	3450	4310					









## Part 3 Required Horizontal Anchorage - Ah - Transverse Direction

### Single-Section C, E, I

Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

Wind		Seismic Ground										
Spee	ed .	<u>Aa</u> Snow	Location	Length (ft)								
(mph)		(psf)		40	50	60	70	80	<b>9</b> 0	100		
Inland	80	All Seismic	end	540	680	820	-950	1090	1230	1370		
	90	All Seismic	end	690	870	1040	1210	1390	1560	1730		
	100	All Seismic	end	860	1070	1280	1500	1710	1930	2140		
	110	All Seismic	end	1040	1290	1550	1810	2070	2330	2590		
Coastal	80	All Seismic	end	600	750	900	1050	1210	1360	1510		
	90	All Seismic	end	760	960	1150	1340	1530	1720	1910		
	100	All Seismic	end	940	.1180	1420	1650	1890	2120	2360		
	110	All Seismic	end	1140	1430	1710	2000	2280	2570	2850		

### Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

							9				
Win	ıd	Seismic	Ground					11 A.		÷	$L^{(1)}$
Spee	ed	<u>Aa</u>	Snow	Location	11		Le	ngth (ft	)		
<u>(mp</u> )	h)		(psf)	1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	40	50	60	70	80	90	100
Inland	80	.0530	0-100	end	480	600	720	840	960	1080	1200
	ĺ	.40	0-90	end	480	600	720	840	960	1080	1200
			100	end	490	610	720	840	960	1080	1200
	90	All Se	eismic	end	610	760	910	1060	1210	1370	1520
	100	All Seismic		end	750	940	1120	1310	1500	1690	1870
	110	All Seismic		end	910	1130	1360	1590	1810	2040	2270
Coastal	80	All Se	eismic	end	530	660	790	920	1060	1190	1320
	90	All Se	eismic	end	. 670	840	1000	1170	1340	1510	1670
	100	All Se	eismic	end	830	1030	1240	1450	1650	1860	2070
	110	All Se	eismic	end	1000	1250	1500	1750	2000	2250	2500
1											

### Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

Wir Spec	ed	Seismic <u>Aa</u>		Location	40	50	L. 60	ength (ft 70	) 80	90	. 100
Inland	80	.0530	0-100	end	430	-540	650	760	860	970	1080
•		.40	0-80	end	430	540	650	760	860	970	1080
			90	end	450	560	670	780	890	1000	1110
	1		100	end	490	600	720	840	960	1080	1200
	. 90	All Se	ismic	end	550	690	820	960	1100	1230	1370
	100	All Se	eismic	end	680	850	1020	1180	1350	1520	1690
	110	All Se	eismic	end	820	1020	1230	1430	1640	1840	2050
					table con	tinues					

Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load.



Ah

C, E, I

12'

2

Ah C, E, I

> 14' 2

**Single-Section** 

Width

Short Walls

Single-Section Width

Short Walls



### Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

Win	ıd	Seismic	Ground							•	
Spee	d	Aa	Snow	Location		· .	Le	ength (fi	.)	÷., .	
(mp	h)		(psf)		40	50	60	70	<b>8</b> 0	90	100
Coastal	80	.0530	0-100	end	480	600	720	830	950	1070	1190
		.40	0-90	end	480	600	720	830	950	1070	1190
1 A.	. <u> </u>		100	end	490	600	720	840	960	1080	1200
1. A. A.	90		ismic	end	600	760	910	1060	1210	1360	1510
	100		ismic	end	750	930	1120	1310	1490	1680	1870
	110	All Se	ismic	end	900	1130	1350	1580	1810	2030	2260

# Single-Section Width Short Walls

Ah

C, E, I

12'

4

### Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

Wir	id 🐨	Seismi	c Ground		1999 1997 - 1997						
Spee	eđ	<u>Aa</u>	Snow	Location			L	ength (fi	t)		
(mp)	- í		(psf)		40	50	60	70	80	90	100
Inland	80	AllS	eismic	end	180	220	270	320	360	410	450
1 A.	<u></u>		- <u> </u>	int	360	450	540	630	720	810	900
	90	All S	Seismic	end	230	290	350	400	460	520	580
1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -				int	460	580	690	810	920	1040	1150
	100	All S	eismic	end	290	360	430	500	570	640	710
·		<u>.</u>		, int .	570	<u>710</u>	860	1000	1140	1280	1430
	110	All S	eismic	end	350	430	520	600	690	780	860
·		·		int	690	860	1040	1210	1380	1550	1730
Coastal	80	All S	eismic	end	200	250	300	350	400	450	500
et de la composition de la composition de la composition de la composition de la composition de la composition La composition de la c			· · · · ·	int	400	500	600	700	800	900	1000
5.1.2	90	All S	eismic	end	250	320	380	450	510	570	640
				int	510	640	760	890	1020	1150	1270
	100	All S	eismic	end	310	390	470:	550	630	710	790
				int	630	790	940	1100	1260	1420	1570
	110	All S	eismic	end	380	480	570	670	760	860	950
				int	760	950	1140	1330	1520	1710	1900

**Single-Section** 

Width

Short Walls

### Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

- :	Wi	nd	Seismic	Ground		11.1	12					
	Spe	ed	<u>Aa</u>	Snow	Location	:		L	ength (fi	t) .		
	(mp	<u>h)</u>		(psf)		40	50	60	70	80	90	100
	Inland	- 80	0530	0-100	end	160	200	240	280	320	360	400
		-			int	310	390	470	550	630	710	790
		1.5	.40	0-90	end	160	200	240	280	320	360	400
-		:		i in contractions	int	310	390	470	550	630	710	790
	· • * *	÷	1	100	end	160	200	240	280	320	360	400
				i 	int	320	400	480	560	640	720	800
		90	) All S	eismic	end	200	250	300	350	400	460	510
		;			int	400	510	610	710	810	910	1010
		100	) All S	eismic	end	250	310	370	440	500	560	620
					int	500	620	750	870	1000	1120	1250
		110	$\mathbf{D} = \mathbf{All} \mathbf{S}$	eismic	end	300	380	450	530	600	680	760
					int	600	760	910	1060	1210	1360	1510
					t	able con	tinues					



Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load.

B-61



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Ah

C, E, 1 16' 4

#### Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

Win	d	Seismic Ground					1.1		÷	
Spee	d	<u>Aa</u> Snow	Location		1.1.1	L	ength (fi	t)		
(mpl	n)	(psf)		40	50	60	70	80	90	100
Coastal	80	All Seismic	end	170	220	260	310	350	400	440
			int	350	440	530	610	700	790	880
	90	All Seismic	end	220	280	330	390	450	500	560
			int	450	560	670	780	890	1000	1120
	100	All Seismic	end	280	340	410	480	.550	620	690
			int	550	690	830	960	1100	1240	1380
	110	All Seismic	end	330	420	500	580	670	750	830
	•		int	670	830	1000	1170	1330	1500	1670
			÷.*		:		1.1.1			7.1

#### Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

	Kequi	104	HOHE	Juan 11	nonorag	50 - AI	1 - 110	uisvei	SC DH	.conor	1 (105).	il)
Single-Section Width	Win			Ground			÷ .	<b>.</b>			enti e	
Short Walls	Spee		<u>Aa</u>		Location				ength (fi			2
Unort wants	(mp)	, <b>í</b>		(psf)		40	50	. 60.	70	80	90	100
	Inland	80	.0530	.0-100	end	140	180	210	250	290	320	360
1		[			int	280	360	430	500	570	640	720
			.40	0-80	end	140	180	210	250	290	320	360
					int	280	360	430	500	570	640	720
	:		1	90	end	150	190	220	260	300	330	370
					int	300	380	450	520	600	670	740
	2.5			100	end	160	200	240	280	320	360	400
		l		- :	int	320	400	480	560	640	720	800
	· · · ·	90	All S	eismic	end	180	230	270	320	370	410	460
		5 - S			int	370	460	550	640	730	820	910
		100	All S	eismic	end	230	280	340	390	450	510	560
•					int	450	560	680	. 790		1020	1130
		110	All S	eismic	end	270	340	410	480	550	610	680
	· · ·			11 J 1	int	550	680	820	960	1090	1230	1370
	Coastal	80	.0530	0-100	end	160	200	240	280	320	360	400
					int	320	400	480	560	630	710	790
	1		.40	0-90	end	160	200	240	280	320	360	400
	<i></i>				int	320	400	480	560	630	710	790
				100	end	160	200	240	280	320	360	400
					int	320	400	480	560	640	720	800
and the second second		90	All Se	eismic	end	200	250	300	350	400	450	500
		· ·	1	· ·	int	400	500	600	710	810	910	1010
		100	All Se	eismic	end	250	310	370	440	500	560	620
			• •	1 A.	int	500	620	750	870	1000	1120	1240
		110	All Se	eismic	end	300	380	450	530	600	680	750
	· ·				int	600	750	900	1050	1200	1350	1510
					·4-	······································						100 M 100 M 100 M

Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load.

**B-62** 

Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

Win	nd	Seismic	Ground								
Spe	ed	<u>Aa</u>	Snow	Location			L	ength (fi	t)		
(mp			(psf)		40	50	60	<b>7</b> 0	80	90.	100
Inland	80	All Se	ismic	end	110	130	160	190	220	240	270
				int	210	270	320	380	430	490	540
	90	All Se	ismic	end	140	170	210	240	280	310	350
				int	.280	350	420	480	550	620	690
	100	All Se	ismic	end	.170	210	260	300	340	390	430
				int	340	430	510	600	680	770	860
· .	110	All Se	ismic	end	210	260	310	360	410	470	520
	<u> </u>			int	410	520	620	720	830	930	1040
Coastal	80	All Se	ismic	end	120	150	180	210	240	270	300
				int	240	300	360	420	480	540	600
	90	All Se	ismic	end	150	190	230	270	310	340	380
				int	-310	380	460	530	610	690	760
	100	All Se	ismic	end	190	240	280	330	380	420	470
				int	380	470	570	660	750	850	940
	110	All Se	ismic	end	230	290	340	400	460	510	570
				int	460	570	680	800	910	1030	1140
· · ·			· .		:						





### Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

5 m					1.1						
Wir	nd	Seismic	Ground		i.			· . · ·			
Spe	ed	Aa		Location	·		Ĺe	ngth (ft	)		
(mp			(psf)	<u> </u>	40	50	60	ັ70	80	90	100
Inland	80	.0530	0-100	end	90	120	140	160	190	210	240
				int	190	230	280	330	380	430	470
	-	.40	0-90	end	-90	120	140	160	190	210	240
				int	190	230	280	330	380	430	470
		-	100	end	100	120	140	170	190	220	240
				int	190	240	290	340	380	430	480
	<mark>90</mark>	All Se	eismic	end	120	150	180	210	240	270	300
				int	240	300	360	430	490	550	610
	100	All Se	eismic	end	150	190	220	260	300	340	370
				int	300	.370	450	520	600	670	750
	110	All Se	eismic	end	180	230	270	320	360	410	450
				int	360	450	540	640	730	820	910
Coastal	80	All Se	eismic	end	100	130	160	180	210	240	260
				int	210	260	310	370	420	470	530
	90	All Se	eismic	end	130	170	200	230	270	300	330
		·		int	270	330	400	470	540	600	670
	100	All Se	eismic	end	170	210	250	290	330	370	410
				int	330	410	500	580	660	740	830
	110	All Se	ismic	end	200	250	300	350	400	450	500
	: 			int	400	500	600	700	800	900	1000
						-					



Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load.

Ah C, E, I Single-Section	Requi	ired	Horizo	ontal A	nchora	ge - Al	h - Tra	insver	se Dir	ectior	n (lbs/	ft)
16' Width	Wir	nd	Seismic	Ground								
	Spe	ed	<u>Aa</u>	Snow	Location			Le	ength (ft	)		
6 Short Walls	(mp	h) –		(psf)		40	50	60	70	80	90	100
	Inland	80	.0530		end	80	110	130	150	170	190	210
		ľ			int	170	210	260	300	340	380	430
			.40	0-80	end	.80	110	130	150	170	190	210
<b>^ ^ ^ ^ ^ ^ ^ ^ ^ ^</b>					int	170	210	260	-300	340	380	430
	· .	[ 		90	end	90	110	130	160	180	200	220
		1			int	180	230	270	310	360	400	450
		:		100	end	100	120	140	170	190	220	240
					int	190	240	290	340	380	430	480
	1. 	90	All Se	ismic	end	110	140	160	190	220	250	270
-	÷			10	int	220	270	330	380	440	490	550
		100	All Se	ismic	end	140	170	200	240	270	300	340
					int	270	340	410	470	540	610	680
	1999 - 1999 1999 - 1999	110	All Se	ismic	end	160	200	250	290	330	370	410
					int	330	410	490	570	660	740	820
	Coastal	80	.0530	0-100	end	90	120	140	170	190	210	240
	ана стала (1996) Стала стала (1996) Стала (1996)				int	190	240	280	330	380	430	480
			.40	0-90	end	90	120	140	170	190	210	240
· .					int	190	240	280	330	380	430	480
		·		100	end	100	120	140	170	190	220	240
					int	190	240	290	340	380	430	480
		90	All Se	ismic	end	120	150	180	210	240	270	300
			<u> </u>		int	240	300	360	420	480	540	600
• • •		100	All Se	ismic	end	150	190	220	260	300	340	370
· · ·					int	300	370	450	520	600	670	750
		110	All Se	ismic	end	180	230	270	320	360	410	450
					int	360	450	540	630	720	810	900

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Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load.

ч,

		÷		Inchorag	,	• •					/	Multi-Secti
Wir			Ground						- 4	· · · ·		
Spee		<u>Aa</u>		Location			L	ength (f	t)			Width
(mp			(psf)		40	50	60	70	80	90	100	Short Walls
inland	80	.0520	0-100	end	310	390	470	550	630	710	790	
	1	.30	0-70	end	310	390	470	550	630	710	790	
· · .			80	end	320	390	470	550	630	710	790	
'			90	end	340	420	510	590	670		840	2
			100	end	370	460	550	630	720		900	
		.40	0-40	end	310	390	470	550	630	710	790	
			50	end	320	400	480	550	630	710	790	
			60	end	360	440	530	610	700		870	
			70	end	390	480	580	670	770	860	950	· · · · · · · · · · · · · · · · · · ·
			80	end	420	530	630	730	830	930	1040	
			90	end	460	570	680	790	900	1010	1120	
		•	100	end	490	610	730	850	960		1200	
	90	.0530	0-100	end	400	500	600	700	800	900	1000	
		.40	0-70	end	400	500	600	700	800	900	1000	
			80	end	420	530	630	730	830	930	1040	
			90:	end	460	570	680	790	900	1010	1120	
114			100	end	490	610	730	850	960	1080	1200	
i i	100	All Se	ismic	end	490	620	740	870	990	1110	1240	
	110	All Se	ismic	end	600	750	900	1050	1200	1350	1500	
Coastal	80	.0520	0-100	end	350	430	520	610	700	780	870	
		.30	0-90	end	350	430	520	610	700	780	870	
			- 100	end	370	460	550	630	720	810	900	
		.40	0-50	end	350	430	520	610	700	780	870	
			.60	end	360	440	530	610	700	780	870	
	ĺ		70	end	390	480	580	670	770	860	950	
	÷		80	end	420	530.	630	730	830	930	1040	
	:		90	end	460	570	680	790	900	1010	1120	
			100	end	490	610	730	850	960	1080	1200	
	90	.0530	0-100	end	440	550	660	770	880	990	1100	
	. •	.40	0-80	end	440	550	660	770	880	990	1100	
			90	end	460	570	680	790	900	1010	1120	
	- 1		100	end	490	610	730	850	960	1080	1200	
	100	All Se		end	540	680	820	950	1090	1230	1360	
	110	All Se		end	660	820	990	1150	1320	1480	1650	

Ah

C, E, I

.12'

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Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load. 

	Reau	ired	Horiza	ontal A	nchorag	ze - Al	h - Tra	insvei	rse Dir	rectio	n (lhs	(ft)
C, E, I Multi-Section	Win			Ground				2110 1 01	.50 171	0040	II (103/	
H4 Width	Spe		Aa		Location			L	ength (f	n		
2 Short Walls	(mp			(psf)		40	50	60	70	80	90	100
	Inland		.0520		end	280	350	420	490	560	630	70
			.30	.0-60	end	280	350	420	490	560	630	70
				70	end	290	360	430	500	560	630	
				80	end	310	390	460	540	610	690	76
<u> </u>	÷.		Ļ	90	end	340	420	500	580	660	750	83
			i.	100	end	360	450	540	630	710	800	89
	1. Sec. 1		.40	0-40	end	280	350	420	490	560	630	70
	· · ·	ł		50	end	320	390	470	540	620	700	77
				60	end	350	430	520	600	690	770	85
			· ·	70	end	380	480	570	660	750	840	94
		:		80	end	420	520	620	720	820	920	102
				90	end	450	560	670	780	880	990	110
	•			100	end	480	600	720	830	950	1070	119
	5. 1	90	.0530	0-100	end	360	450	540	630	720	800	89
		:	.40	0-60	end	360	450	540	630	720	800	890
			1	70	end	380	480	570	660	750	840	94
			l.	80	end	420	520	620	720	820	920	102
	· · · ·			90	end	450	560	670	780	880	990	110
				100	end	480	600	720	830	950	1070	1190
		100	.0530		end	440	550	660	770	880	990	1100
	1	н. 1 4	.40	0-80	end	440	550	660	770	880	990	1100
				90	end	450	560	670	780	880	990	1100
			1.1	100	end	480	600	720	830	950	1070	1190
		110			end	530	670	800	930	1070	1200	1340
	Coastal	80	.0520		end	310	390	470	540	620	700	780
	·. ·		.30	0-80	end	310	390	470	540	620	700	78(
				90	end	340	420	500	580	660	750	830
	1997 - 1997 1997 - 1997			100	end	360	450	540	630	710	800	890
		:	.40	0-40	end	310	390	470	540	620	700	780
		:		50	end	320	390	470	540	620	700	780
				60	end	350	430	520	600	690	770	850
				70	end	380	480	570	660	750	840	94(
				80	end	420	520	620	720	820	920	1020
			:	90	end	450	560	670	780	880	990	1100
				100	end	480	600	720	830	950	1070	1190
		90	.0530		end	390	490	590	690	790	890	990
			.40	0-70	end	390	490	590	690	790	890	990
			:	80	end	420	520	620	720	820	920	1020
			- Alexandre	.90	end	450	560	670	780	880		1100
		100	A 11 C	100	end	480	600	720	830	950		1190
		100	All Se		end	490	610	730	850	970	1090	1220
		110	All Se	smic	end	590	740	880	1030	1180	1320	1470

Note: All Seismic refers to all values of Au and all magnitudes of ground snow load.

### Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

$\begin{array}{c c c c c c c c c c c c c c c c c c c $	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	100
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	650
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	650
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	650
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	700
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	760
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	830
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	890
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	650
60         end         350         430         520         600         680         770           70         end         380         480         570         660         750         840           80         end         420         520         620         720         820         920         90           90         end         450         560         670         780         880         990         1070           90         end         480         600         720         830         950         1070         1070           90         off-20         end         330         410         490         570         660         740           30         0-80         end         330         410         490         570         660         740           30         0-80         end         330         410         490         570         660         740           100         end         350         430         520         600         680         770           40         0-50         end         350         430         520         600         680         770           70	770
70         end         380         480         570         660         750         840           80         end         420         520         620         720         820         920         90           90         end         450         560         670         780         880         990         90           90         end         480         600         720         830         950         1070         90           90         end         330         410         490         570         660         740           30         0-80         end         330         410         490         570         660         740           30         0-80         end         330         410         490         570         660         740           30         0-80         end         330         410         490         570         660         740           40         0-50         end         330         410         490         570         660         740           40         0-50         end         330         430         520         600         680         770         840	850
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	940
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	020
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	100
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	190
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	820
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	820
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	830
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	890
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	820
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	850
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	940
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	020
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$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	010
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	010
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110         All Seismic         end         490         610         730         860         980         1100         1           Coastal         80         05-20         0-100         end         290         360         430         500         570         640           .30         0-70         end         290         360         430         500         570         640           80         end         310         390         460         540         610         690	100
Coastal         80         .0520         0-100         end         290         360         430         500         570         640           .30         0-70         end         290         360         430         500         570         640           .80         end         310         390         460         540         610         690	190
.300-70end29036043050057064080end310390460540610690	220
80 end 310 390 460 540 610 690	710
	710
(1) $(2)$	760
	830
	890
	710
	770
	850
	940
	020
	100
100 end 480 600 720 830 950 1070 1 table continues	190

 Ah

 Multi-Section

 Width

 Short Walls



Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load



table continues

Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load.

Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

Wir Spee		Aa	Ground Snow	Location			Le	ngth (ft	)		
(mp			(psf)		40	50	60	70	80	90	10
Inland	90	.0530		end	130	170	200	230	270	300	3
	;			int	270	330	400	470	530	600	6
	-	.40	0-70	end	130	170	200	230	270	300	3.
				int	270	330	400	470	530	600	6'
-	2		80	end	140	180	210	240	280	310	3
				int	280	350	420	490	550	620	6
2			90	end	150	190	230	260	300	340	3'
			· .	int	300	380	450	530	600	670	7
			100	end	160	200	240	280	320	360	4
				int	330	410	480	560	640	720	80
	100	All Se	eismic	end	160	210	250	290	330	370	41
				int	330	410	490	580	660	740	82
	110	All Se	eismic	end	200	250	300	350	400	450	50
~ ·		05 00	0.700	int	400	500	600	700	800	900	100
Coastal	80	.0520	0-100	end	110	140	170	200	230	260	29
1.1.1.1		20		int	230	290	340	400	460	520	58
		.30	0-90	end	110	140	170	200	230	260	29
			100	int	230	290	340	400	460	520	58
÷ .			100	end	120	150	180	210	240	270	3(
		.40	0-50	int	240	300	360	420	480	540	6(
		.40	0-50	end	110	140	170.	200	230	260	29
			60	int	230 120	290 150	340	400	460	520 260	58
			. 00	end int	240	290	350	200 410	230 470	200 520	29
			70	end	130	160	190	220	260	290	- <u>58</u> - 32
	1		10	int	260	320	380	450	200 510	290 570	52 64
			80	end	140	180	210	240	280	310	35
				int	280	350	420	490	550	620	69
			90	end	150	190	230	260	300	340	37
	-		20.	int	300	380	450	530	600	670	75
			100	end	160	200	240	280	320	360	40
				int	330	410	480	560	640	720	80
19 A. A. A. A. A. A. A. A. A. A. A. A. A.	90	.0530	0-100	end	150	180	220	260	290	330	37
				int	290	370	440	520	590	660	74
		.40	0-80	end	150	180	220	260	290	330	37
1.1				int	290	370	440	520	590	660	74
		[	90	end	150	190	230	260	300	340	37
۰.				int	300	380	450	530	600	670	75
	:		100	end	160	200	240	280	320	360	40
	-			int	330	410	480	560	640	720	80
	100	All Se	eismic	end	180	230	270	320	360	410	45
	,			int	360	450	540	640	730	820	91
	110	All Se	ismic	end	220	270	330	380	440	490	55
				int	440	550	660	770	880	990	110





Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load.

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Ab Discretion	Requ	ired	Horizo	ontal A	nchorag	ge - Al	h - Tra	insver	se Dir	rectior	ı (lbs/i	ft)
Standard for a f	Win	nđ	Seismic	Ground								
14' Width	Spe		Aa		Location			L	ength (ft	;)		
Short Walls	(mp			(psf)		40	50	60	70	80	90	100
	Inland	80	.0520	0-100	end	90	120	140	160	190	210	230
1	÷ *				int	180	230	280	320	370	420	470
			.30	0-60	end	90	120	140	160	190	210	230
					int	180	230	280	320	370	420	470
<u> </u>				70	end	100	120	140	170	190	210	230
					int	190	240	280	330	380	420	470
	4 . A .			80	end	100	130	150	180	200	230	250
	· · ·				int	210	260	310	360	410	460	510
	н., с., с., с., с., с., с., с., с., с., с			90	end	110	140	170	190	220	250	280
		·		100	int	220	280	330	390	.440	500	550
		1		100	end	120	150	180	210	240	270	300
			.40	0-40	int	240	300	360	420	480		590
			.40	. 0-40	end	90 180	120 230	140 280	160	190	210	230
				50	int end	110	130	160	320 180	370 210	420	470
				70	int	210	260	310	360	410	460	
			[	60	end	120	140	170	200	230	260	<u>510</u> 280
					int	230	290	350	400	460	200 510	280 570
				70	end	130	160	190	220	250	280	310
				10	int	260	320	380	440	500	560	620
		· · .		80	end	140	170	210	240	270	310	340
					int	280	340	410	480	550	610	680
				90	end	150	190	220	260	290	330	370
					int	300	370	440	520	590	660	730
	1.1	· ·		100	end	160	200	240	280	320	360	400
	$(r_{1},\ldots,r_{n})$				int	320	400	480	560	630	710	790
	4 - 4 - 4	90	.0530	0-100	end	120	150	180	210	240	270	300
	•				int	240	300	360	420	480	540	600
			.40	0-60	end	120	150	180	210	240	270	300
				2	int	240	300	360	420	480	540	600
	·			70	end	130	160	190	220	250	280	310
					int	260	320	380	440	500	560	620
				80	end	140	170	210	240	270	310	340
	· ·	ĺ			int	280	340	410	480	550	610	680
	· · · ·			90	end	150	190	220	260	290	330	370
	-				int	300	370	440	520	590	660	730
				100	end	160	200	240	280	320	360	400
			[]		int	320	400	480	560	630	710	790
					te	able con	tinues		:			

Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load.

### Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

	Win			Ground				T	1	<b>`</b>		
	Spee		<u>Aa</u>		Location	10	<b>6</b> 0		ngth (ft	-		
÷	(mp			(psf)		40	50	60	70	80	90	1(
1	nland	100	.0530	0-100	end	150	180	220	260	290	330	· 3'
					int	290	370	440	510	590	660	7
			.40	0-80	end	150	180	220	260	290	330	3
					int	290	370	440	510	_ <u>59</u> ^	660	74
				90	end	150	190	220	260	290	330	3'
				· .	int	300	370	440	520	590	660	_ 74
	2	:		100	end	160	200	240	280	320	360	4
		· .			int	320	400	480	560	630	710	7
		110	All Se	eismic	end	180	220	270	310	360	400	4
	8 8 8 8				int	360	450	<u>530</u>	620	710	800	89
C	Coastal	80	.0520	0-100	end	100	130	150	180	210	230	20
	1.1				int	210	260	310	360	410	460	52
			.30	0-80	end	100	130	150	180	210	230	20
					int	210	260	310	360	410	460	52
				90	end	110	140	170	190	220	250	2
		1		1.1	int	220	280	330	390	440	500	5
				100	end	120	150	180	210	240	270	3(
					int	240	300	360	420	480	530	59
			.40	0-40	end	100	130	150	180	210	230	20
					int	210	260	310	360	410	460	- 52
				50	end	110	130	160	180	210	230	20
	2.1			·	int	210	260	310	360	410	460	-52
				60	end	120	140;	170	200	230	260	28
					int	230	290	350	400	460	510	-51
		, ,		70	end	130	160	190	220	250	280	3
					int	260	320	380	440	500	560	б.
				80	end	140	170	210	240	270	310	34
-				<u>1 - 1 - 2 - </u>	int	280	340	410	480	550	610	-68
				90	end	150	190	220	260	290	330	31
					int	300	370	440	520	590	660	73
	- 1 <sub>1</sub>		-	100	end	160	200	240	280	320	360	40
	:				int	320	400	480	560	630	710	79
		90	.0530	0-100	end	130	160	200	230	260	300	33
				1	int	260	330	390	460	530	590	66
			.40	0-70	end	130	160	200	230	260	300	33
					int	260	330	390	460	530	590	66
	•			80	end	140	170	210	240	270	310	34
	11				int	280	340	410	480	550	610	68
				90	end	150	190	220	260	290	330	37
			· · · · · · · · · · · · · · · · ·		int	300	370	440	520	590	660	7
	N.			100	end	160	200	240	280	320	360	4
					int	320	400	480	560	630	710	79
		100	All Se	ismic	end	160	200	240	280	320	360	41
					int	320	410	490	570	650	730	81
		110	All Se	ismic	end	200	250	290	340	390	440	49
					int	390	490	590	690	790	880	98





Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load.

Wir	ıd	Seismic	Ground					· .			
Spee	ed	<u>Aa</u>		Location		. 1	Le	ength (ft	)		
(mp	h)		(psf)		40	50	60 -	70	80.	90	10
land	80	.0520	0-100	end	80	110	130	150	170	190	2
	1			int	170	210	260	300	340	380	4
	• •	.30	0-50	end	80	110	130	150	170	190	2
				int	170	210	_ 260	300	340	380	4
			60	end	90	110	130	150	170	190	2
. 1		·		int	170	220	260	300	340	380	4
	1		70	end	100	120	140	160	190	210	2
				int	190	240	280	330	380	420	4
	•		80	end	100	130	150	180	200	230	<b>2</b>
				int	210	260	310	360	410	460	-5
			90	end	110	140	170	190	220	250	28
				int	220	280	330	390		500	_5
			100	end	120	150	180	210	240	270	3(
		10		int	240	300	360	420	480	530	5
		.40	0-40	end	80	110	130	150	170	190	2
				int	170	210		300	340	380	4
			50	end	110	130	160	180	210	230	20
	÷			int	210	260	310	360	410	460	5]
.*			60	end	120	140	170	200	230	260	- 28
			70	int	230	290	340	400	460	510	_5
5			70	end	130 260	160	190	220	250	280	31
		]	80	int end	140	320 170	380 210	440 240	500 270	560 310	62 34
			00	int	280	340	410	480	550	610	68
	÷.,		90	end	150	190	220	260	290	330	37
	-			int	300	_ 370	440	520	590	660	72
	· .		100	end	160	200	240	280	320	360	- 4(
			100	int	320	400	480	560	630	710	79
	90	.0520	0-100	end	110	140	160	190	220	250	27
				int	220	270	330	380	440	490	55
		_30	0-80	end	110	140	160	190	220	250	27
1 - 1 				int	220	270	330	380	440	490	55
			90	end	110	140	170	190	220	250	28
1.1	·			int	220	280	330	390	440	500	55
· · · · ·			100	end	120	150	180	210	240	270	-30
· .				int	240	300	360	420	480	530	-59
		.40	0-50	end	110	140	160	190	220	250	27
. *		1997 - 1997 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -		int	220	270	330	380	440	490	55
·			60	end	120	140	170	200	230	260	28
21	-			int	230	290	340	400	460	510	57
			70	end	130	160	190	220	250	280	31
				int	260	320	380	440	500	560	62
			80	end	140	170	210	240	270	310	34
		·. ·		int	280	.340	410	480	550	610	68
			90	end	150	190	220	260	290	330	37
				int	300	370	440	520	:590	660	73
			100	end	160	200	240	280	320	360	40
		5 - A		int	320	400	480	560	630	710	79

Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load.

Ah

C, E, I

16' 4  $\square$ 

Multi-Section Width Short Walls
Required Horizontal	Anchorage - Ah -	Transverse Direction (lbs/ft)

Win		Seismic					· •		1. F		
Spee		Aa		Location	10			ngth (ft)		:	
(mpł	,		(psf)		.40	50	60	70	80	90	10
Inland	100	.0530	0-100	end	130	170	200	240	270	300	34
				int	270	340	400	470	540	610	67
		.40	0-70	end	130	170	200	240	270	300	34
				int	270	340	400	470	540	610	67
	1		80	end	140	170	210	240	270	310	34
				int	280	340	410	480	550	610	-68
			90	end	150	190	220	260	290	330	3
				int	300	370	440	520	590	660	3
			100	end	160	200	240	280	320	360	4(
				int	320	400	480	560	630	710	79
	110	All Se	eismic	end	160	200	240	290	330	370	41
				int	330	410	490	570	650	730	82
Coastal	80	.0520	0-100	end	.90	120	140	170	190	210	24
			÷	int	190	240	280	330	380	430	47
. :	1	.30	0-60	end	. 90	120	140	170	190	210	- 24
		÷	• •	int	190	240	280	330	380	430	4
			70	end	100	120	140	170	-190	210	- 24
		`	$f_{1}=-e^{2\pi i t}$	int	190	240	280	330	380	430	47
			80	end	100	130	150	180	200	230	2
-				int	210	260	310	360	410	460	5
			.90	end	110	140	170	190	220	250	28
				int	220	280	330	390	440	500	5
			100	end	120	150	180	210	240	270	30
				int	240	300	360	420	480	530	50
		.40	0-40	end	90	120	140	170	190	210	24
			n 1177.	int	190	240	280	330	380	430	47
	1		50	end	110	130	160	180	210	230	20
	-			int	210	260	310	360	410	460	5
			60	end	120	140	170	200	230	260	28
1				int	230	290	340	400	460	510	5
			70	end	130	160	190	220	250	280	31
				int	260	320	380	440	500	560	6.
			80	end	140	170	210	240	270	310	32
			00	int	280	340	410	480	550	610	68
	. '		90	end	150	190	220	260	290	330	37
,				int	300	370	440	520	590	660	7
			100	end	160	200	240	280	320	360	40
			100	int	320	400	480	560	630	710	79
	00	.0530	0-100	end	120	150	180	210	240	270	30
	20		0-100	int	240	300	360	420	480	540	- 60
				· · · · · · · · · · · · · · · · · · ·	ible con		500	420	400	540	00

AhMulti-SectionWidthShort Walls



tuble continues

Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load.

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Win	nd	Seismic	Ground								
Spee	ed .	<u>Aa</u>	Snow	Location			Le	ngth (ft)	) .		
(mp	h)		(psf)	dia dia mandri dia dia dia dia dia dia dia dia dia di	40	50	60	70	80	90	100
land	80	.0520	0-100	end	60	80	90	110	120	140	150
· ·	ĺ	1.1		int	120	150	180	210	250	280	310
		.30	0-70	end	60	80	90	110	120	140	150
	1			int 👘	120	150	180	210	250	280	310
1.			80	end	60	80	90	110	120	140	160
	1		· · · · ·	int	130	160	190	220	250	280	310
			90	end	70	80	100	120	130	150	170
· · ·		et i te	·. ·	int	140	170	200	240	270	300	340
			100	end	70	90	110	130	140	160	180
				int	150	180	220	250	290	320	360
				t	able con	tinues				- and " I which	

Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load.

Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

	Win	nd	Seismic	Ground								
	Spee	ed	Aa		Location			Le	ngth (ft)	)		
	(mp		·	(psf)		40	50	60	70	80	90	100
	Inland	80	.40	0	end	60	80	90	110	120	140	150
			· ·		int	120	150	180	210	250	280	310
		i i		50	end	60	80	100	110	130	140	160
		1			int	130	160	190	220	250	280	310
				60	end	70	90	140	120	140	160	170
			i		int	140	180	210	250	280	310	350
			 	70	end	80	100	120	130	150	170	190
					int	160	190	230	270	310	340	380
				80	end	80	110	130	150	170	190	210
					int	170	210	250	290	330	370	410
2				90	end	90	110	140	160	180	200	220
	1		- e - [		int	180	230	270	320	360	400	450
		1		100	end	100	120	150	170	190	220	240
					int	200	240	290	340	390	430	480
		90	.0530	0-100	end	80	100	120	140	160	180	200
					int	160	200	240	280	320	360	400
			.40	0-70	end	80	100	120	140	160	180	200
		•			int	160	200	240	280	320	360	400
	1.5			80	end	80	110	130	150	170	190	210
1					int	170	210	250	290	330	370	410
· `				90	end	90	110	140	160	180	200	220
					int	180	230	270	320	360	400	450
				100	end	100	120	150	170	190	220	240
				<u> </u>	int	200	240	290	340	390	430	480
1.	·.	100	All Se	eismic	end	100	120	150	170	200	220	250
				-	int	200	250	300	350	400	440	490
• •		110	All Se	eismic	end	120	150	180	210	240	270	300
		· .		· · · · · · · · · · · · · · · · · · ·	int	240	300	360	420	480	540	600
•	Coastal	80	.0520	0-100	end	70	90	100	120	140	150	170
	1.		· · ·		int	140	170	210	240	280	310	340
	·	1	.30	0-90	end	70	90	100	120	140	150	170
<u>.</u> 1.		· ·			int	140	_ 170_	210	240	280	310	340
		1		100	end	70	90	110	130	140	160	180
1					int	150	180	220	250	290	320	360
		1	.40	0-50	end	70	90	100	120	140	150	170
			1		int	140	170	210	240	280	310	340
				60	end	70	90	110	120	140	160	170
·					int	140	180	210	250	280	310	350
		:		70	end	80	100	120	130	150	170	190
		1			int	160	190	230	270	310	340	380
		. ·		. 80	end	80	110	130	150	170	190	210
••			r		int	170	210	250	290	330	370	410
		-		90	end	90	110	140	160	180	200	220
		:			int	180	230	270	320	360	400	450
				100	end	100	120	150	170	190	220	240
		· ·		·	int	200	240	290	340	390	430	480
					1	able con	tinues					
						1						





Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load.



#### Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

W	lind	Seismic	Ground								
S Sr	beed	<u>Aa</u>	Snow	Location			Le	ngth (ft	)		
. (n	nph)		(psf)		40	50	60	70	80	90	10
Inland	1 80	.0520	0-100	end	50	70	80	100	110	120	140
				int	110	140	160	190	220	250	280
	· ·	.30	0-60	end	50	70	80	100	110	120	14(
				int	110	140	160	190	220	250	280
• .		81.1 A	70	end	60	70	90	100	110	130	]4(
н 1				int	120	140	170	200	230	250	280
	ст. 1		80	end	60	80	90	110	120	140	15(
				int	130	160	190	220	250	280	31(
•			- 90	end	70	80	100	120	130	150	17(
				int	130	170	200	230	270	300	33(
•		•	100	end	70	90	110	130	140	160	18
	Ì			int	140	180	220	250	290	320	36
	1	.40	0-40	end	50	70	80	100	110	120	14(
	<i>n</i> 1			int	110	140	160	190	220	250	.280
			50	end	60	80	90	110	120	140	150
				int	130	160	190	220	250	280	310
			60	end	70	90	100	120	140	150	17(
				int	140	170	210	240	270	310	34(
			70	end	80	100	110	130	150	170	19(
				int	150	190	230	260	300	340	37(
			80	end	80	100	120	140	160	180	200
				int	170	210	250	290	330	370	41(
			90	end	90	110	130	160	180	200	220
				int	180	220	270	310	350	400	44(
	l.		100	end	100	120	140	170	190	210	24(
				int	190	240	290	330	380	430	47(
	90	.0520	0-100	end	70	90	110	130	140	160	180
				int	140	180	210	250	2 <del>9</del> 0	320	360
				te te	able con	tinues					

Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load.

C, E, I

14'

6

**Multi-Section** 

Width

Short Walls

#### Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

	Win	ıd	Seismic	Ground				ι.				
	Spee	ed	<u>Aa</u>	Snow	Location			Le	ength (ft	э.		
	(mpl			(psf)		40	50	60	70	80	90	10
Int	and	90	.30	0-90	end	70	90	110	130	140	160	18
					int	140	180	210	250	290	320	36
			1 11	100	end	70	90	110	130	140	160	18
		: : .	÷		int	140	180	220	250	290	320	36
		-	.40	0-60	end	70	90	110	130	140	160	18
					int	140	180	210	250	290	320	36
				70	end	80	100	110	130	150	170	19
					int	150	190	230	260	300	340	37
	÷			80	end	80	100	120	140	160	180	20
		1			int	170	210	250	290	330	370	41
	÷.,			90	end	90	110	130	160	180	200	22
					int	180	220	270	310	350	400	44
	1.			100	end	100	120	140	170	190	210	24
				100	int	190	240	290	330	380	430	47
1	1	100	.0530	0-100	end	90	110	130	150	180	200	220
		100	.0000	0-100	int	180	220	260	310	350	400	44(
			.40	0-80	end	90	110	130	150	180	200	
			0	0-00	int	180	220	260	310	350		22
				90	end	90	110	130	160	180	400 200	
				30	int	180	220	270	310	350		
				100	end	100	120	140	170	190	400	44(
				100	int	190	240	290		380	210	24
· .		110	All Se	iemio	end	110	130	160	330 190	210	430	47 27
		110		Jame	int	210	270	320			240	
Cox	astal	80	.0520	0-100	end	60	80	90	<u>370</u> 110	<u>430</u> 120	480	<u>530</u> 150
	astas	00	.0520	0-100	int	120	150	180	220	250	140	
			.30	0-70	end	60	80	90	110		280	<u>310</u> 150
				. 0-70	int	120	150	180	220	120 250	140	
				80	end	60	80	90	110		280	<u>310</u> 150
14				. 00	int	130	160	190	220	120 250	140	
				90	end	70	80	100			280	31(
	1			. 90	int	130	170	200	120 230	130	150	170
				100	end	70	90	110	130	270	300	33(
	1	:		100	int	140	180			140	160	180
				0-40	end	60	80	220	250	290	320	360
2	-		.40	0-40	int	120	150	90 180	110 220	120	140	150
		4		50		60	80			250	280	310
					end int	130	160	90	110	120	140	150
				60	end			190	220	250	280	310
	. 11	-		00		70 140	90 170	100 210	120 240	140 270	150	170
				70	int		Art				310	34(
7	:		į	· 70	end	80	100	110	130	150	170	190
	11			00	int	150	190	230	260	300	340	370
	-			80	end	80	100	120	140	160	180	200
	:				int	170	210	250	290	330	370	41(
	:			90	end	90	110	130	160	180	200	220
	-			100	int	180	220	270	310	350	400	44(
		1		100	end	100	120	140	170	190	210	240
					int	190	240	290	330	380	430	47(





Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load.

#### Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

Spe	ed	Aa	Snow	Location			Le	ngth (ft	)		
(mp		: :	(psf)		40	50	60	<b>ັ</b> 70	80	90	100
Coastal	90	.0530	0-100	end	80	100	120	140	160	180	200
				int	160	200	240	280	320	350	390
		.40	0-70	end	80	100	120	140	160	180	200
	•			int	160	200	240	280	320	350	390
			80	end	80	100	120	140	160	180	200
s. 1			· .	int	170	210	250	290	330	370	410
			90	end	90	110	130	160	180	200	220
				int	180	220	270	310	350	400	440
	· ·		100	end	100	120	140	170	190	210	240
				int	190	240	290	330	380	430	470
· .	100	All Se	eismic	end	100	120	150	170	190	220	240
·		5 C	1.5	int	190	240	290	340	390	440	490
	110	All Se	ismic	end	120	150	180	210	240	260	290
	. · ·	1.	· · · · ·	int	240	290	350	410	470	530	590

Ah C. E. I	Multi-Section	
16' 6	Width Short Walls	

Ah

**C, E, I** 

14'

6

٦

Multi-Section Width

Short Walls

#### Required Horizontal Anchorage - Ah - Transverse Direction (lbs/ft)

Win	ıd	Seismic	Ground				н Ц. Ц. Ч. Ч. С. Ч. Ч. Ч. Ч. Ч. Ч. Ч. Ч. Ч. Ч. Ч. Ч. Ч.				
Spee	ed	Aa	Snow	Location			Le	ngth (ft)			
(mp	h)	anto a com	(psf) .		40	50	60	70	80	90	100
Inland	80	.0520	0-100	end	50	60	80	90	100	110	130
				int	100	130	150	180	200	230	260
		.30	0-50	end	50	60	80	90	100	110	130
				int	100	130	150	180	200	230	260
		÷.	60	end	50	70	80	90	100	120	130
				int	100	130	160	180	210	230	260
· · · ·			70	end	60	70	90	100	110	130	140
				int	110	140	170	200	230	250	280
			80	end	60	80	90	110	120	140	150
				int	120	160	190	220	250	280	310
1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1		· :	90	end	70	•80	100	120	130	150	170
	l		1997 - A.	int	130	170	200	230	270	300	330
			100	end	70	90	110	130	140	160	180
1			tere a se	int	150	180	220	250	290	320	360
ма на По		.40	0-40	end	50	60	80	90	100	110	130
				int	100	130	150	180	200	230	260
	ļ	<i>1</i>	50	end	60	80	90	110	120	140	150
· · · ·	[			int	130	160	190	220	250	280	310
	ļ		60	end	70	90	100	120	140	150	170
				int	140	170	210	240	270	310	340
			70	end	80	100	110	130	150	170	190
· ·				int	150	190	230	260	300	340	370
			80	end	80	100	120	140	160	180	200
				int	170	210	250	290	330	370	410
· · · ·			90	end	90	110	130	160	180	200	220
:				int	180	220	270	310	350	400	440
			100	end	,100	120	140	170	190	210	240
-	l			int	190	240	290	330	380	430	470
			·	t	able con	tinues					

Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load.

Required Horizontal Anchorage -	Ah - Transverse Direction (lbs/ft)
---------------------------------	------------------------------------

	Win	đ	Seismi	c Ground	-	-							Multi-Sectio
	Spee		Aa		Location			Ť	ength (ft	• \	· · ·		Width
	(mpl			(psf)	Location	40	50	60	70 r	5) 80	90	100	Short Walls
Ī	nland		.0520		end	70	80	100	110	130	150	160	
					int	130	160	200	230	260	300	330	· · ·
			.30	0-80	end	70	80	100	110	130	150	160	
					int	130	160	200	230	260	300	330	
			t i ji	90	end	70	80	100	120	130	150	170	
н. 11 г. с	18.2				int	130	170	200	230	270	300	330	<b>T-T-T</b> -1
÷ .			:	100	end	70	90	110		140	160	180	
8 - C	15				int	150	180	220	250	290	320	360	
	a de la		.40	0-50	end	70	80	100	110	130	150	160	
e .					int	130	160	200	230	260	300	330	
			на – а 	60	end	70	90	100	120	140	150	170	:
			5 A.	-	int	140	170	210	240	270	310	340	
				70	end	80	100	110	130	150	170	190	
1			et i		int	150	190	230	260	300	340	370	
				80	end	80	100	120	140	160	180	200	
. :	÷		·.		int	170	210	250	290	330	370	410	
				90.	end	90	110	130	160	180	200	220	
			1		int	180	220	270	310	350	400	440	
1.1	·		· .	100	end	100	120	140	170	190	210	240	
	-				int	190	240	290	330	380	430	470	
		100	.0530	0-100	end	80	100	120	140	160	180	200	
	1.				int	160	200	240	280	320	360	400	
			.40	0-70	end	80	100	120	140	160	180	200	
1.2.3			an an an an an an an an an an an an an a		int	160	200	240	280	320	360	400	
la j	1.54 1.54		siy	80	end	80	100	120	140	160	180	200	
	÷ . *			00	int	170	210	250	290	330	370	410	
	·			, <b>90</b>	end	90	110	130	160	180	200	220	
1999	t un La com			100	int	180	220	270	310	350	400	440	
	<ul> <li>M.</li> </ul>			100	end	100	120	140	170	190	210	240	
	-	10	All Se	iami a	int	190	240	290	330	380	430	470	
		110	All St	asinic	end	100	120	150	170	200	220	240	
	oastal	80	.0520	0.100	int	200	240	290	340	390	440	490	
	Jaslai	00	.0520	0-100	end	60	70	90	100	110	130	140	
1. E			.30	0.70	int	110	140	170	200	230	260	280	
			.50	0-70	end	60	70	90	100	110	130	140	
		1		00	int	110	140	170	200	230	260	280	
	· · ·			80	end	60	80	90	110	120	140	150	
			· .		int	120	160	190	220	250	280	310	
			:	90	end	70	80	100	120	130	150	170	
			:	100	int	130	170	200	230	270	300	330	and the second second second second second second second second second second second second second second second
				100	end	70	90	110	130	140	160	180	
·	·····	···· ··•			int	150	180	220	250	290	320	360	
					ta	ble cont	nnues						

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Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load. .

Wi	nd	Seismic	Ground						1. J. J. J. J. J. J. J. J. J. J. J. J. J.	1100	
Spe		Aa		Location			L	ength (ft	·)		
(m			(psf)		40	50	60	70	. 80	90	1
Coasta		.40	0	end	60	70	90	100	110	130	1
				int	110	140	170	200	230	260	2
			50	end	60	80	90	110	120	140	Ę
		i		int	130	160	190	220	250	280	3
	1	-	60	end	70	90	100	120	140	150	1
			• • • • • •	int	140	170	210	240	270	310	3
	1	1	70	end	80	100	110	130	150	170	1
				int	150	190	230	260	300	340	3
	;		80	end	80	100	120	140	160	180	2
			-	int	170	210	250	290	330	370	4
			90	end	90	110	130	160	180	200	2
			:	int	180	220	270	310	350	400	4
			100	end	100	120	140	170	190	210	2
			· .	int	190	240	290	330	380	430	4
	90	.0520	0-100	end	70	90	110	130	140	160	1
			· · ·	int	140	180	220	250	290	330	- 30
		.30	0-90_	end	70	90	110	130	140	160	1
				int	140	180	220	250	290	330 .	3(
			100	end	70	90	110	130	140	160	18
	1	·		int	150	180	220	250	290	330	36
		.40	0-60	end	70	90	110	130	140	160	18
	i			int	140	180	_220	250	290	330	36
			70	end	80	100	110	130	150	170	19
	1	-		int	150	190	230	260	300	340	31
2	ľ	· :	80	end	80	100	120	140	160	180	20
				int	170	210	250	290	330	370	4
			90	end	90	110	130	160	180	200	:22
		· · · ·		int	180	220	270	310	350	400	44
		1.	100	end	100	120	140	170	190	210	24
	100	05 20	0.100	int	190	240	290	330	380	430	47
	100	.0530	0-100	end	90	110	130	160	180	200	22
			0-90	int	180	220	270	310	360	400	45
		.40	0-90	end	:90	110	130	160	180	200	22
		•	100	int	180	220	270	310	360	400	45
	1		100.	end	100	120	140	170	190	210	24
	110	·	icmic	int	190	240	290	330	380	430	47
	110	All Se	ISHIC	end int	110 220	140 270	160 320	190 380	220 430	240 490	27 54

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Note: All Seismic refers to all values of Aa and all magnitudes of ground snow load. 

Ab C, E, I

16' 6

**Multi-Section** 

Width Short Walls

## Part 4 Required Horizontal Anchorage - Ah - Longitudinal Direction

## Single-Section C, E, I

	Ground					I	ength			
<u>Aa</u>	Snow	Spee					(ft)			
	(psf)	(mph	-	40	50	60	70	80	90	10
.0510	0-100	Inland	80	34	27	23	20	17	15	14
			90	43	35	29	25	22	19	17
		<u>}</u>	100	54	43	36	31	27	24	21
			110	65	52	43	37	32	29	26
		Coastal	80	38	30	25	22	19	17	15
		1	90	48	38	32	27	24	21	19
			100	59	47	39	34	30	26	24
			110	71	57	48	41	36	32	29
.15	0-40	Inland	80	34	27	23	20	17	17	15
		1 .	90	43	35	29	25	22	19	17
			100	54	43	36	31	27	24	21
	-	· · ·	110	65	52	43	37	32	29	26
		Coastal	80	38	30	25	22	19	17	17
· .			90	48	38	32	27	24	21	19
. *			100	59	47	39	34	30	26	24
		· · · · · · · · · · · · · · · · · · ·	110	71	57	48	41	36	32	29
	50	Inland	80	36	36	35	35	35,	35	35
1.4 T		,	90	43	36	35	-35	35	35	35
			100	54	43	36	35	35	35	35
:		<b></b>	110	65				35	35	35
		Coastal	80	38	36	35	35	35	35	35
			90	48	38	35	35	35	35	35
			100	59	47	39	35	35	35	35
			110	71	57	48	41	36	35	35
	60	Inland	80	40	39	39	39	39	39	39
· ·		-	<b>9</b> 0	43	39	39	39	39	39	39
			100	54	43	39	39	39	39	39
			110	65	52	43	39	39	39	39
		Coastal	80	40	39	39	39	39	39	-39
			<b>9</b> 0	48	39	39	39	39	39	-39
			100	59	47	39	39	39	39	- 39
		-	110	<b>7</b> 1	57	48	41	39	39	- 39
	70	Inland	80-90	43	43	43	43	43	42	42
			100	54	43	43	43	43	42	42
			110	65	52	43	43	43	42	42
		Coastal	80	43	43	43	43	43	42	42
			<b>9</b> 0	48	43	43	43	43	42	42
			100	59	47	43	43	43	42	42
			110	71 ble con	57	48	43	43	42	42





Ab C, E, I Single-Section	Require	ed Hor	izontal	Anchora	ge - A	h - Lo	ngitu	dinal I	Directi	ion (Ib	os/ft)
12' Width	Seismic	Ground	W	ind	•		· I	ength			
YY IUUI	<u>Aa</u>	Snow		eed				(ft)			
		(psf)		ph)	40	50	60	70	80	90	100
	.15	80	Inland	80-90	47	47	46	46	46	46	46
				100	54	47	46	46	46	46	46
				110	65	52	46	46	46	46	46
			Coastal	80	47	47	46	46	46	46	46
• · · · ·				90	48	47	46	46	46	46	46
				100	59	47	46	46	46	46	46
				110	71	57	48	46	46	46	46
		90	Inland	80-90	50	50	50	50	50	50	50
		-		100	54	50	50	50	50	50	50
	4.			110	65	52	50	50	50	50	50
			Coastal	80-90	50	50	50	50	50	50	50
				100	59	50	50	50	50	50	50
				110	71	57	50	50	50	50	50
	2	100	Inland	80-100	54	54	54	54	53	53	53
			<b>a</b> . 1	110	65	54	54	54	53	53	53
			Coastal	80-90	54	54	54	54	53	53	53
				100	59	54	54	54	53	53	53
	20	0.40	Tuland	110	71	57	54	54	53	53	53
	.20	0-40	Inland	80	34 43	27	23	23	23	23	23
				90 100	43 54	35 43	2 <u>9</u> 36	25 31	23	23	23
				110	54 65	43 52	30 43	37	27 32	24 29	<b>23</b> 26
	N		Coastal	80	38	30	<u>45</u> 25	23	23	29	23
		1. A. A.	Coasiai	90	48	38	32	27	24	23	23
				100	59	47	39	34	30	26	24
				110	71	57	48	41	36	32	29
:		50	Inland	80-90	48	48	47	47	47	47	47
		50	IIIIuiita	100	54	48	47	47	47	47	47
				110	65	52	47	47	47	47	47
	•		Coastal	80-90	48	48	47	47	47	47	47
				100	59	48	47	47	47	47	47
				110	71	57	48	47	47	47	47
	dia dia ka	60	Inland	80-90	53	52	52	52	52	52	52
				100	54	52	52	52	52	52	52
	•			110	65	52	52	52	52	52	52
	1. 1.		Coastal	80-90	53	52	52	52	52	52	52
	۰.	-		100	59	52	52	52	52	52	52
	·-		· ·	110	71	57	52	52	52	52	52
		70	Inland	80-100	58	57	57	57	57	57	57
				110	65	57	57	57	57	57	57
			Coastal	80-90	58	57	57	57	57	57	57
				100	59	57	57	57	57	57	57
	1		<u></u>	110	71	57	57	57	57	57	57
				ta	ible con	ntinues					
			·		÷ .						

B-82

Required Horizontal Anchorage - Ah - Longitudinal Dire	ction (lbs/ft)
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		Ground		ind			· ·	Length			
	<u>Aa</u>	Snow		eed				(ft)	, î		
_		(psf)	(m		40	50	60	70	80	90	10
	.20	80	Inland	80-100	62	62	62	62	62	5 - F - F - F	
				110		62	62	62	62	61	6
			Coastal	80-100		62	62	62	62	61	6
				110	71	62	62	62	62	61	6
		90	Inland	80-110	67	67	67	67	66	66	6
			Coastal	80-100	67	67	67	67	66	66	6
				110	71	67	67	67	66	66	6
_		100	All V	the second second second	72	72	72	71	71	71	7
	.30	0-40	Inland	80	36	35	35	34	34	34	34
		:		90	43	35	35	34	34	34	34
				100	54	43	36	34	34	34	34
			· .	110	65	52	43	37	34	34	34
			Coastal	80	38	35	35	34	34	34	34
				90	48	38	35	34	34	34	34
				100	59	47	39	34	34	34	34
				110	71	57	48	41	36	34	34
		50	All V	Vind	72	71	71	71	71	70	7
		60	All V	Vind	79	79	78	78	78	78	78
		70	All V	Vind	86	86	86	85	85	85	85
		80	All V	Vind	94	93	93	93	92	92	92
		90	All V	Vind	101	100	100	100	100	99	99
		100	All W	Vind	108	108	107	107	107	107	
	.40	0-40	Inland	80-90	47	47	46	46	46	45	45
				100	54	47	46	46	46	45	45
				110	65	52	46	46	46	45	45
	:		Coastal	80	47	47	46	46	46	45	45
				90	48	47	46	46	46	45	45
				100	59	47	46	46	46	45	45
	-			110	71	57	48	46	46	45	45
		50	All W	Vind	96	95	95	94	94	94	94
		60	All W	/ind	106	105	104	104	104	104	103
		70	All W	/ind	115	115	114	114	113	113	113
		80	All W	/ind	125	124	124	123	123	123	123
		90	All W	/ind	135	134	133	133	133	133	132
		100	All W		144	144	143	143	142	142	142
				· · · · · · · · · · · · · · · · · · ·			The order between the		www.andianog	**************************************	3000
					5						







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$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	100 16 21 26 31 18 23 28 34 19 21
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	21 26 31 18 23 28 34 19 21
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	26 31 18 23 28 34 19 21
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	31 18 23 28 34 19 21
Coastal         80         45         36         30         26         23         20           90         57         46         38         33         29         25           100         71         56         47         40         35         31           110         85         68         57         49         43         38	18 23 28 34 19 21
90         57         46         38         33         29         25           100         71         56         47         40         35         31           110         85         68         57         49         43         38	23 28 34 19 21
100         71         56         47         40         35         31           110         85         68         57         49         43         38	28 34 19 21
110 85 68 57 49 43 38	34 19 21
	<b>19</b> 21
$15 0-40$ Inland 80 41 33 27 22 20 $\approx$	21
90 52 41 35 30 26 23	
100 64 51 43 37 32 28	26
<u>110 77 62 52 44 39 34</u>	31
Coastal 80 45 36 30 26 23 20	19
90 57 46 38 33 29 25	23
100 71 56 47 40 35 31	28
110 85 68 57 49 43 38	34
50 Inland 80 41 41 41 41 40 40	40
90 52 41 41 40 40	40
100 64 51 43 41 40 40	40
<u>110 77 62 52 44 40 40</u>	40
Coastal 80 45 41 41 41 40 40	40
90 57 46 41 41 40 40	40
100 71 56 47 41 40 40	40
110 85 68 57 49 43 40	40
60 Inland 80 45 45 45 45 45 45	44
90 52 <b>45 45 45 45 45</b>	44
100 64 51 45 45 45 45	44
110 77 62 52 45 45 45	44
Coastal 80 45 45 45 45 45 45	44
90 57 46 45 45 45 45	44
100 71 56 47 45 45 45	44
110 85 68 57 49 45 45	44
70 Inland 80 50 49 49 49 49 49	49
90 52 <b>49 49 49 49 49</b>	49
100 64 51 49 49 49 49	49
<u>110 77 62 52 49 49 49</u>	49
Coastal 80 50 49 49 49 49 49	49
90 57 <b>49 49 49 49</b> 49	49
100 71 56 49 49 49 49	49
110 85 68 57 49 49 49	49

table continues

Required Horizontal Anchorage - Ah - Longitudinal Direction (lbs/ft)

	Ground		'ind			· I	ength			
<u>Aa</u>	Snow		eed		-		(ft)			
	(psf)		iph)	40	50	60	70	.80	90	1
.15	80	Inland	80-90	54	54	53	53	53	53	19 <b>4</b>
	1		100	64	54	53	53	53	53	4
			110	77	62	53	53	53	53	
		Coastal	80	54	54	53	53	53	53	
		1	90	57	54	53	53	53	53	5
			100	71	56	53	53	53	53	5
	00	T_I_ 1	110	85	68	. 57	53	53	53	
	90	Inland	80-90	58	58	58	57	57	57	5
			100	64	58	58	57	57	57	5
		Ceretal	110	77	62	58	57	57	57	5
1.1		Coastal	80-90	58	58	58	57	57	57	5
			100	71	58	58	57	57	57	5
	100	Tulord	110	85	68	58	57	57	57	5
	100	Inland	80-90	62	62	62	62	62	61	6
.	•		100	64	62	62	62	62	61	6
	· ·	Coostal	110		62	62	62	62	61	6
	24	Coastal	80-90	62	62	62	62	62	61	6
	-		100 110	71 85	62	62	62	62	61	6
20	0-40	Inland	80	41	68	62	62	62	61	6
20	0-40	manu	90	52	33 41	27	26	26	25	2
			100	52 64	41 51	35	30	26	25	2
1.1			110	77	62	43 52	37	32	28	20
		Coastal	80	45	36	30	<u>44</u> 26	39	34	3
		Coastai	90	57	46	38	33	26	25 25	2
	-		100	71	56	47	40	29	25	2
			110	85	68	47 57	40 49	35	31	28
	50	Inland	80-90	55	55	54	54	43 54	38 54	34
	20	mand	100	64	55	54	54	54 54	54 54	54 54
	·		110	77	62	54	54	54	54 54	205.03
		Coastal	80	55	55	54	54	54 54	54 54	54 54
-		ovasan	90	57	55	54	54	54	54	54 54
5 4 5 1			100	71	56	54	54	54	54	52
			110	85	68	57	54	54	54	54
	60	Inland	80-90	61	60	60	60	60	59	59
			100	64	60	60	60	60	59	59
-			110	77	62	60	60	60	59	59
4	·	Coastal	80-90	61	60	60	60	60	59	55
			100	71	60	60	60	60	59	59
			110	85	68	60	60	60	59	59
	70	Inland	80-100	66	66	66	65	65	65	65
			110	77	66	66	65	65	65	65
		Coastal	80-90	66	66	66	65	65	65	65
			100	71	66	66	65	65	65	65
	1		110	85	68	66	65	65	65	65



C, E, I	Single-Section
14'	Width
	<u> </u>

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### Required Horizontal Anchorage - Ah - Longitudinal Direction (lbs/ft)

Seis	mic	Ground	i w	ïnd			÷	Length			
<u>A</u> :		Snow		eed				(ft)			
:		(psf)		ph)	40	50	-60	70	80	90	100
.20	0	80	Inland	80-100			71			71	
				110		71	71	71		71	71
÷ .			Coastal	80-100				71		71	71
				110		71	71	71		71	71
		90	Inland	80-110	78		77	77	76	76	76
· .			Coastal	80-100	78		77	77	76	76	76
+ +				110	85	77	77	77	76	76	76
11	:	100	Inland	80-110	83		82	82	82	82	82
			Coastal	80-100	83	83	82	82	82	82	82
	.			110	85	83	82	82	82	82	82
.30	)	0-40	Inland	80	41	39	39	39	38	38	38
				90	52	41	39	39	38	38	38
÷	.	· · ·		100	64	51	43	39	38	38	38
		i.		110	77	62	52	44	39	38	38
- 14 	.		Coastal	80	45	39	39	39	38	38	38
				90	57	46	39	39	38	38	38
· · · ·				100	71	56	47	40	38	38	38
				110	85	68	57	49	43	38	38
	-	50	Inland	80-110	82	82	81	81	81	81	80
:			Coastal	80-100	82	82	81	81	81	81	80
				110	85	82	81	81	81	81	80
	.	60	All V		91	90	90	89	89	89	89
	-	70	All V		99	99	98	98	98	98	97
	-	80	All V		108	107	107	106	106	106	106
		90	All V		116	116	115	115	115	115	114
	-	100	All V		125	124	124	123	123	123	123
.40	)	0-40	Inland	80-90	53	52	52	51	51	51	51
				100	64	52	52	51	51	51	51
			. ·	110	77	62	52	51	51	51	51
	i.		Coastal	80	53	52	52	51	51	51	51
				90	57	52	52	51	51	51	51
				100	71	56	52	51	51	51	51
				110	85	68	57	51	51	51	51
		50	All V		110	109	108	108	108	107	107
		60	All V		121	120	120	119	119	119	119
1	3·n.	70	All V		133	132	131	131	130	130	130
·.		80	All W		144	143	142	142	142	141	141
		90	All W		155	154	154	153	153	153	152
		100	All W		166	166	165	165	164	164	164
	i					بالإستراقات من القير			1021		

B-86

				-		U			``	
Seismic	Ground	l Wind				I	ength			
<u>Aa</u>	Snow	Speed					(ft)			
	_(psf)	(mph)		40	50	60	70	80	90	10
.0510	0-100	Inland	80	47	38	32	27	24	21	19
			90	60	48	40	34	30	27	24
			100	74	59	49	42	37	33	30
· .			110	89	72	60	51	45	40	36
		Coastal	80	52	42	35	30	26	23	21
			90	66	53	44	38	33	29	26
		Б	100	82	65	54	47	41	36	33
1		· .	110	99	79	66	56	49	44	39
.15	0-40	Inland	80	47	38	32	27	24	21	21
			90	60	48	40	34	30	27	24
1		- 14 - 14	100	74	59	49	42	37	33	30
			110	89	72	60	51	45	40	36
		Coastal	80	52	42	35	30	26	23	21
		· ·	90	66	53	44	38	-33	29	26
			100	82	65	54	47	41	36	33
			110 -	99	79	66	56	49	44	39
7	50	Inland	80	47	46	46	46	46	45	45
			90	60	48	46	46	46	45	45
			100	74	59	49	46	46	45	45
			110	89	72	60	51	46	45	45
	·	Coastal	80	52	46	46	46	46	45	45
			90	66	53	46	46	46	45	45
			100	82	65	54	47	46	45	45
			110	99	79	66	56	49	45	45
	60	Inland	80	51	51	51	51	50	50	50
			90	60	51	51	51	50	50	50
			100	74	59	51	51	50	50	50
			110	89	72	60	51	50	50	50
		Coastal	80	52	51	51	51	50	50	50
			90	66	53	51	51	50	50	50
111		· · ·	100	82	65	54	51	50	50	50
			110	99	79	66	56	50	50	50
	70	Inland	80	56	56	56	55	55	55	55
		· ·	90	60	56	56	55	55	55	55
			100	74	59	56	55	55	55	55
			110	89	72	60	55	55	55	55
2		Coastal	80	56	56	56	55	55	55	55
	Į		90	66	56	56	55	55	55	55
••			100	82	65	56	55	55	55	55
			110	99	79	66	56	55	55	55
		t.		ble con	The start share a second	~~	<u> </u>	Arrest Arrests		

Single-Section Width 46

table continues

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Ah C, E, I Single-Section	Requir	ed Hor	izontal	Anchora	ge - A	h - Lo	ongitu	dinal l	Direct	ion (lt	os/ft)
16 Width	Seismic	Ground	i w	ind			I	ength			
, rour	<u>Aa</u>	Snow	Sp	eed			_	(ft)			
	· · · · · ·	(psf)	(n	iph)	40	50	60	<b>`</b> 70	80	90	. 100
	.15	80	Inland	80-90	61	61	60	60	60	60	60
				100	74	61	60	60	60	60	60
7				110	89	72	60	60	60	60	60
			Coastal	80	61	61	60	60	60	60	60
•				90	66	61	60	60	60	60	60
				100	82	65	60	60	60	60	60
				110	99	79	66	60	60	60	60
		90	Inland	80-90	66	65	65	65	65	65	65
				100	74	65	65	65	65	65	65
				110	89	72	65	65	65	65	65
	· .		Coastal	80-90	66	65	65	65	65	65	65
	•			100	82	65	65	65	-65	65	65
			<u> </u>	110	99	79	66	65	65	65	65
		100	Inland	80-90	71	70	70	70	70	70	70
				100	74	70	70	70	70	70	70
				110	89	72	70	70	70	70	70
	at sh		Coastal	80-90	71	70	70	70	70	70	70
				100	82	70	70	70	70	70	70
				110	99	79	70	70	70	70	70
	.20	0-40	Inland	80	47	38	32	29	28	28	28
				90	60	48	40	34	30	28	28
				100	74	59	49	42	37	33	30
				110	89	.72	60	51	45	40	36
	1.1		Coastal	80	52	42	35	30	28	28	28
				90	66	53	44	38	33	29	28
				100	82	65	54	47	41	36	33
		50	T1	110	99	79	66	56	49	44	39
		20	Inland	80-90	62	61	61	61	61	61	60
		-		100	74	61	61	61	61	61	60
			Coastal	110	89	72	61	61	61	61	60
		-1	CUastal	80	62 66	61	61	61	61	61	60
	1.			90 100	66 82	61	61	61	61	61	60
		1		110		65 ×	61	61	61	61	60
		60	Inland	80-90	99 68	79 68	66	61 67	61	61	60
		00	munn	100	74	68	68	67 67	67 67	67 67	67 67
				110	89	72	68	67	67 67	67 67	67 67
		.*	Coastal	80-90	68	68	68	67	67	67	67
			Coastal	100	82	68	-68	67	67	67	67
				110	82 99	79 79	68	67	67 67	67 67	67
		70	Inland	80-100	75	74	74	07 74	74	73	67 72
				110	89	7 <del>4</del>	74	74	74 74	73	73
			Coastal	80-90	75	74	74	74	74		73
			Journal	100	82	74	74	74	74	73 73	73
				110	9 <u>9</u>	2/ <u>7</u> 79	74	74	74	73	73
	ι.				ble con			.7**	1**	12	73

Required Horizontal An	chorage - Ah - Long	itudinal Direction (lbs/ft)

	<u>Aa</u>	Ground Snow		ed				Length			
	<u>84</u>	(psf)	spe (mj		40	50	60	(ft) 70	00	00	17
	.20	80	Inland	80-100	81	81	81		80	90	1(
	.20	00	manu	110	89	81	81	80 80	80 80		A
	÷		Coastal	80-90	81	81	81			80	1
			Cuastai	100	82	81	81	80	80	80	
				110	82 99	81	81	80	80	80	1
		90	Inland	80-100	88	$-\frac{81}{87}$	87	80	80	80	
			i manu	110	89	87		87	87	86	
	· · · · ·		Coastal	80-100	88	87	<u> </u>	87	87	86	
			Cuastal	110	99 99	87		87	87	86	
		100	Inland	80-110	99		87	_ <u>87</u> 93	_ 87	_ <u>86</u>	
		100	Coastal	80-110	94	94	93		93	93.	
-			Cuastai	110	94 99	94 94		93	93	93	4
• ••	.30	0-40	Inland	80			93	93	93	93	Ç
	.50	0-40	intanu .		47	44	43	43	43	42	Y
				90	60	48	43	43	43	42	2
		2.5		100	74	.59	49 60	43	43	42	1
			Casadal	110	89	72	60	_ <u>51</u>	45	42	4
			Coastal	80	52	. 44	43	43	43	42	4
		·.		90	66	53	44	43	43	42	2
				100	82	65	54	47	43	42	4
		60	<b>T</b> 1 1	110	99	_ 79	66	56	49	_ <u>44</u>	- 4
		50	Inland	80-110	93	92	92	91	91	91	9
			Coastal	80-100	93	92	92	91	91	91	9
			A 11 XX	110	99	_92	92	91	91	91	9
1		60	All W		103	102	101	101	101	101	10
		70	All W		112	112	111	111	110	110	11
		80	All W		122	121	121	120	120	120	12
		90	All W		132	131	130	130	130	130	312
	40	100	All W		141	141	140	140	140	139	13
	.40	0-40	Inland	80	59	58	58	57	57	56	5
				90	60	58	58	57	57	56	5
				100	74	59	58	57	57	56	5
			~	110	89	72	60	57	57	56	5
	÷ .		Coastal	80	59	58	58	57	57	56	S
:				90	66	58	58	57	:57	56	5
			Ξ.	100	82	65	58	57	57	56	5
		50		110	99	79	66	. 57	57	56	5
		50	All W	and a second a second sec	124	123	122	122	121	121	12
·		60	All W		137	136	135	135	134	134	13
	-	70	All W		150	149	148_	148	147	147	_14
		80	All W		163	162	161	161	160	160	16
		90	All W		176	175	174	173	173	173	17
		100	All W	ind	189	188	187	186	186	186	18



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· · · · · ·	Μ	ulti	-Section	n C	, E,	I			1.1		
	Requir	ed Hor	izontal An	chore	ao 1	ь т.	onaite	dinal T		ion (11	
Multi-Section	Kequin	cu 1101	izontai An	choia	ge - A	иі - Гі	ongitu	icinal L	nreci	10n (IC	)s/π)
	Seismic	Ground	Wind			· .	÷	T 4h			
Width		Snow					ана 19	Length			
<u>.</u>	Aa		Speed		10	50	60	(ft)	00		
	05 10	(p	(mph)		40	50	<u> </u>	70	80	90	100
	.0510	<b>0-</b> 100	Inland	80	82	66	55	47	41	37	33
	· ·			90	104	83	70	60	52	46	42
				100	129	103	: 86	74	64	57	51
		5 - S		110	156	125	104	89	78	69	62
			Coastal	80	91	73	61	52	45	40	- 36
	:			90	115	92	77	66	57	51	46
				100	142	114	95	81	71	63	57
		· .		110	172	137	114	98	86	76	69
	.15	0-40	Inland	80	82	66	55	47	41	37	33
		· .		90	104	83	70	60	52	46	42
				100	129	103	86	74	64	57	51
				110	156	125	104	89	78	69	62
			Coastal	80	91	73	61	52	45	40	36
				90	115	92	77	66-	57	51	46
				100	142	114	95	81	71	63	57
				110	172	137	114	98	86	76	69
		50	Inland	80	82	70	70	69	69	69	69
		2.0		90	104	83	70	69	69	69	69
		•		100	129	103	86	74	69	69	69
	· · · · ·			110	156	105	104	89	78	69	
			Coastal	80	91	73	70	69		and the second se	69
	, s s s s s		Cuastai	90	115	92			69	69	69
							77	69	69	69	69
				100	142	114	95	81	71	69	69
:	;	60	Taland	110	172	137	114	98	86	76	69
		60	Inland	80	82	77	77	77	76	76	76
				90	104	83	77	77	76	76	76
				100	129	103	86	77	76	76	76
			0	110	156	125	104	. 89	78	76	76
			Coastal	80	91	77	77	77	76	76	76
	· · ·			90	115	92	77	77	76	76	76
	1			100	142	114	95	81	76	76	76
		-		110	172	137	114	98	86	76	76
		70	Inland	80	85	85	84	84	84	84	83
		:		90	104	85	84	84	84	84	83
		-	, in the second s	100	129	103	86	84	84	84	83
	1			110	156	125	104	89	84	84	83
			Coastal	80	91	85	84	84	84	84	83
				90	115	92	84	84	84	84	83
	·		 	100	142	114	95	84	84	84	83
	1		· .	110	172	137	114	98	86	84	83
	•			maker minkederman Marrow	ble con						

Ah C, E, I

12'

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B-90

Required Horizontal	Anchorage - Ah	- Longitudinal	Direction (lbs/ft)
redanog riourouren	1 monorago - 1 m	- Longituumai	

	<u>Aa</u>	Snow	SD	eed				Length (ft)			
		(psf)	-	ph)	40	50	60	70	80	90	. 10
•	.15	80	Inland	80	93	92	91		91	91	
				90	104	92	91	91	91	<b>9</b> 1	
	•			100	129	103	91	91	91	91	1000
ċ	. :			110	156	125	104	91	91	91	1.2481.04
		1	Coastal	80	93	92	91	91	91	91	ġ
	:			90	115	92	91	91	91	91	1000 S
			1	100	142	114	95	91	91	91	5.22
				110	172	137	114	98	91	91	-020
		90	Inland	80	100	99	99	98	98	98	100
		× .		90	104	99	99	98	98	98	ġ
			r Fri g	100	129	103	<b>9</b> 9	98	98	98	107-0
				110	- 156	125	104	98	98	98	1
	, i	1. A.	Coastal	80	100	99	99	98	98	98	
				90	115	99	-99	98	98	98	
				100	142	114	99	98	98	98	
	_			110	172	137	114	98	98	98	
-		100	Inland	80-90	107	106	106	106	105	105	đ
	÷ .	8 g. s		100	129	106	106	106	105	105	A
				110	156	125	106	106	105	105	1
			Coastal	80	107	106	106	106	105	105	)][
	e e			90	115	106	106	106	105	105	- 1
				100	142	114	106	106	105	105	Ű.
		1.1		110	172	137	114	106	105	105	1(
	.20	0-40	Inland	80	82	66	55	47	44	43	9
		1.1		90	104	83	70	60	52	46	2
		. "•		100	129	103	86	74	64	57	4
	21			110	156	125	104	89	78	69	(
	1.00		Coastal	80	91	73	61	52	45	43	4
				90	115	92	77	66	57	51	4
		1		100	142	114	95	81	71	63	4
÷				110	172	137	114	98	86	76	
1		50	Inland	80	94	93	93	92	92	92	S
•	1.1	-	. •	90	104	93	93	92	92	92	ç
•				100	129	103	93	92	92	92	ç
		1.		110	156	125	104	92	92	92	Ś
2			Coastal	80	94	93	93	92	92	92	ŝ
	-	•		90	115	93	93	92	92	92	9
		· * *	i di se	100	142	114	95	92	92	92	S
	-			110	172	137	114	98	92	92	S
		60	Inland	80-90	104	103	103	102	102	102	10
		-	. ·	100	129	103	103	102	102	102	10
	· · ·			110	156	125	104	102	102	102	្វាល
	÷ .		Coastal	80	104	103	103	102	102	102	10
				90	115	103	103	102	102	102	10
				100	142	114	103	102	102	102	2LÇ
				110	172 able con	137	114	102	102	102	10



C, E, I Multi-Section	Seismi	ic Groun	a . 11							tion (1	
12 Width	1			Vind				Length	L		
	<u>Aa</u>	Snow		peed	40	50		(ft)			
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		(psf)		<u>nph)</u>	40	50	60	70	80	90	10
	.20	70	Inland	80-90	4 min (1974)			112	112	Secondary States	11
				100				112	112	111	11
<b></b>				110			112	112	112	111	11
			Coasta		- 1000000 - 200000			112	112	111	11
				90				112	112	111	11
				100			112	112	112	111	
	1.1	00	T 1 1	110		137	114	112	112	111	11
		80	Inland	80-90	Server Street		122	122	121	121	12
· · · · · · · · · · · · · · · · · · ·				100		123	122	122	121	121	12
	· · ·			110		125	122	122	121	121	12
			Coastal			123	122	122	121	121	12
:				100		123	122	122	121	121	12
				110		137	122	122	121	121	12
		<b>√90</b>	Inland	80-100			132	131	131	131	13
			0.11	110		132	132	131	131	131	13
			Coastal		133		132	131	131	131	13
				100	2	132	132	131	131	131	13
	N-	100	T 1 1	110	172	137	132	131	131	131	13
	· · ·	100	Inland	80-100	143	142	141	141	141	140	14(
			0	110	156	142	141	141	141	140	14(
			Coastal		143	142	141	141	141	140	14(
	.30	0-40	Inland	110	172	142	141	141	141	140	14(
	.50	0~40	manu	80	82	67	67	66	66	65	65
				90 100	104	83	70	66	66	65	65
				100	129	103	86	74	66	65	65
			Coastal	<u>110</u> 80	156	125	104	89	78	69	65
			Coastai	80 90	91	73	67	66	66	65	65
		5		90 100	115	92	77	66	66	65	-65
				110	142	114	95	81	71	65	65
		50	Inland	80-100	172 141	137	114	98	86	76	69
		50	unano	110	156	140	139	139	138	138	138
			Coastal	80-90		140	139	139	138	138	138
	ъ.		Cuastai	100		140	139	139	138	138	138
	1			110	142	140	139	139	138	138	138
	1. A.	60	Inland		172 156	140	139	139	138	138	138
				80-110	156	155 155	154	153	153	152	152
			coasial	110	172	155	154	153	153	152	152
		70	Inland	80-110	170	169	154		153	152	152
		10		80-110	170	169	168 168	168	167	167	167
	•		Cousiai	110	170	169	168			167	167
		80	All		185	184	183	168		167	167
		90	All V		200	and a commence of the second second second second second second second second second second second second second		182		182	181
		100	All		200	213	197 212	197		196	196
					ible con			211	211	211	210
	1.1			10	wie coi	unnue2					

Required Horizontal Anchorage - Ah - Longitudinal Direction (lbs/ft)

Seismic	Ground	Wind				1	ength			
<u>Aa</u>	Snow	Speed					(ft)			
	(psf)	(mph)		40	50	60	70	80	90	100
.40	0-40	Inland	80	92	90	89	88	87	87	87
	÷.,		90	104	90	89	88	87	87	87
1.		. :	100	129	103	89	88	87	87	87
1. A.			110	156	125	104	89	87	87	87
		Coastal	80	92	90	89	88	87	87	87
			90	115	92	89	88	87	87	87
	_		100	142	114	95	88	87	87	87
	-		110	172	137	114	98	87	87	87
	50	All Win	d	189	187	186	185	184	184	184
	60	All Win	d	208	206	205	204	204	203	203
	70	All Win	d	227	226	225	224	223	223	222
	80	All Win	d	247	245	244	243	243	242	242
	90	All Win	d	266	264	263	263	262	261	261
	100	All Win	d	285	284	283	282	281	281-	280
								~~*************************************		





Seismic	Ground	Wind					Length			
Aa	Snow	Speed		· · · ·	e.,		(ft)			
	(psf)	(mph)		40	_50	60	70	80	90	100
.0510	0-100	Inland	80	100	80	67	57	50	44	40
			90	127	101	84	72	63	56	51
			100	156	125	104	89	78	.69	62
			110	189 -	151	126	108	94	84	76
		Coastal	- 80	110	88	73	63	55	49	44
·			- <b>9</b> 0	139	112	93	80	70	62	.56
	÷		100	: 172	.138	115	98	86	77	69
			110	208	167	139	119	104	93	83
.15	0-40	Inland	80	100	80	67	57	50	44	40
			90	127	101	84	72	63	56	51
	-		100	156	125	104	89	78	69	62
			110	189	151	126	108	94	84	76
		Coastal	80	110	88	73	63	55	49	44
			90	139	112	93	80	70	62	56
. *			100	172	138	115	98	86	77	69
			110	208	167	139	119	104	93	83
1 A.	50	Inland	80	100	81	80	80	79	79	79
		- -	90	127	101	84	80	79	79	79
		4 P	100	156	125	104	89	79	79	79
			110	189	151	126	108	94	84	79
		Coastal	80	110	88	80	80	79	79	79
			<b>9</b> 0	139	112	93	80	79	79	79
			100	172	138	115	98	86	79	79
			110	208	167	139	119	104	93	83
			t	able cor	ntinues					·

	Ah
<b>Multi-Section</b>	<b>C, E, I</b>
Width	14'

<b>', E, I</b> <sup>∣'</sup> M 14'	ulti-Section Width	Seismi	c Ground	d Wind					Length			
	WIGGI	] <u>Aa</u>	Snow	Speed					(ft)			
			<u>(psf)</u>	(mph)		40	50	60	70	80	90	100
una nan		.15	60	Inland	80	100	89	89	88	88	88	88
		7			90	127	101	89	88	88	88	85
¥		· · · · ·			100	156	125	104	89	88	88	88
					110	189	151	126	108	94	88	81
	2			Coastal	80	110	89	89	88	88	88	88
					90	139	112	93	88	88	88	88
		•			100	172	138	115	98	88	88	88
			70	Inland	110 80	208	167	139	119	104	93	88
			10	manu	80 90	100 127	98	97	97	96	96	96
		4			100	127	101 125	<b>97</b> 104	97	96	96 06	96
		· · · ·			110	189	151	126	<b>97</b> 108	96 96	96 96	96 96
				Coastal	80	110	98	97	97	<u> </u>	96	96
					90	139	112	97	97	96	96	96
		i i			100	172	138	115	98	96	96	96
					110	208	167	139	119	104	96	96
		Alexandra de la composición de la composicinde la composición de la composición de la composición de l	80	Inland	80	107	106	106	105	105	105	105
	12				90	127	106	106	105	105	105	105
					100	156	125	106	105	105	105	105
					110	189	151	126	108	105	105	105
			•	Coastal	80	110	106	106	105	105	105	105
					90	139	112	106	105	105	105	105
					100	172	138	115	105	105	105	105
		n de la dela Nota del composito de la del composito de la del composito de la del composito de la del composito de la del co	90	Inland	110 80	208	167	139	119	105	105	105
		a.	. 90	mano	90 -	127	115 115	114 114	114	113	113	113
		1			100	156	125	114	114 114	113 113	113 113	113
					110	189	125	126	114	113 113	113	113 113
				Coastal	80	115	115	114	114	113	113	113
					90	139	115	114	114	113	113	113
					100	172	138	115	114	113	113	113
					110	208	167	139	119	113	113	113
		· · · ·	100	Inland	80	124	123	122	122	122	122	121
				•		127		122	122	122	122	121
					100	156	125	122	122	122	122	121
					110	189		126		122	122	121
		. *			80	124				122	122	121
			· · · ·			1 <b>39</b> 172			122		122	121
					110			122	122	122	122	121
		÷ .					tinues	1.27	3.404	144	124	121
						510 101				,		
			• • • •	· .		: · ·	1. A.					
			. 1	• •								
		· ·		51 A. A.		1997 - 1997 1997 - 1997	$\{i_1, \ldots, i_n\}$					

**B-9**4

eismic	Ground	I W	ind				Length	·	1 . I	·
<u>Aa</u>	Snow	Spe	eed				(ft)		·	
	(psf)	(m	ph)	40	50	60	70	80	90	10
.20	0-40	Inland	80	100	80	67	57	-50	49	4
			90	127	101	84	72	63	56	5
			100	156	125	104	89	78	69	6
			110	189	151	126	108	94	84	7
		Coastal	80	110	88	73	63	55	49	4
			90	139	112	93	80	70	62	5
			100	172	138	115	98	86	77	6
			. 110	208	167		119	104	93	8
	50	Inland	80	108	107	107	106	106	106	10
		:	90	127	107	107	106	106	106	10
			100	156	125	107	106	106	106	10
e			110	189	151	126	108	106	106	10
		Coastal	80	110	107	107	106	106	106	10
			90	139	112	107	106	106	106	10
			100	172	138	115	106	106	106	10
			110	208	167	139	119	106	106	10
	60	Inland	80	120	119	118	118	117	117	11
			90	127	119	118	118	117	117.	11
			100	156	125	118	118	117	117	11
			110	189	151	126	118	117	117	ir
•		Coastal	80	120	119	118	118	117	117	11
· .			90	139	119	118	118	117	117	ar
			100	172	138	118	118	117	117	11'
			110	208	167	139	119	117	117	11
	70	Inland	80-90	131	130		129	129	128	12
		• • •	100	156	130	129	129	129	128	12
			110	189	151	129	129	129	128	128
		Coastal	80	131	130	129	129	129	128	128
1		· · .	90	139	130	129	129	129	128	12
			100	172	138	129	129	129	128	128
	1	· · · ·	110	208	167	139	129	129	128	121
	80	Inland	80-90	142	141	141	140	140	140	139
			100	156	141	141	140	140	140	139
			110	189	151	141	140	140	140	139
		Coastal	80-90	142	141	141	140	140	140	139
	a de la composición de la composición de la composición de la composición de la composición de la composición de		100	172	141	141	140	140	140	139
			110	208	167	141	140	140	140	139
	90	Inland	80-90	154	153	152	152	151	151	15
			100	156	153	152	152	151	151	151
			110	189	153	152	152	151	151	151
		Coastal	80-90	154	153	152	152	151	151	151
		Joudia	100	172	153	152	152	151	151	
		м. С	110	208	167	152				151
		······		ble con		1,92	152	151	151	151





2, E, I 14'	Multi-Section Width		Ground		ind	0 -		_	Length			bs/ft)
14		<u>Aa</u>	Snow	-	eed				(ft)			
		· · ·	(psf)		ph)	40	50	60	70	80	90	10
	<u></u>	.20	100	Inland	80-100	165	164	163	163	162	162	16
		.20	100	Interior	110	189	164	163	163	162	162	16
		•		Coastal	80-90	165	164	163	163	162	162	
<del> )</del>		· · ·		Coastai	100	172	and the second se	163	163	162		16
			· .		110	208	<b>164</b> 167	163	163	162	162 162	16
		.30	0-40	Inland	80	100	80	75	75	74		16
	•	.50	0 -10	mana	90	127	101	75 84	75	74	74 74	7.
					100	156	125	04 104	89	78		7
					110	189	125	126	108	94	74 84	7
				Coastal	80	110	88	75	75	74	74	7(
				Cuastai	90	139	- 112	93	75 80	74 74		Ľ
		1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -			100	172	138	115	98	86	74 77	T.
					110	208	167	139	119	104	- 93	7: 8:
			50	Inland	80-100	163	161	160	159	159	158	158
		ant an	50	Interio	110	189	161	160	159	159	158	15
				Coastal	80-90	163	161	160	159	159	158	158
				Coustin	100	172	161	160	159	159	158	158
					110	208	167	160	159	159	158	158
			60	Inland	80-100	180	178	177	176	176	175	175
		1. N.	00	mand	110	189	178	177	176	176	175	175 175
			•	Coastal	80-100	180	178	177	$\frac{176}{176}$	176	175	175
				Coustai	110	208	178	177	176	176	175	175
	н. Н	· · ·	70	Inland	80-110	197	195	194	193	193	192	192
				Coastal	80-100	197	195	194	193	193	192	192
÷.,				oowaa	110	208	195	194	193	193	192	192
			80	All V		214	212	211	210	210	209	209
			90	All V		231	229	228	227	227	226	209
			100	All V		247	246	245	244	244	243	243
		.40	0-40	Inland	80	104	102	100	100	99	98	98
			• • •		90	127	102	100	100	99	98	98
				÷	100	156	125	104	100	99	98	98
					110	189	151	126	108	99	98	98
				Coastal	80	110	102	100	100	99	98	98
					90	139		100	100	99	<del>9</del> 8	98
					100	172	138	115	100	99	98	98
					110	208	167	139	119	104	98	98
			50	All V		217	215	214	213	212	211	211
			60	All V		240	237	236	235	234	234	233
			70	All V		262	260	259	258	257	257	256
	5		80	All V		285	283	281	280	280	279	279
			90	All V		307	305	304		302	302	301
			100	All V		330	328	327	326	325	324	324

 $\square$ 

Multi-Section

Width

Ah

**C**, E, I

16'

-				-		•				,
Seismic	Ground	Wind				]	Length		·	
<u>Aa</u>	Snow	Speed				• .	(ft)			
	(psf)	(mph)		40	50	60	70	80	90	100
.0510	0-100	Inland	80	117	94	78	67	58	52	47
			90	148	118	99	85	74	66	59
	1		100	183	146	122	104	91	81	73
	1.1	1.5	110	221	177	147	126	111	98	88
		Coastal	80	129	103	86	74	64	57	52
1			90	163	131	109	93	82	73	65
			100	202	161	134	115	101	90	81
			110	244	195	163	139	122	108	98
.15	0-40	Inland	80	117	94	78	67	58	52	47
	1.1		90	148	118	99	85	74	66	59
			100	183	146	122	104	91	81	73
			110	221	177	147	126	111	98	88
		Coastal	80	129	103	86	74	64	57	52
			90	163	131	109	93	82	73	65
			100	202	161	134	115	101	90	81
			110	244	195	163	139	122	108	98
	50	Inland	80	117	94	91	90	90	90	89
			90	148	118	99	90	90	90	89
		an an an an an an an an an an an an an a	100	183	146	122	104	91	90	89
			110	221	177	147	126	111	98	89
		Coastal	80	129	103	91	90	90	90	89
			90	163	131	109	93	90	90	89
		1 A A	100	202	161	134	115	101	90	89
		and the second second	110	244	195	163	139	122	108	98
	60	Inland	80	117	101	100	100	99	99	99
			90	148	118	100	100	99	99	99
×			100	183	146	122	104	99	99	99
	10 - 10 10		110	221	177	147	126	111	99	99
	. *	Coastal	80	129	103	100	100	99	99	99
	2.		90	163	131	109	100	<del>9</del> 9	99	99
		анан сайта. 1	100	202	161	134	115	101	99	99
			110	244	195	163	139	122	108	99
	70	Inland	80	117	111	110	109	109	109	109
	- E.	· ·	90	148	118	110	109	109	109	109
1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -			100	183	146	122	109	109	109	109
r (*			110	221	177	147	126	111	109	109
	х. Х	Coastal	80	129	111	110	109	109	109	109
4		e esteren esteren esteren esteren esteren esteren esteren esteren esteren esteren esteren esteren esteren ester Esteren esteren	90	163	131	110	109	109	109	109
			100	202	161	134	115	109	109	109
	an star i star i	N	110	202	195	163	139	102		107

table continues

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	Require	ed Hor	izontal And	chora	.ge - A	h - Lo	ongitu	dinal	Direct	ion (ll	os/ft)
C, E, I Multi-Section	Seismic	Ground	Wind				1	Length			
16 Width	<u>Aa</u>	Snow	Speed					(ft)			
· · · · ·	<u>7.64</u>	(psf)	(mph)		40	50	60	. 70	80	90	100
	.15	80	Inland	80	121	120	120	119	119	119	118
				90	148	120	120	119	119	119	118
				100	183	146	122	119	119	119	118
<b></b>				110	221	177	147	126	119	119	118
			Coastal	80	129	120	120	119	119	119	118
				90	163	131	120	119	119	119	118
				100	202	161	134	119	119	119	118
		2		110	244	195	163	139	122	119	118
:		90	Inland	80	131	130	129	129	129	128	128
				90	148	130	129	129	129	128	128
				100	183	146	129	129	129	128	128
				110	221	177	147	129	129	128	128
			Coastal	80	131	130	129	129	129	128	128
				90	163	131	129	129	129	128	128
				100	202	161	134	129	129	128	128
				110	244	195	163	139	129	128	128
	· .	100	Inland	80	140	140	139	139	138	138	138
				90	148	140	139	139	138	138	138
		. 1		100	183	146	139	139	138	138	138
			0	110	221	177	147	139	138	138	138
			Coastal	80	140	140	139	139	138	138	138
				90	163	140	139	139	138	138	138
				100	202	161	139	139	138	138	138
	.20	0-40	Inland	110 80	244 117	<u>195</u> 94	<u>163</u> 78	<u>139</u> 67	138 58	138	<u>138</u> 54
	.20	0-40	manu	90	148	118	99	85	58 74	66	59
				100	183	146	122	104	91	81	73
				110	221	177	147	126	111	98	88
			Coastal	80	129	103	86	74	64	57	54
				90	163	131	109	93	82	73	65
			· .	100	202	161	134	115	101	90	81
				110	244	195	163	139	122	108	98
		50	Inland	80	123	121	121	120	120	119	119
	· · · · · · · · · · · · · · · · · · ·			90	148	121	121	120	120	119	119
		:		100	183	146	122	120	120	119	119
		÷		110	221	177	147	126	120	119	119
			Coastal	80	129	121	121	120	120	119	119
		۰.		90	163	131	121	120	120	119	119
				100	202	161	134	120	120	119	119
				110	244	195	163	139	122	119	119
				ta	able co	ntinues					1 A

S	eismic	ismic Ground Wind			Length						
	<u>Aa</u>	Snow	-	eed				(ft)			
		(psf)		<u>ph)</u>	40	50	60	70	. 80	90	100
	.20	60	Inland	. 80	136	134	134	133	133	132	132
				90	148	134	134	133	133	132	132
				100	183	. 146	134	133	133	132	132
		:	ļ	110	221	177	147	133	133	132	132
			Coastal	80	136	134	134	133	133	132	132
				90	163	134	134	133	133	132	132
	· · ·			100	202	161	134	133	133	132	132
				110	244	195	163	139	133	132	132
		70	Inland	80-90	149	147	147	146	146	145	145
÷			i i	100	183	147	147	146	146	145	145
		~		110	221	177	147	146	146	145	145
			Coastal	80	149	147	147	146	146	145	145
		.*	·	90	163	147	147	146	146	145	145
				100	202	161	147	146	146	145	145
				110	244	195	163	146	146	145	145
		80	Inland	80-90	161	160	159	159	158	158	158
•				100	183	160	159	159	158	158	158
				110	221	177	159	159	158	158	158
			Coastal	80	161	160	159	159	158	158	158
				90	163	160	159	159	158	158	158
				100	202	161	159	159	158	158	158
				110	244	195	163	159	158	158	158
• •		90	Inland	80-90	.174	173	172	172	171	171	171
· .				100	183	173	172	172	171	171	171
			1	110	221	177	172	172	171	171	171
			Coastal	80-90	174	173	172	172	171	171	171
			ļ	100	202	173	172	172	171	171	171
				110	244	195	172	172	171	171	171
	:	100	Inland	80-100	187	186	185	185	184	184	184
				110	221	186	185	185	184	184	184
			Coastal	80-90	187	186	185	185	184	184	184
				100	202	186	185	185	184	184	184
			4	110	244	195	185	185	184	184	184
	.30	0-40	Inland	80	117	94	84	83	83	82	82
				90	148	118	99	85	83	82	82
				100	183	146	122	104	91	82	82
				110	221	177	147	126	111	98	88
			Coastal	80	129	103	86	83	83	82	82
				90	163	131	109	93	83	82	82
				100	202	161	134	115	101	90	82
				110	244	195	163	139	122	108	98
		50	Inland	80-100		182	181	180	180	179	179
			~*********	110		182	181	180	180	179	179
			Coastal	80-90		182	181	180	180	179	179
			Coustai	100		182	181	180	180	179	179
				110			181	180	180	179	179
			J		able co		101	100	100	1 1.7	117
				1							

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Ab			Requir	ed Hor	izontal A	Anchora	ige - A	h - Lo	ongitu	dinal	Direct	ion (ll	bs/ft)
C, E, I	Multi-Section		_				-						
16'	Width		Seismic	Ground	•• <b>W</b> 1	ind			· . ]	Length			
1980000000		J	<u>Aa</u>	Snow	Spe	eed				(ft)			
		•		_(psf)	(m	ph)	40	50	60	70	80	. 90	100
. <u>1</u> 281 M (1. 1. 1			.30	60	Inland	80-100	203	202	200	200	199	198	198
	<b>V</b>					110	221	202	200	200	199	198	198
		-		•	Coastal	80-100	203	202	200	200	199	198	198
7						110	244	202	200	200	199	198	198
			· ·	70	Inland	80-110	223	221	220	219	218	218	217
	abber ne ter stander einer ster einer ster stander im die ster ster ster ster ster ster ster ste		÷ *		Coastal	80-100	223	221	220	219	218	218	217
			÷.,			110	244	221	220	219	218	218	217
				80	Inland	80-110	242	240	239	238	238	237	237
		÷ .			Coastal	80-100	242	240	239	238	238	237	237
						110	244	240	239	238	238	237	237
			7	90	All V		262	260	259	258	257	257	256
				100		Wind	281	279	278	277	276	276	276
			.40	0-40	Inland	80	117	114	112	111	110	110	109
				1. A.		90	148	118	112	111	110	110	109
				· ·		100	183	146	122	111	110	110	109
						110	221	_177**	147	126	111	110	109
				÷ *	Coastal		129	114	112	111	110	110	109
		19				90	163	131	112	111	110	110	109
						100	202	161	134	115	110	110	109
			14. 1			110	244	195	163	139	122	110	109
			<u>.</u>	50	All V	Vind	245	243	241	240	239	239	238
			· · · ·	60	All V	Vind	271	269	267	266	265	265	264
				70	All V	Vind	297	295	293	292	291	290	290
		÷		80	All V	Vind	323	321	319	318	317	316	316
		:		90	All V	Vind	349	346	345	344	343	342	342
		÷		100	All V	Vind	375	372	371	369	369	368	367
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### APPENDIX C FOUNDATION CAPACITIES TABLES

## C-100. USE OF FOUNDATION CAPACITIES TABLES.

C-100.1. GENERAL. The Foundation Capacities Tables provide foundation design capacities and dimensions for three conditions of foundation design.

A. Withdrawal Resistance. The ability of a foundation wall or pier plus its respective footing to resist uplift and overturning. See Tables C-1 & C-2.

**B.** Vertical Anchor Capacity. The required size and spacing of anchors to tie the superstructure to the foundation to meet the required uplift or overturning in the transverse direction. See Tables C-3 & C-4 (a & b).

**C.** Horizontal Anchor Capacity. The required size and spacing of anchors to tie the superstructure to the foundation to resist sliding in the transverse and longitudinal directions - Horizontal Anchor Capacity Table, Table C-5.

C-100.2. CONNECTIONS of the foundation to the manufactured home is dependent on the rated capacity of the manufacturer's connection designs.

C-200. WITHDRAWAL RESIS-TANCE CAPACITY TABLES. There are two tables providing the withdrawal resistance (uplift and overturning) for different designs of foundation walls and piers on spread footings at different depths. **C-200.1. LONGITUDINAL FOUNDATION WALLS.** The "Withdrawal Resistance for Longitudinal Foundation Walls - Table C-1" is used for manufactured homes anchored to longitudinal foundation walls, specifically system type E. The table provides a footing width and depth below grade to prevent uplift.

*Example*: Determine the withdrawal resistance of a 6" reinforced concrete wall with a height (hw) of 3'- 4" and with a 6"x16" footing. Repeat for a 6"CMU wall grouted solid, then grouted at 48" o.c., and lastly for an all-weather wood foundation.

Solution: Start with the concrete wall: wall weight:  $(0.5') \times (3.33') \times 150 \text{ pcf} = 250 \text{ plf};$ reinforced concrete footing weight:  $(6"\times 16" \div 144 in.sq./sq.ft.) \times 150 pcf = 100 plf;$ rectangular soil wedge wt: (3.33'-1')×((16"× 6'') ÷  $(2'' \times 12'')$  × 120 pcf = 116 plf. The total withdrawal resistance is the sum of the wall, footing and soil block weight, which is 250+100+116 = 466 plf. This matches the tabled value. The solid grouted CMU wall: wall wt.:  $(3.33') \times (63 \text{ psf}) = 210 \text{ plf}, 16'' \text{ footing and}$ 5" soil wedge calculations are the same as above. The total withdrawal is the sum = 210 +100 + 116 = 426 plf, just as found in the Table. The partially grouted CMU wall: wall wt.:  $(3.33) \times (45 \text{psf}) = 150 \text{ plf}, 16^{\circ} \text{ footing and } 5^{\circ}$ soil wedge are the same. The total withdrawal is the sum = 150+100+116 = 366 plf, just as found in the table. Lastly, for the all-weather wood foundation: wood stud wall wt.: 2"x6" plate = 2.1 plf; (3)-2"x4" plates =  $3 \times 1.3 \text{ plf}$  = 3.9 plf; 2"x4"@ 16" o.c. =  $1.0 \text{ psf} \times 3.33' =$ 

3.33plf; 1/2"plywood =  $1.5psf \times 3.33' = 5.0$ plf. Wood sum = 2.1+3.9+3.33+5.0 = 14.3 plf; footing weight is the same as caculated before. Soil weight is based on a 6" wide wedge:  $(3.33')\times(16-4)\div(2\times12)\timespcf = 140$  plf. Total withdrawal = 14.3+100+140 = 254 plf, just as in the Table.

**C-200.2. PIER FOUNDATIONS.** The "Withdrawal Resistance for Piers - Table C-2" is used for manufactured homes anchored to piers; specifically system Types **C**, **I**, and Type **E** when interior piers are used for anchorage. This table also applies to the concrete tie-down block for type **C1** foundations.

*Example*: Determine the withdrawal resistance of a 3 foot square footing with an 8"x16" solid grouted CMU pier of a height (hp) of 3'-4". Grade exists 12 inches down from the top of the pier.

Solution: Assume the following material weights: 8"CMU = 84 psf; soil = 120 pcf; and concrete = 150 pcf. Pier weight =  $(84psf) \times (16/12) \times (3.33') = 373$  lbs. Footing weight =  $(150pcf) \times (8/12) \times (3' \times 3') = 900$  lbs. Assume footing perimeter creates a conservative shear plane. Soil above footing also counted to resist withdrawal. Soil Weight =  $(120pcf) \times (3.33' - 1') \times (3^2 - (8) \times (16)/144) = 2267$  lbs. Total withdrawal resistance is the sum of the pier + footing + soil = 3541 lbs. This magnitude matches the value found in the Table C-2.

C-200.3. FOOTING DEPTH. The bottom of the footings must be below the maximum frost depth for the area where the home is located.

*Example*: The average depth of frost penetration is 35 inches. Assume that the required footing depth to resist withdrawal (Av) is hw = 2 feet. The depth of the base of the footing is 24"-12"+6"=18". This is less than 35". The depth of hw must be increased to 41" in order for the base of the footing to be at 35"--the required depth to prevent frost damage & also satisfy withdrawal requirements (41"-12"+6"=35").

C-300. VERTICAL ANCHOR CA-PACITY TABLES provide the required anchor and reinforcing size and spacing to tie the superstructure to the foundation wall or piers. As in section C-200.1 above, there are two Vertical Anchorage Capacity Tables, one for longitudinal foundation walls and one for piers.

C-300.1. PIERS. The "Vertical Anchor Capacity for Piers - Table C-3" is used for manufactured homes anchored to piers to prevent uplift specifically system Types C, I, and Type E when interior piers are used for anchorage (multi-section E's).

*Example*: Anchor bolts are assumed to be made from A36 rod stock and of embedment length sufficient to fully develop the allowable tensile capacity ( $0.6 \times F_y$ ) of the diameter of rod used. A 1/2"diameter anchor bolt has the following capacity: ( $0.6 \times 36,000$  psi) $\times(\pi \times 0.5^2/4) = 4,240$ psi, as noted in the Table. The capacity of any substituted grade of steel can easily be calculated if the yield point and diameter are known.

C-300.2. LONGITUDINAL CON-CRETE/MASONRY FOUNDATION WALLS. The "Vertical Anchorage Capacity for Longitudinal Foundation Walls - Table C--4A" is used for manufactured homes anchored to a continuous Reinforced concrete or reinforced concrete masonry foundation wall, specifically system Type E. *Example*: Determine the anchorage capacity per foot of foundation wall if 1/2" diameter anchor bolts are spaced 3'-4" o.c. and attach to a continuous treated wood mud sill 1-1/2" thick. Standard washers are used under the nut and bear into the mud sill perpendicular to grain.

Solution: Determine the bearing area of a standard washer with O.D. =  $1.375^{\circ}$  and I.D. =  $0.5625^{\circ}$ : A<sub>brg</sub> =  $\pi \times (1.375^2 - 0.5625^2) \div 4 =$  $1.237^{\text{sq. in.}}$ . The capacity in bearing multiplied by a bearing area factor C<sub>b</sub> = 1.25. Thus, the bearing capacity =  $1.237 \times 1.25 \times 565$  psi = 873 lbs./ bolt. The capacity for a given spacing of bolts is found by division of that spacing. Thus, for a 3'-4" bolt spacing:  $873 \div 3.33' =$ 262 plf, which is the same as in the Table.

Use of an oversized washer (for a 5/8" dia. bolt) produces a larger capacity per bolt. The O.D. = 1.75" and the I.D. = 0.6875", thus the net bearing area :  $A_{brg} = \pi \times (1.75^2 - 0.6875^2) \div$  $4 = 2.03^{sq. in}$ . The vertical anchor capacity at the same same spacing =  $2.03 \times 1.25 \times 565$  psi  $\div 3.33' = 431$  plf, which is the same as in the Table.

C-300.3. LONGITUDINAL TREATED WOOD FOUNDATION WALLS. The "Vertical Anchorage Capacity for Longitudinal Foundation Walls - Table C-4B" is used for manufactured homes anchored to a continuous treated wood foundation wall, specifically system Type E. Vertical anchorage capacities are based on the use of standard washers over 1/2" dia. bolts. Plywood thickness, nail size and spacing are selected so as to provide equal or greater capacity than the standard washer in bearing. The APA Plywood Diaphragm Guide was used to select plywood, and nailing requirements for the Table.

*Example:* A 1/2" dia. bolt spaced at 3'-4" o.c. provides a vertical anchor capacity of 262 lbs./ft. This is the same capacity as found in Table C-4A for a standard washer in bearing, and its calculation is illustrated above. The APA Table - *Recommended Shear for Horizontal APA Panel Diaphrapms* requires for a shear of 320 plf > 262 plf: 8d COM nails @ 4" o.c. and uses 3/8" APA rated sheathing.

C-400. HORIZONTAL ANCHOR CAPACITY TABLES FOR TRANS-VERSE AND LONGITUDINAL FOUNDATION WALLS (Table C-5A & C-5B) are used for all types of manufactured homes: homes on continuous foundations -Type E; homes on piers - Types C and I.

**C-400.1. ASSUMPTIONS.** Along with the notes at the bottom of the tables the following assumptions are made:

A. The horizontal sliding forces are resisted totally by transverse foundation shear walls in the transverse direction and by longitudinal foundation shear walls in the longitudinal direction. An appropriate number of vertical X-bracing planes can be substituted for shear walls to resist sliding in the transverse or longitudinal direction. See sections 602-5.G and 602-6.F.

**B.** The roof/ceiling and floor of the superstructure are adequate as diaphragms, transferring wind load to the transverse and longitudinal foundation shear walls.

**C.** A home supported by piers does not provide adequate horizontal sliding resistance unless the piers and footings have been engineered to withstand lateral loads.

**C-400.2. TABLES FOR HORIZONTAL ANCHOR CAPACITY.** There are two Tables (C-5A & C-5B) for the Horizontal Anchor Capacity for Transverse or Longitudinal Walls.

A. Concrete or Masonry Walls. Table C-5A is based on the capacity of the anchor bolt in a properly designed concrete or masonry foundation system. Horizontal shear capacity for a specific spacing of anchor bolts is based on bearing of the anchor bolt against concrete or grout:  $F_{brg} = 0.35 \times f_c' = 0.35 \times 2500 \text{psi} = 875 \text{psi}.$ 

*Example:* Horizontal capacity per anchor bolt bearing = 875 psi  $\times$  1/2" dia.  $\times$  4" min. embed. = 1750 lb/bolt, rounded to 1800 lb/bolt. (Note: shear of the bolt did not control since it calculated to be 2830 lb/bolt, assuming A36 rod stock). Thus for 3 foot spacing: 1800  $\div$  3' = 600 plf, as shown in the Table.

**B.** Wood Foundation Walls. Table C-5B is based on the capacity of the anchor connection to a treated wood wall which is attached to a concrete footing. Horizontal shear capacity is controlled by bearing of wood parallel to grain against the anchor bolt, and then the spacing of those bolts. A 1600 psi end grain bearing allowable stress was assumed, since it would cover most typical species. Thus, the capacity per bolt = 1/2" dia.  $\times 1.5$ "  $\times 1600$  psi = 1200 lb. The APA Plywood Diaphragm Guide was used to select plywood, and nailing requirements for the Table.

Example: For a 1/2" dia. bolt spaced at 3'-4", the horizontal capacity is: 1200 lb.  $\div$  3.33' = 360 plf as shown in the Table. The APA Table - Recommended Shear for Horizontal APA Panel Diaphrapms requires for a shear of 360 plf: 8d COM nails @ 4" o.c. and uses 15/32" APA rated sheathing, just as shown in the Table.

C. Anchorage For Diagonal Steel Members To Complete Transverse Foundation Walls Used As Shear Walls. The number of anchor bolts required to anchor the diagonal steel members to the foundation wall can be found by dividing the capacity value for a bolt spaced at 12 inches into the required Ah.

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<sup>1</sup> Potential resistance to withdrawal is the maximum uplift resistance which can be provided by the foundations shown. It is computed by adding the weights of building materials and soil over the top of the footing, plus the footing weight. To fully develop this potential, adequate connections to the footing and superstructure must be provided. Material weights used: concrete (nlwt) = 150 psf; 6"solid grouted CMU = 63 psf; 6" CMU grouted @ 48"o.c. = 45psf; grout wt assumed = 140 pcf; CMU units nlwt; wood = 35 pcf; soil = 120 pcf.

<sup>2</sup> Foundations must be designed for bearing pressure, gravity loads, and uplift loads in addition to meeting the anchorage requirements tabulated in the Foundation Design Tables.

<sup>3</sup> Values shown in this table could be increased by widening the footing, provided the system is designed for the increased load, or by a more detailed analysis of the shearing strength of the soil overburden.

Нр	Width of Square Footing: Wf					
Depth	1'-0''4	2'-0"	3'-0"	4'-0'' <sup>4</sup>		
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		





Potential resistance to withdrawal is the maximum uplift resistance which can be provided by the foundations shown. It is computed by adding the weights of building materials and soil over the top of the

footing, plus the footing weight. To fully develop this potential, adequate connections to the footing and superstructure must be provided. Material weights used: concrete (nlwt) = 150 psf; nlwt 8"CMU = 84 psf grouted solid; grout (nlwt) = 140 pcf; soil = 120 pcf.

- <sup>2</sup> Foundations must be designed for lateral soil pressure, bearing pressure, gravity loads, and uplift loads, in addition to meeting the anchorage requirements tabulated in the Foundation Design Tables. The bottom of the footing must also be below the maximum depth of frost penetration.
- <sup>3</sup> Values shown in this table could be increased by widening the footing, providing the wall system is designed for the increased load, or by a more detailed analysis of the shear strength of the soil overburden.
- <sup>4</sup> Assumes 8" x 8" pier for the 1'-0" square footing, and 16" x 16" pier for the 4'-0" square footing.

# Table C-3 Vertical Anchor Capacity For Piers<sup>1, 2</sup> (In pounds)

Anchor	Capacity Per Number Of Bolts				
Bolt Dia.	1	2			
1/2"	4240	8480			
5/8"	6620	13240			



Anchor Bolt Dia.	Vertical Rebar	Minimum Lap Splice	Rebar Hook	
1/2"	#4	16"	6" 7"	
5/8"	# 5	20"	T''	



<sup>1</sup> The vertical anchor capacity is based upon the working capacity of ASTM A-36 rod stock anchor bolts in 2500 psi concrete or grout. To fully develop this capacity, anchor bolts must be properly lapped with the pier's vertical reinforcement.

<sup>2</sup> The capacity is based on  $f_c = 2500$  psi;  $F_y = 36,000$  psi.

 
 Table C-4A

 Vertical Anchor Capacity For Longitudinal Foundation Wall<sup>1</sup> (In pounds per linear foot of wall)



Vertical lbs	Capacity <sup>5</sup> ./ft.	Required Anchorage <sup>2, 3</sup>				
Standard Washer	Over-Sized Washer	Anchor Bolt	Rebar <sup>4</sup>	Spacing <sup>5</sup>		
146	239	1/2"	#4	6'-0"max.		
164	270			5'-4"		
187	307			4'-8"		
218	359			4'-0"		
262	431			3'-4"		
327	538			2'-8"		
437	718	↓	↓	2'-0"		

<sup>1</sup> Compare with required Av for Type E units.

<sup>2</sup> Values are based on vertical capacity per foot of wall.

<sup>3</sup> Assuming 1 1/2" thick sill plate, 3/4" edge distance for wood or composite nailer plates or 20 diameter end distance for plywood sheathing; APA rated, properly seasoned wood; Group III woods, not permanently loaded, and a 25% length of bearing factor increase.

<sup>4</sup> It is assumed that a reinforcing bar of the same diameter and spacing as the anchor is adequately embedded in the footing and lapped with the anchor.
 <sup>5</sup> Spacing and capacity is based on allowable compression of wood perpendicular to prove for E = 565 and events.

Spacing and capacity is based on allowable compression of wood perpendicular to grain for  $F_c = 565$  psi and washer as define below:

Standard washer: 1 3/8" O.D. and 0.5625" I.D. washer (for 1/2"  $\phi$  bolt)

Over-sized washer: 1 3/4" O.D. and 0.6875" I.D. washer (for 5/8"  $\phi$  bolt) placed under the standard washer.



 Table C-4B

 Vertical Anchor Capacity For Longitudinal Foundation Wall<sup>1, 2</sup>

 (In pounds per linear foot of wall)



Treated Wood Wall

Vertical Capacity Ibs./ft.	Required Nailing <sup>4, 5</sup> (Edge Spacing, in.)	Min. Plywood Thickness	Required Anchorage <sup>2, 3</sup>			
Standard Washer			Anchor Bolt Diameter	Bolt Spacing <sup>6</sup>		
146	6d @ 6" o.c.	3/8"	1/2"	6'-0"max.		
164			· · · · · · · · · · · · · · · · · · ·	5'-4"		
187				4'-8"		
218	8d @ 6" o.c.			4'-0"		
262	8d @ 4" o.c.	↓ ↓		3'-4"		
327	8d @ 4" o.c.	15/32"		2'-8"		
437	10d @ 2 1/2" o.c.	↓ ↓ ↓		2'-0"		
***		and a second second second				

\*\* For required Av greater than 437 lbs./ft., consider using a different foundation material or utilize an engineered design with a higher capacity.

<sup>1</sup> Compare with required Av for Type E units.

<sup>2</sup> In the case of a treated wood foundation wall, the wood wall and its connections must be designed to transfer the anchor load to a concrete footing. This table does not apply to treated wood foundation walls on gravel bases.

<sup>3</sup> Values are based on vertical capacity per foot of wall.

<sup>4</sup> Assuming 1 1/2" thick sill plate, 3/4" edge distance for wood or composite nailer plates or 20 diameter end distance for plywood sheathing; APA rated, properly seasoned wood; Group III woods, not permanently loaded, and a 25% length of bearing factor increase.

<sup>5</sup> Nailing schedule in this table is intended to secure the superstructure to the foundation only, and not to provide required edge fastening for plywood siding or sheathing.

<sup>6</sup> Spacing and capacity is based on allowable compression of wood perpendicular to grain for F<sub>c</sub> = 565 psi and standard washer = 1 3/8" O.D. and 9/16" I.D. washer (for 1/2" φ bolt).
Table C-5A

 Horizontal Anchor Capacity For Transverse or Longitudinal Shear Walls<sup>1</sup> (In pounds per foot of wall)

(	Concrete or Ma	asonry	pier diagonal strap		
	Horizontal Capacity <sup>2</sup>	Req	uired Ancho	rage <sup>5</sup>	90° bend ; anchor bolt Required C or B
	lbs./ft.	Anchor Bolt <sup>4</sup>	Rebar	Spacing <sup>6</sup>	• Let 3-#4 e.w.t&b
	300	1/2"	#4	72" o.c. max.	Pier Footing Used With X-Bracing
	600			36" o.c.	
	675			32" o.c.	Required Ah
	900			24" o.c.	
	1350		4	16" o.c.	
	1800	- ↓	¥	12" o.c.	Concrete or Masonry
	***				! ! N
	Se	e Table C-3A F	or Rebar De	tails	Required Ah
	*** <b>T</b>	ad Ab granter the	- 1200 11 - /		

Treated Wood

\*\*\* For required Ah greater than 1800 lbs./ft., consider using an engineered design with a higher capacity.

Table C-5B

Ŧ	I reated Wood				and the second second second second second second second second second second second second second second second	
	Horizontal	Required Nailing <sup>3, 4</sup>	Min. Plywood <sup>4</sup>	Required	Anchorage	
	Capacity <sup>2</sup>	(Edge Spacing, in.)	Nailer Thickness	Anchor Bolt	D-16 C	
	lbs./ft.			Diameter	Bolt Spacing'	
ſ	300	8d @ 4" o.c.	7/16"	1/2"	4'-0" max.	
	360	8d @ 4" o.c.	15/32"		3'-4"	
	449	10d @ 4`` o.c.	15/32"		2'-8"	
	600	10d @ 3" o.c.	19/32"	. ↓ .	2'-0"	

<sup>1</sup> Compare capacity with required Ah in transverse or longitudinal direction.

 $^{2}$  Values are based on horizontal load per foot of wall. Select Ah for pier spacing of 4 feet for use with this table.

<sup>3</sup> Assuming 1 1/2" thick sill plate. 3/4" edge distance for wood or composite nailer plates or 20 diameter end distance for plywood sheathing; APA rated. properly seasoned wood; Group III woods, not permanently loaded.

<sup>4</sup> Nailing schedule in this table is intended to secure the superstructure to the foundation only, and not to provide required edge fastening for plywood siding or sheathing.

<sup>5</sup> It is assumed that a reinforcing bar of the same diameter as the anchor is adequately embedded in the footing and lapped with the anchor. In the case of a treated wood foundation wall, the wood wall and its connections must be designed to transfer the anchor load to a concrete footing. This table does not apply to treated wood foundation walls on gravel bases.

<sup>6</sup> Spacing based on bearing capacity of bolt against concrete/grout.

<sup>7</sup> Spacing based on capacity of anchor bolt in bearing against the wood plate. (see also #5.)

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# APPENDIX D DERIVATION OF FOUNDATION DESIGN

# **D-100. CONDITIONS AFFECTING**

**DESIGN.** Values for the Foundation Design Load Tables have been derived based on major foundation design factors, foundation design criteria, and design assumptions.

**D-100.1 MAJOR FOUNDATION DESIGN FACTORS** determine the appropriateness of foundations for manufactured homes:

### A. Soil and site conditions.

- 1. Soil types
- 2. Bearing capacities
- 3. Drainage
  - 4. Slopes

**B.** Load Conditions and Combinations. Various combinations of (1) through (5) with appropriate factors:

- 1. Dead loads
- 2. Occupancy live loads
- 3. Wind loads
- 4. Snow loads / Minimum roof live loads
- 5. Seismic loads

#### C. Foundation Design and Capacity.

- 1. Footing depth
- 2. Footing size
- 3. Reinforcing
- 4. Materials

**D.** Connection Compatibility with Manufactured Home. Adequate capacity plus a safety factor is required to transfer forces

from the manufactured house to the foundation without failure.

**D-100.2 CRITERIA FOR FOUNDATION DESIGN** for manufactured homes must meet the following:

**A.** Assumptions made in foundation system design must be compatible with the design of the housing unit and actual site conditions.

**B.** Stress Limitations. The design must sustain all loads within stress limitations of connection systems.

**C.** Acceptable Foundation Design must provide for the Permanent Foundation criteria as specified in Section 100-1.C.

## **D-100.3 DESIGN ASSUMPTIONS**

A. Values Included In Appendix B & C. The foundation tables in Appendices B & C are based on a number of design assumptions:

1. Building width is discussed in terms of minimum chassis beam spacing in Chapter 1: 100-1.A.5 and again in Chapter 6: 600-2.A.1. for comparison of nominal and range of actual width, and then is illustrated in Figure 6-1. It is clear that many actual widths are possible. The following actual widths and projections (dc) were used in the Tables of Appendix B:

Wt	Wt	dc
(nominal)	(actual)	
12'	11'-8"(11.67')	32.25"(2.69')
14'	13'-8"(13.67')	41"(3.42')
16'	15'-6"(15.5')	45.25"(3.77')
	and the second second second second second second second second second second second second second second second	

- The Overturning (Av) and Sliding (Ah) Tables in Appendix B assume hn=8.0 feet and assume a chassis beam depth of 10" (0.833 ft).
- 3. The manufactured home is located on a flat, open site with no protection from the wind.
- 4. Wind force on the manufactured home, instead of seismic force, is the controlling factor for the foundation overturning anchorage design in the transverse direction. Seismic forces or wind force may control sliding anchorage in the transverse or longitudinal direction.
- 5. Uplift, overturning, and sliding caused by wind or seismic forces



Marriage Wall Connection Options

Figure D - 1

acting on the manufactured home are transferred to the foundation by the structural integrity of the manufactured home.

- 6. The manufactured home unit, single or multi-width, is assumed to be a box with flexible floor and roof diaphragms. End walls and selected interior shear walls were assumed to transfer lateral forces based on tributary area methodology. The unit's shear wall locations must closely coincide with the foundation shear walls or vertical X-bracing planes. A structural engineer shall design the system if deviations from these assumptions exist.
- Multi-section units are assumed to be connected at the marriage wall to act as a single box for overturning consideration, and do not act separately as illustrated in Figure D-1. This is particularly necessary in high seismic locations.

**B.** List of Variables. These variables are used throughout Appendix D.

- <u>Aa</u> Seismic coefficient representing effective peak acceleration
- Ah Required horizontal anchorage (lbs. or lbs./LF)
- Av Required vertical anchorage (lbs. or lbs./LF)
- <u>Av</u> Seismic coefficient representing effective peak velocity related acceleration

- Ce Exposure factor (See ASCE 7-93)
- Ct Thermal factor (See ASCE 7-93)
- Cp External wall or roof pressure coefficient (See ASCE 7-93)
- Cs Roof slope factor (See ASCE 7-93)
- <u>Cs</u> Seismic design coefficient (See ASCE 7-93)
- dc Distance from perimeter of structure to chassis beam line.
- DL Total dead load of structure for each foot of length
- **Fr** Force resisting sliding
- **Fsl** Sliding force (lbs.)
- GCpi Internal wall or ceiling pressure coefficient (See ASCE 7-93)
- Gh Gust response factor (See ASCE 7-93)
- hn Height of the exterior wall acted on by lateral wind pressure
- I Importance factor (See ASCE 7-93)
- **Kz** Velocity pressure exposure coefficient (See ASCE 7-93)
- LL Live load
- Mo Overturning moment of structure
- Mr Moment resisting overturning

- **p** Design wind pressure
- Pf Design roof snow load (See ASCE 7-93)
- Pg Ground snow load (See ASCE 7-93)
- **Sp** or Spacing: Spacing of foundation elements in the longitudinal direction.
- V Basic wind speed (See ASCE 7-93)
- Wt Width of structure (or 1/2 the total width of a multi-section unit)

**D-200.** LOAD CONDITIONS IN-CLUDED IN FOUNDATION DESIGN. The following load conditions have been used as assumptions in design of the foundation systems in this handbook. This information is important for engineers who may be designing connection details or modifying foundations designs. All Design Loads are based on ASCE 7-93, except as noted otherwise.

**D-200.1 DEAD LOAD DESIGN FAC-TORS.** Dead loads consist of the material weight of the manufactured home without furnishings or occupants. Dead load includes the weight of the roof, floor, walls, and chassis, and may include permanent attachments such as cabinets and attached appliances.

A. Dead Load Categories. Dead loads were grouped into two categories: heavy and light. The heaviest combinations of dead loads were used for the computation of footing areas, and the determination of inertia forces for the computation of sliding and overturning due to seismic activity. Heavier loads generate the largest inertia forces and produce the largest footings. The lightest combinations of dead loads were used for the computation of horizontal and vertical anchorage due to wind. Lighter loads offer less resistance to overturning and sliding and thus require greater anchorage. The following dead loads in Table D-1 have been included in the calculations for the

Foundation Design Load Tables on the next page.

B. Dead Load Equations for use in computing the required vertical and horizontal anchorage to resist overturning and sliding are listed below by type. The equations are for the total Dead Load per foot of Manufactured Home length. Figure D-2 illustrates the individual component loads and the total dead load situated at the geometric centroid of the unit.

Lightest combination of loads:

SINGLE-SECTION TYPES C, E, & I

 $DL = (34.5)2 + (6 + 8.6)Wt + 9 \times 2$ (walls)+(floor+roof)+(chassis beams) DL = 87 + (14.6)Wt

MULTI-SECTION TYPES C, E, & I

DL = (34.5)2 + (26.25)2 + $2(6 + 8.6)Wt + 9 \times 4$ (ext. walls) + (marriage wall) + (floor + roof) + (chassis beams)

DL = 157.5 + (29.2)Wt

Heaviest combination of loads:

SINGLE-SECTION TYPES C, E, & I

 $DL = (44.25)2 + (13 + 9.7)Wt + 9 \times 2$ (walls) + (floor + roof) +(chassis beams)

DL = 106.5 + (22.7)Wt

MULTI-SECTION TYPES C, E, & I

DL = (44.25)2 + (26.25)2 + $2(13 + 9.7)Wt + 9 \times 4$ (ext. walls) + (marriage wall) + (floor + roof) + (chassis beams)

DL = 177 + (45.4)Wt



Figure D - 2

gat a	DEAL	D LOAD ON FO	JUNDATION		
LOCATION	ITEM	HEAVY	LIGHT	HEAVY	LIGHT
		(psf)	(psf)	(plf of	(plf of length)
				length)	
EXTERIOR	7/16" siding	1.4			
WALL	.019 aluminum		0.1	at a c	
	2 x 4 studs @ 16"o.c.	1.5	1.5	and the Annalysis of the	
	3 1/2" fiberglass insu-	1.0	1.0		
	lation				
	1/2" gypsum	2.0	2.0	an an an an an an an an an an an an an a	
	SUM =	5.9	4.6		
TOTAL	7'-6" WALL			44.25	34.5
FLOOR	carpet & pad	1.0			
	1/16" vinyl	- -	0.7		
	5/8" plywood	1.7	1.7		
	2 x 10 joist @ 16"o.c.	2.6			
	2 x 6 joist @ 16"o.c.		1.4		
	11" fiberglass insula-	2.2	· · · ·		
	tion			:	·
	5 1/2" fiberglass insu-		1.2		
	lation				an an an an an an an an an an an an an a
	mechanical	2.0	1.0		
	misc. partitions	3.5	0.0		· · ·
	SUM =	13.0 *	6.0 *	$13 \times Wt + 9$	$6 \times Wt + 9$
			h manufactured	home beam	
ROOF	asphalt shingles with felt	2.5			
	3/8" plywood	1.1		·	
1 1 1					
	20 ga. steel		2.5		
	20 ga. steel 2 x 3 truss	1.5	2.5 1.5		
	2 x 3 truss	1.5 2.6			· .
			1.5		• •
	2 x 3 truss 9 1/2" fiberglass insu-		1.5		
	2 x 3 truss 9 1/2" fiberglass insu- lation	2.6	1.5 2.6	9.7 × Wt	<b>8.6</b> × Wt
MARRIAGE	2 x 3 truss 9 1/2" fiberglass insu- lation 1/2" gypsum ceiling	2.6 2.0	1.5 2.6 2.0	9.7 × Wt	<b>8.6</b> × Wt
MARRIAGE WALL	2 x 3 truss 9 1/2" fiberglass insu- lation 1/2" gypsum ceiling SUM =	2.6 2.0 <b>9.7</b>	1.5 2.6 2.0 <b>8.6</b>	9.7 × Wt	<b>8.6</b> × Wt
	2 x 3 truss 9 1/2" fiberglass insu- lation 1/2" gypsum ceiling SUM = 2x4 studs @ 16"	2.6 2.0 <b>9.7</b> 1.5	1.5 2.6 2.0 <b>8.6</b> 1.5	9.7 × Wt	<b>8.6</b> × Wt
	2 x 3 truss 9 1/2" fiberglass insu- lation 1/2" gypsum ceiling SUM = 2x4 studs @ 16" 1/2" gypsum (one	2.6 2.0 <b>9.7</b> 1.5	1.5 2.6 2.0 <b>8.6</b> 1.5	9.7 × Wt	<b>8.6</b> × Wt

# TABLE D-1 DEAD LOAD ON FOUNDATION

### D-200.2 LIVE LOAD DESIGN FACTORS

A. Description. Design live loads consist of the weight of all moving and variable loads (from use and occupancy) that may act on the manufactured home including loads on floors, operational loads on roofs and ceilings, or snow loads, but do not include wind, earthquake or dead loads. All live loads are assumed to be uniformly distributed and roof live loads are horizontally projected on sloped surfaces. The design live loads specified herein for the floor and attic are the minimums recommended by the ASCE standard. The design live loads specified herein for the roof are the minimum recommended by the Minimum Property Standard, HUD Handbook 4910.1, 1994 Edition. The roof live load used for the design of the foundation system should be the greater of the appropriate value indicated in the Data Plate shown here or as obtained from the ASCE 7-93 for snow load.

**B.** Design Assumptions. The following values for live loads were used in the engineering calculations and are included in the tables. They are provided here as background information only. The field inspector will not need to calculate live loads under normal circumstances. See box of live loads.

## D-200.3 SNOW LOAD DESIGN FAC-TORS



Minimum Uniformly Distributed							
Live Loads							
(used for Foundation Design Load Tables)							
Location	Live Load						
	(psf)						
Roof (slope $3/12$ or less, $\leq 14^{\circ}$ )	20*						
Roof (slope over $3/12$ , >14°)	15*						
(Over the entire width of the unit.							
Compare with snow load value.							
Use the larger value.)							
Dwelling rooms	40						
(Floor design live loads over the							
entire area of the unit.)							
Attics	10						
(uninhabitable, without storage)							
	<b>C</b> 1						
* Due to snow load factors, the 30 p	-						
snow load used on the Foundation I							
Tables is equivalent to a 20 psf root							
The 20 psf ground snow load is equ	ivalent to a						
15 psf roof live load.							

A. Ground Snow Load. The ground snow load values (Pg) to be used in the design of the manufactured home are found in Appendix H. The ground snow load is converted to a roof snow load to account for wind and thermal factors (see Figure D-3). The value (Pg) modified by snow load design factors has been included in the derived values for the Foundation Design Load Tables. The following assumptions were made to find Pf, the horizontally projected uniformly distributed design roof snow load:

#### **B.** Design Assumptions.

Basic Snow Load Equation:  $Pf = 0.7 \times Ce \times Ct \times I \times Pg$ 

Where:

- 5. Slope factor Cs = 1.0 (4/12 slope or)
- 6. Flat roof factor = 0.7 (contiguous U.S.; Use 0.6 in Alaska.)

1. Ground snow load (Pg) from the

H-11, H-12 and H-13.

(residential buildings)

2. Importance

structures)

less)

Ground Snow Load maps on pages

factor

3. Exposure factor Ce = 1.0 (locations)

4. Thermal factor Ct = 1.0 (heated

lied on to reduce snow loads)

where snow removal cannot be re-

Ι

1.0

Therefore, the Required Effective Footing Area Tables are based on:

 $Pf = 0.7 \times Pg$  (Roof snow load)

**C.** Drifted Snow. At locations where the manufactured home is adjacent to a higher structure, drifted snow loads MUST be calculated in accordance with ASCE 7-93. An average value including the drifted load may be used with the Foundation Design Load Tables.

# D-200.4 WIND LOAD DESIGN FAC-TORS.

A. Model for Analysis. The methodology for resistance of the box to uplift, overturning and sliding utilizes equations for Main Wind-Force Resisting Systems as defined in ASCE 7-93.

**B.** Basic Wind Speed. The basic wind speed map is found on page H-14. Wind factors have been included in the derived values

for the Foundation Design Load Tables of Appendix B.

- C. Design Assumptions.
  - 1. To convert mile per hour (MPH) wind speed to a basic wind velocity pressure (q) in pounds per square feet (psf) use the following equation from ASCE 7-93:

 $q = 0.00256 \times Kz \times (V \times I)^{2}$ 

where:

- a. Mean roof height is assumed to be less than or equal to 15 feet from grade.
- b. Basic Wind Speed (V) is from the isobar map on page H-14 for the unit's geographic location.
- c. Velocity Pressure Coefficient (Kz) is based on Exposure C: open terrain with scattered obstructions having heights generally less than 30 feet. This Category includes flat open country and grasslands. For these conditions, including item (a) above, Kz = 0.8.
- d. Importance Category I (residential) for inland sites, sets I = 1.0, while for coastal sites (hurricane oceanline) I = 1.05. Linear interpolation can be utilized for sites between the oceanline and 100 miles inland; however, this was not done for the tables of Appendix B. Thus, only the above two values have been included.

 Velocity pressure (q) is applied to surfaces, i.e. walls and roof planes, to generate design wind pressures (p) for Main Wind-Force Resisting Systems. Design wind pressures (p) are based on external and internal effects utilizing the following equation from ASCE 7-93:

$$p = q \times Gh \times Cp - q \times (\pm GCpi)$$
  
(external) - (internal)

where:

a. The Gust Response Factor (Gh) is assumed to be based on Expo-

sure C (see section D-200.4.C.1.c). The Minimum Property Standard (MPS) permits use of Exposure C regardless of whether the site is inland or coastal. Thus, for units of assumed mean height less than or equal to 15 feet, Gh = 1.32.

b. External Roof and Wall Pressure Coefficients (Cp) vary on the windward roof surface based on the structural issue being analyzed. Figure D-4 illustrates the various (Cp) values for the transverse and longitudinal di-



Figure D - 4

rections. A roof slope of 10 to 15 degrees ( 2 in 12 to 3 in 12) produces 2 possible situations: (+0.2) pressure and (-0.9) suction. The value (-0.9) was selected to produce maximum suction for uplift and overturning while (+0.2) was selected to maximize sliding. Note that (+) means pressure on the external surface, while (-) means suction on the external surface. For the leeward wall in the longitudinal direction the proportions of the unit (L/Wt) are important to establishing the proper exterior (Cp) value. Single-section units,

regardless of the combination of width or length, has a ratio L/Wt  $\geq 4.0$ ; therefore, Cp = -0.2. For multi-section units An average proportion of unit (28' x 70', or 32' x 80') was assumed. Thus, the L/Wt ratio was 2.5 and by interpolation Cp = -0.275. Single or multi-section units have a Wt/L ratio, which is  $\leq 1.0$  for all proportions of units. Thus, the leeward value for Cp = -0.5 in the transverse direction.

c. Internal Roof and Wall Pressure Coefficients assume a uniform distribution of openings on all



surfaces, thus GCpi =  $\pm 0.25$ . Figure D-5 illustrates the pressures and suctions used for various structural considerations. Note that the walls receive offsetting values that cancel any internal effect; therefore, only the roof (GCpi) values are utilized for the calculation of overturning and sliding in the transverse direction. Internal roof Pressures are not utilized in the longitudinal direction.

d. Wind pressures and suctions are typically treated as uniformly



- Roof Plane Wind Components Transverse Direction
  - Figure D 6

distributed and typically applied perpendicular to the orientation of any planar surface. This usually requires the calculation of horizontal and vertical components when wind is applied to sloping surfaces, in this case only roof planes. Figure D-6 illustrates that by the use of trigonometry the resultant force (P) on any sloping surface has components  $(P_V)$  and  $(P_H)$ , which can be arrived at as shown. Note that for the vertical components (Pv) it is possible to merely multiply the pressure (p) by the horizontal length of the slope (Wt/2) for single section units or by (Wt) for multi-section units. This approach simplifies the sample calculations provided in section D-300 for uplift, overturning and sliding in the transverse direction.

#### D-200.5 SEISMIC LOAD FACTORS.

A. Seismic Versus Wind Forces. It has been stated in Chapters 4 and 6 that seismic forces did not control over wind forces in the computations for consideration of overturning in the transverse direction; however, seismic forces did sometimes control over wind for certain situations of sliding in the transverse and longitudinal direction. This is particularly true in the longitudinal direction because only the end wall elevations are exposed to the wind, producing small applied horizontal forces. Seismic inertia forces are a function of mass that is the same in both directions, which may be larger than the wind forces in particular when the geographic region is also a high snow region.

and the second second

**B.** Dead Loads. The model assumes use of the "heavy" dead load values for roof, floor and wall components from Table D-1. It is assumed that the weight of the exterior walls and the weight of the marriage wall (for multisection units only) are distributed half to the roof plane and half to the floor plane. The







marriage wall was assumed continuous, without any large openings to maximize the dead load. This distribution of the dead load is illustrated in Figure D-7 to arrive at inertia forces (Fxr) and (Fxf). The weight of the end walls was included in the total mass of the unit and distributed to the roof and floor as shown in Figure D-7 and defined by the equations below:

1. Areas at each end of a Single-Section unit:

$$A_{r} = \frac{Wt \times a}{2} + \frac{hn}{2} \times Wt$$
$$A_{f} = Wt \times \frac{hn}{2}$$

2. Areas at each end of a Multi-Section unit:

$$A_{r} = Wt \times a + 2 \times Wt \times \frac{hn}{2}$$

$$A_f = 2 \times Wt \times \frac{nn}{2}$$

3. These areas are multiplied by the heavy wall weight of 5.9 psf resulting in total roof and floor load additions respectively for Single or Multi-Section units as follows:

 $W_{endroof} = 2 \times 5.9 \times A_r$  $W_{endfloor} = 2 \times 5.9 \times A_f$ 

The above loads are in pounds and are smeared into the unit's dead load for overturning by using an average length of 60 feet, while for sliding they are smeared into the unit's dead load by dividing by "L". See Section D-200.5.E.7.a for further clarification. **C.** Snow Loads. When the flat roof snow load (Pf) is less than 30 psf, the snow load to be attributed to the mass at the roof plane shall be zero. Where siting and snow duration and conditions warrant, and roof snow load is equal to or exceeds 30 psf, the snow load shall be added to the mass of the roof plane. The local authority may permit a reduction in snow load by as much as 80%. See Figure D-7. Note that roof snow load (Pf) has been previously defined as 70% of the ground snow load (Pg) in section D-200.3B.

**D.** Miscellaneous Loads. No consideration of partial occupancy live load was included in the mass of the floor plane; however, mechanical and partition load was included in the floor plane.

**E. Seismic Analysis Method.** The Equivalent Lateral Force Procedure (ELF) was assumed for manufactured housing units, as defined by ASCE 7-93. No plan or elevation irregularities were assumed, Thus, the manufactured home superstructure was assumed to be a simple rectangular box with proportions of length to width not exceeding 5 to 1.

1. The Fundamental Period (T): the manufactured home is assumed to have the same period in either direction, transverse or longitudinal, determined from the following equation:

$$T = Ct \ge h^{3/4}$$

where:

a. Ct = 0.02 for the category of: all other buildings.

- b. the height from bottom of footing to the mean roof height (h) has been assumed as 13.5 feet.
- c. Thus: T = 0.14 seconds.
- 2. Site Coefficient (S): the site has been selected for the most significant soil classification, thus S = 2.0.
- The Response Modification Coefficient (R): the structure has been selected as a bearing wall system with light frame walls with shear panels. Thus, R = 6.5.
- Effective peak velocity-related acceleration coefficient (Av): is selected for the geographic location based on the map H-16 in Appendix H.
- 5. The Seismic Design Coefficient (Cs) is determined by the following equation:

$$\underline{Cs} = \frac{1.2 \times \underline{Av} \times S}{R \times T^{2/3}}$$

Insertion of all the above values in the equation for (Cs) leads to the results tabulated below:

Av	de tre	<u>C</u> s	
0.15		0.204	
0.2		0.273	
0.3		0.409	
0.4		0.546	

6. But (<u>C</u>s) need not exceed the following equation:

$$\underline{Cs} = \frac{2.5 \times \underline{Aa}}{R}$$

where:

 a. Effective peak acceleration coefficient (<u>A</u>a): selected for the geographic location based on map H-15 in Appendix H.

b. The results are tabulated below:

Aa	<u>Cs</u>
0.15	0.058
0.2	0.077
0.3	0.115
0.4	0.154

c. The values for (<u>Cs</u>) are definitely smaller in item (6.b) above rather than in item (5.a), thus <u>Cs</u> is based on the equation in item (6). Thus, for this Manual assuming <u>Aa</u> = <u>Av</u>:

$$\underline{Cs} = \frac{2.5 \times \underline{Aa}}{R}$$

7. The basic equation for base shear  $(V_B)$ , using the (ELF) method, is:

$$V_B = \underline{Cs} \times W$$

where:

a. The total weight (W) is the summation of the roof plane mass and the floor plane mass, including snow as applicable, as a function of unit length. It is advantageous to keep the roof and floor loads separated for calculation ease and kept in units of lbs/ft of unit length as follows:

For a Single-Section Unit:  

$$w_{roof} = 9.7 \times Wt + 44.25 + \frac{W_{endroof}}{L} + \%P_{f} \times Wt$$

$$w_{floor} = 13.0 \times Wt + 44.25 + 18 + \frac{W_{endfloor}}{L}$$
For a Multi-Section Unit:  

$$w_{roof} = 19.4 \times Wt + 44.25 + 26.25 + \frac{W_{endroof}}{L} + 2 \times \%P_{f} \times Wt$$

$$w_{floor} = 26.0 \times Wt + 36 + 44.25 + 26.25 + \frac{W_{endfloor}}{L}$$

Note: For overturning calculations, where (L) does not enter the equations, use L=60 ft as an average length to smear the end wall load. For Sliding (L) is always required and the end wall weight is smearing over the real length (L).

Where for either the Single or Multi-Section unit, the total dead load per foot of length of the unit becomes:

 $W = W_{roof} + W_{floor}$ 

- b. The seismic coefficient (Cs) is based on equation in item (6.b).
- 8. The base shear  $(V_B)$  is then distributed vertically as inertia forces  $(F_{xr}$ and  $F_{xf}$ ) to the floor and roof levels according to the mass that exists at each level (see Figure D-7), based on the following generic equation:

$$F_x = C_{vx} \times V_B$$

where also generically:

$$C_{vx} = \frac{w_x \times h_x}{\sum_{i=1}^{n} (w_i \times h_i)}$$

a. The weight and height at each respective level is subscripted with an (x) while the sum of the product of each level's weight and height are generically subscripted with an (I). The uppermost level of the building (n) is in this case the roof. For a one story manufactured home, there will only be two levels,  $w_{roof}$  and  $w_{floor}$  reducing to two expressions substituting Single or Multi-Section unit values as follows:

$$C_{\text{roof}} = \frac{w_{\text{roof}} \times h_{\text{r}}}{w_{\text{roof}} \times h_{\text{r}} + w_{\text{floor}} \times h_{\text{f}}}$$
$$C_{\text{floor}} = \frac{w_{\text{floor}} \times h_{\text{f}}}{w_{\text{roof}} \times h_{\text{r}} + w_{\text{floor}} \times h_{\text{f}}}$$

Thus, the inertia forces in lbs/ft of unit length at the two respective levels becomes:

$$F_{xr} = C_{roof} \times V_B$$
 and,  
 $F_{rf} = C_{floor} \times V_B$ 

b. Sample spreadsheet intput for two cases (snow Pg = 0 psf and snow Pg = 100 psf) indicates the range of ( $F_{xr}$ ) and ( $F_{xf}$ ) values at the roof and floor levels respectively for a single section unit. These examples include the 12, 14 and 16 nominal width units and are labeled as Tables D-2 and D-3. Note: nominal, rather than actual unit width (Wt) were used in the dead load calculations for conservatism.

9. The forces  $(F_{xr} \text{ and } F_{xf})$  were applied to the manufactured home unit as illustrated in Figure D-7 and used for transverse and longitudinal overturning and sliding calculations for comparison to the wind forces. The forces that produced the largest required resistance values were used in the Foundation Design Load Tables - Appendix B. Values that are grayed in the Tables of Appendix B are controlled by seismic inertia forces.

# D-300. SAMPLE EQUATIONS USED FOR FOUNDATION DESIGN LOAD TABLE VALUES.

D-300.1 REQUIRED **EFFECTIVE** FOOTING AREA. Refer to Figures D-8(A&B) and D-9(A&B) for the free-body diagrams illustrating the applied gravity loads on the superstructure and on the foundation for a Type C and Type E or I single-section unit, and a Type C multi-section unit with consideration of a continuous marriage wall and a marriage wall with a large opening. Note that the "heavy" dead loads are used from Table D-1. For allowable stress design methodology, the load combination from ASCE 7-93 is: DL(heavy) + LL(occupancy) + LL(attic) + SL(or min. roof LL).



Figure D -8A

# <u>Seismic</u>

Smax= 2			R=	6.5		hn≃	11.0 ft	
Exposure Group	5 I		Ct=	0.02		19 19 19 19 19 19 19 19 19 19 19 19 19 1		
Seismic Perform		)	Assume no	plan or elevat	tion irregularitie	S		
Equivalent Later	ral Force Pro				an <b>X</b> aaa		14 A.	
Period: Ta:	=Ct(hn)^3/4=	=	0.120802			e i se e e s	ан сайтаан ал ал ал ал ал ал ал ал ал ал ал ал ал	
Tm	ax=Ta*Ca		Ca=	1.5	(1.5 max for Av	/=.15)		
	н. 1. н. н. н.		Tmax=	0.181203	•			
Cs max=2.5*Aa	/R	Aa	Cs max				•	
		0.15	0.057692	<u>,</u>				
te de la companya de la companya de la companya de la companya de la companya de la companya de la companya de La companya de la comp		0.20	0.076923					
Verse Alternet	· · · .	0.30	0.115385	1				
		0.40	0.153846		an the second all second		\$ 	
Snow Load: Pg=	ŧ.	0	psf	Pf=	0 ps	sf -		
		Wt			and the second sec	- 1 - 1		
DL	12.0	14.0	16.0			1. 1. T. D.		
roof	160.65	180.05	199.45					
floor	218.25	244.25	270.25			al de la composition. Composition de la composition de la comp		
total	378.90	424.30	469.70	i le di di e				
						:		
Width 12 ft			· .	Vbase=	21.86	29.15	43.72	58.29
						Fx=Cvx*V		'n
						Aa		
. <u></u>	W	h	w*h	Cvx	0.15	0.2	0.3	0.4
roof	160.65	11.0	1767.15		15.95	21.27	31.90	42.53
floor	218.25	3.0	654.75	0.270346	5.91	7.88	11.82	15.76
sum	378.90		2421.90	1.0	21.86	29.15	43.72	58.29
					and the second second	· · ·		
Width 14 ft				Vbase=	24.48	32.64	48.96	65.28
						Fx=Cvx*V	base	
				_		Aa		
	w	h	w*h	Cvx	0.15	0.2	0.3	0.4
roof	180.05	11.0	1980.55	0.729941	17.87	0.2 23.82	35.74	47.65
floor	180.05 244.25		1980.55 732.75	0.729941 0.270059	17.87 6.61	0.2 23.82 8.81	35.74 13.22	47.65 17.63
	180.05	11.0	1980.55	0.729941	17.87	0.2 23.82	35.74	47.65
floor sum	180.05 244.25	11.0	1980.55 732.75	0.729941 0.270059 1.0	17.87 6.61 24.48	0.2 23.82 8.81 32.64	35.74 13.22 48.96	47.65 17.63 65.28
floor	180.05 244.25	11.0	1980.55 732.75	0.729941 0.270059	17.87 6.61	0.2 23.82 8.81 32.64 36.13	35.74 13.22 48.96 54.20	47.65 17.63
floor sum	180.05 244.25	11.0	1980.55 732.75	0.729941 0.270059 1.0	17.87 6.61 24.48	0.2 23.82 8.81 32.64 36.13 Fx=Cvx*V	35.74 13.22 48.96 54.20	47.65 17.63 65.28
floor sum	180.05 244.25 424.30	11.0 3.0	1980.55 732.75 2713.30	0.729941 0.270059 1.0 Vbase=	17.87 6.61 24.48 27.10	0.2 23.82 8.81 32.64 36.13 Fx=Cvx*V Aa	35.74 13.22 48.96 54.20 base	47.65 17.63 65.28 72.26
floor sum Width 16 ft	180.05 244.25 424.30 w	11.0 3.0 h	1980.55 732.75 2713.30 w*h	0.729941 0.270059 1.0 Vbase= Cvx	17.87 6.61 24.48 27.10 0.15	0.2 23.82 8.81 32.64 36.13 Fx=Cvx*V Aa 0.2	35.74 13.22 48.96 54.20 base 0.3	47.65 17.63 65.28 72.26 0.4
floor sum Width 16 ft roof	180.05 244.25 424.30 w 199.45	11.0 3.0 h 11.0	1980.55 732.75 2713.30 w*h 2193.95	0.729941 0.270059 1.0 Vbase= Cvx 0.730173	17.87 6.61 24.48 27.10 0.15 19.79	0.2 23.82 8.81 32.64 36.13 Fx=Cvx*V Aa 0.2 26.38	35.74 13.22 48.96 54.20 base 0.3 39.57	47.65 17.63 65.28 72.26 0.4 52.76
floor sum Width 16 ft	180.05 244.25 424.30 w	11.0 3.0 h	1980.55 732.75 2713.30 w*h	0.729941 0.270059 1.0 Vbase= Cvx 0.730173 0.269827	17.87 6.61 24.48 27.10 0.15	0.2 23.82 8.81 32.64 36.13 Fx=Cvx*V Aa 0.2	35.74 13.22 48.96 54.20 base 0.3	47.65 17.63 65.28 72.26 0.4

Seismic Forces - Ground Snow < 30 psf

Table D - 2

D - 16

# <u>Seismic</u>

Smax=	2		R=	6.5	.'	hn=	11.0 f	ŀ
Exposure Gro	-		Ct=	0.02			11.01	L
•	ormance A to I	)			tion irregulariti	es		
	ateral Force Pr					•••		
•	Ta=Ct(hn)^3/4:		0.120802					
	Tmax=Ta*Ca		Ca=	1.5	(1.5 max for A	v=.15)		
			Tmax=	0.181203	(			
Cs max=2.5*,	Aa/R	Aa	Cs max			1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	2	
	—	0.15	0.057692					
	, to the second	0.20	0.076923					
	$(A_{ij}) = \sum_{i=1}^{n} (A_{ij}) = A_{ij}$	0.30	0.115385		· .	· · ·		
	يين آني. از مين الانتراك	0.40	0.153846		1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -			
Snow Load: F	°g=	100	psf	Pf=	70 p	sf		
···		Wt					н — — — — — — — — — — — — — — — — — — —	
DL	12.0	14.0	16.0					
roof	1000.65	1160.05	1319.45					
floor	218.25	244.25	270.25					
total	1218.90	1404.30	1589.70		$(1,1) \in [1,1]$	an annaí su		
	•						a ser a se	
Width 12 ft	$\mathcal{L}^{1} = \mathcal{L}$			Vbase=	70.32	93.76	140.64	187.52
					Fx=Cvx*Vbase			
e vi i e lite	1. m	: · · · ·		_		Aa		
	w	h	w*h	Cvx	0.15	0.2	0.3	0.4
roof	1000.65	11.0	11007.15	0.943856	66.37	88.50	132.75	176.99
floor	218.25	3.0	654.75	0.056144	3.95	5.26	7.90	10.53
sum	1218.90		11661.90	1.0	70.32	93.76	140.64	187.52
							-	
Width 14 ft		1997 - 1997 - 1997 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -		Vbase=	81.02	108.02	162.03	216.05
	te te la	$(i_1,\ldots,i_{n-1})$				Fx=Cvx*\	/base	
	e ta stati		-1			Aa		
	W	h	w*h	Cvx	0.15	0.2	0.3	0.4
roof	1160.05	11.0	12760.55	0.945695	76.62	102.16	153.24	204.31
floor	244.25	3.0		0.054305	4.40	5.87	8.80	11.73
sum	1404.30		13493.30	1.0	81.02	108.02	162.03	216.05
What is a		anta anta an Anta anta		10		100.00		·. · · ·
Width 16 ft				Vbase=	91.71	122.28	183.43	244.57
						Fx=Cvx*\		·: .
		h		<b>^</b>	0.45	Aa		
	W		w*h	Cvx	0.15	0.2	0.3	0.4
roof	1319.45	11.0	14513.95	0.947095	86.86	115.82	173.72	231.63
floor	270.25	3.0	810.75	0.052905	4.85	6.47	9.70	12.94
sum			15324.70	1.0	91.71	122.28	183.43	244.57

Seismic Forces - Ground Snow 100 psf

Table D - 3

# A. Gravity Load Considerations for the Type C Single-Section Unit.

- 1. *General*: The foundation to support the superstructure gravity loads is provided only by the spaced piers under the chassis beams.
- 2. Superstructure load to a pier: As shown in Figure D-8A the snow load, the attic live load and the roof dead load are transferred equally to each exterior wall. The exterior walls in turn transfer the roof loads to the floor framing. The floor live and dead load combine with the roof and wall load to reach the chassis beam, where the foundation piers receive the total concentrated superstructure load (Rp) in proportion to the pier spacing.

$$Rp = \left[ \left( Pf + (40+10) \right) \times \frac{Wt}{2} + \frac{DL}{2} \right] \times \text{spacing}$$

3. Typical chassis beam pier foundation weight: The typical pier assumed for the calculations is based on a pier composed of four 8"x8"x16" concrete masonry units grouted solid with a 2 foot square footing that is 8 inches deep. Thus the assumed pier weight is as follows:

pier:  $2.67' \times 1.33' \times 84 \text{ psf} = 298.0 \text{ lbs.}$ footing:  $150 \text{ pcf} \times 2' \times 2' \times .67' = \underline{402.0} \text{ lbs.}$ total = 700.0 lbs.

4. Required chassis beam Pier Footing size: The footing area (Aftg) must be large enough so that the net allowable soil bearing pressure (Pso) is not exceeded under the full gravity dead, live and snow loads. Note that the pier and footing weight become additional dead load.

$$Aftg = \frac{Rp + 700}{Pso}$$

**B.** Gravity Load Considerations for the Type E and I Single-Section Unit.

- 1. General: Support of the superstructure gravity loads is shared by the exterior longitudinal walls and the spaced interior piers under the chassis beams, which together comprise the foundation.
- 2. Superstructure load to the exterior longitudinal foundation walls: As shown in Figure D-8B, the snow load, the attic live load and the heavy roof dead load are transferred equally to each exterior wall. The exterior wall weight is added, and both loads transfer directly to the exterior foundation walls. A portion (dc/2) of the floor live and heavy dead load also goes to the exterior foundation walls. The total superstructure gravity load (Rw) transferred to the exterior foundation wall is in units of lbs./ft. of home length. The equation is as follows:

$$Rw = [Pf + (9.7 + 10)] \times \frac{Wt}{2} + (40 + 13) \times \frac{dc}{2} + 44.25$$

[snow + (roof DL+attic LL)] (floor LL+DL) + (wall DL) 3. Superstructure load to an interior pier: The remainder of the floor dead and live load is equally divided between the chassis beam lines, and concentrated at the foundation piers based on their spacing. The total superstructure concentrated gravity load to a pier (Rp) is as follows:

$$Rp = \left[ (40+13) \times \frac{Wt - dc}{2} + 9 \right] \times spacing$$

(floor DL+LL) (chassis beam DL)

4. Typical exterior longitudinal foundation wall weight: The typical exterior longitudinal foundation wall is assumed to be composed of a 6" poured concrete wall, 3'-8" high, and a 6" x 24" continuous concrete footing. Thus, the assumed weight is as follows:

wall: 150 pcf  $\times$  3.67'  $\times$  0.5' = 275.0 plf footing: 150 pcf  $\times$  2'  $\times$  0.5' = <u>150.0</u> plf total = 425.0 plf

5. Required Exterior Wall Footing Width: The footing width (Wf) must be large enough so that the net allowable soil bearing pressure (Pso) is not exceeded under the full gravity dead, live and snow loads. Note that the longitudinal foundation wall and footing weight become additional dead load. The required footing width:

$$Wf = \frac{Rw + 425}{Pso}$$

6. Required Interior Pier Footing Area: The footing area (Aftg) must





Gravity Loads



be large enough so that the allowable soil bearing pressure (Pso) is not exceeded under the full gravity dead and live loads. Note that the pier and footing weight become additional dead load. The required footing area:

$$Aftg = \frac{Rp + 700}{Pso}$$

C. Gravity Load Considerations for the Type C Multi-Section Unit with a Continuous Superstructure Marriage wall.

- 1. *General*: The foundation to support the superstructure gravity loads is provided only by spaced piers under the chassis beams and under the continuous marriage wall.
- 2. Superstructure continuous marriage wall load to a pier: As shown in Figure D-9A the snow load, the attic

live load and the roof dead load are transferred between the marriage wall and the exterior walls as bearing walls. The marriage wall in turn transfer the roof loads to the floor framing. A small portion of the floor live and dead load is assumed to combine with the roof loads and marriage wall weight to reach the top of the foundation pier as the total concentrated superstructure load (Rpm) in proportion to the pier spacing.

$$Rpm = \begin{bmatrix} 52.5 + (Pf + 19.7) \times Wt + \\ (40 + 13) \times dc \end{bmatrix} \times spacing$$

- [marr.wall+(snow+roofDL+attic LL)] (floor DL+LL)
- 3. Superstructure load to an exterior chassis beam pier: As shown in Figure D-9A the snow load, the attic



Type C - Multi-Section Unit w/Continuous Marriage Wall

Figure D - 9A

live load and the roof dead load are transferred equally between the exterior wall and the marriage wall. The exterior wall in turn transfers the roof loads to the floor framing. The floor live and dead load combine with the roof and wall weight to reach the chassis beam, where the foundation piers receive the total concentrated superstructure load (Rpe) in proportion to the pier spacing.

$$Rpe = \begin{bmatrix} (Pf + 19.7 + 40 + 13) \times Wt / 2 + \\ (44.25 + 9) \end{bmatrix} \times spacing$$

[snow+roofDL+atticLL+floorDL+LL] (ext.wall DL+chassis bm.)

4. Superstructure load to an interior chassis beam pier: As shown in Figure D-9A The floor live and dead load comprise the only load to reach the interior chassis beam, where the foundation piers receive the total concentrated superstructure load (Rpi) in proportion to the pier spacing.

$$Rpi = \left[ (40+13) \times \left( \frac{Wt - dc}{2} \right) + 9 \right] \times spacing$$

[(floorLL+DL)+chassis bm.]

5. Typical Continuous Marriage Wall Pier: The typical continuous marriage wall within the superstructure of the multi-section unit is assumed to have a foundation pier composed of five courses of 8"x8"x16" concrete block (ungrouted), and a concrete footing 2'x2' by 8" deep. The dead load of a typical continuous marriage wall foundation pier is as follows:

pier:  $42 \text{ psf} \times 3.33' \times 1.33' = 186.0 \text{ lbs.}$ footing:  $150 \text{ pcf} \times 2^2 \times .67' = 402.0 \text{ lbs.}$ total = 588.0 lbs.

6. Required continuous marriage wall pier footing. The footing area (Aftg) must be large enough so that the net allowable soil bearing pressure (Pso) is not exceeded under the full gravity dead, live and snow loads. Note that the pier and footing weight become additional dead load. The required footing area:

$$Aftg_{mar} = \frac{Rpm + 588}{Pso}$$

7. Required exterior chassis beam Pier Footing Area: The footing area (Aftg) must be large enough so that the allowable soil bearing pressure (Pso) is not exceeded under the full gravity dead and live loads. Note that the pier and footing weight become additional dead load. The required footing area:

$$Aftg_{ext} = \frac{Rpe + 700}{Pso}$$

8. Required interior chassis beam Pier Footing Area: The footing area (Aftg) must be large enough so that the allowable soil bearing pressure (Pso) is not exceeded under the full gravity dead and live loads. Note that the pier and footing weight become additional dead load. The required footing area:

$$Aftg_{int} = \frac{Rpi + 700}{Pso}$$

D. Gravity Load Considerations for the Type C Multi-Section Unit with a Superstructure Marriage wall containing one opening or two large adjacent openings.

- 1. General: The foundation to support the superstructure gravity loads, as illustrated in Figure D-9B, is provided only by spaced piers under the chassis beams, piers placed under the posts at the ends of marriage wall openings, and equally spaced piers under the continuous portions of the marriage wall.
- Marriage wall openings: limitations and assumptions. Two marriage wall opening situations were reviewed: (1) a single opening, as il-

lustrated in Figure D-9C, is bounded by posts at the ends of the opening with continuous marriage walls extending beyond the opening width in both directions, and (2) **two adjacent marriage wall openings**, as illustrated in Figure D-9D, consisting of three posts with the outer two posts having continuous marriage walls extending beyond the two openings.

**Note:** A maximum 10 foot pier spacing was assumed under all continuous marriage wall portions.

Note: The center post between the two adjacent openings of the later scheme produces the largest concentrated load to a marriage wall pier. This is the condition used for



centrated load to a marriage wall pier. This is the condition used for the equations that follow.

Note: It is conservatively assumed that the footing size required under the center post will be used under all three posts in the Appendix B Part 1 Tables for Multi-section units.

Note: The opening width used for two adjacent openings in the Appendix B Tables, is the average of the two opening widths:  $(x+x_1) \div 2$ . The marriage wall opening tables use 2 foot increments for single openings, or the average of two adjacent openings, from 10 feet to 20 feet.

3. Superstructure: Two large adjacent marriage wall openings: load to the pier under center post: As shown in Figure D-9D the snow load, the attic





Figure D - 9C

live load and the roof dead load are transferred between the marriage wall ridge beam and the exterior walls as bearing points. The marriage wall ridge beam (assumed to act as two simple span beams) transfers the average of the two opening widths of the roof and attic loads to the center post. The floor live and dead load is assumed to be carried by floor beams, and also is transferred based on the average width of the two openings.

Note: For a single opening  $x_1=0$  and all the formulas still work.









Figure D - 9D

The floor beam is assumed to weigh 10 plf and the ridge beam is assumed to be composed of 6 layers of 3/8" plywood at a depth of 3 feet. Thus, the ridge beam weighs 19.8 plf. The post is assumed to be a 4x4of weight 32 lbs. The total concentrated superstructure load to the pier (Rmax):

$$Rpm = \begin{bmatrix} (Pf + 19.7) \times Wt + \\ (40 + 13) \times dc + 10 + 19.8 \end{bmatrix} \times \left(\frac{x + x_1}{2}\right) + 32$$

[( snow+roofDL+attic LL)] (floor DL+LL)+floor bm+Ridge bm) +post DL

4. Superstructure load to an exterior chassis beam pier: the superstructure load to an exterior pier is unchanged from that for a Type C multi-section unit with a continuous marriage wall. Thus, the total concentrated superstructure load (Rpe) is repeated here:

Rpe =  $\begin{bmatrix} (Pf + 19.7 + 40 + 13) \times Wt / 2 + \\ (44.25 + 9) \end{bmatrix} \times \text{spacing}$ 

D-25

[snow+roofDL+atticLL+floorDL+LL] (ext.wall DL+chassis bm.)

5. Superstructure load to an interior chassis beam pier: the superstructure load to an interior pier is unchanged from that for a Type C multi-section unit with a continuous marriage wall. Thus, the total concentrated superstructure load (Rpi) is repeated here:

$$Rpi = \left[ (40+13) \times \left( \frac{Wt - dc}{2} \right) + 9 \right] \times spacing$$

### [(floorLL+DL)+chassis bm.]

6. Required pier footing area for marriage wall containing large openings. The footing area (Aftg) must be large enough so that the net allowable soil bearing pressure (Pso) is not exceeded under the full gravity dead, live and snow loads. Note that the pier and footing weight become additional dead load. The required footing area;

$$Aftg_{max} = \frac{Rpm + 588}{Pso}$$

7. Required pier footing areas for exterior and interior chassis beam lines. See items 7 and 8 for a Type C Multi-section unit with a continuous marriage wall. Equations are the same and are repeated here for ease of use:

$$Aftg_{ext} = \frac{Rpe + 700}{Pso}$$
$$Aftg_{int} = \frac{Rpi + 700}{Pso}$$

# E. Gravity Load Considerations for the Type E and Type I Multi-Section Unit with a Continuous Superstructure Marriage Wall.

1. General: As illustrated in Figure D-9E, the foundation to support the superstructure gravity loads is provided by spaced piers under the chassis beams, along the exterior wall and by spaced piers under the continuous marriage wall.

Note: Foundation Concepts E5 and E7 do not follow the equation development presented here and are treated

separately, later in Section D.300.1.

2. Superstructure continuous marriage wall load to a pier: Identical to that shown in Figure D-9A for the Type C multi-section unit: the snow load, the attic live load and the roof dead load are transferred between the marriage wall and the exterior walls as bearing walls. As shown in Figure D-9E the marriage wall in turn transfers the roof loads to the floor framing. A small portion of the floor live and dead load is assumed to combine with the roof loads and marriage wall weight to reach the top of the foundation pier as the total concentrated superstructure load (Rpm) in proportion to the pier spacing.

$$Rpm = \begin{bmatrix} 52.5 + (Pf + 19.7) \times Wt + \\ (40 + 13) \times dc \end{bmatrix} \times spacing$$

[marr.wall+(snow+roofDL+attic LL)] (floor DL+LL)

3. Superstructure load to an exterior and interior chassis beam pier: As shown in Figure D-9E there are no gravity roof loads or exterior wall load transferred to the piers under the chassis beams. The floor live and dead load comprise the only load to reach the exterior and interior chassis beam, where the exterior and interior foundation piers receive the total concentrated superstructure load (Rpe and Rpi) equally in proportion to the pier spacing.



Figure D - 9E

$$Rpe = Rpi = \begin{bmatrix} (40+13) \times \\ \left(\frac{Wt - 2dc}{2} + \frac{dc}{2}\right) + 9 \end{bmatrix} \times spacing$$

(floorDL+LL) (chassis bm.)

4. Superstructure load to the exterior foundation wall. As shown in figure D-9E the snow load, the attic live load and the roof dead load are transferred equally between the exterior wall and the marriage wall. The exterior wall in turn transfers the roof loads to the floor framing. A small portion of the floor live and dead load combine with the roof and wall weight to reach the foundation wall as a lineal uniform load (Rw).

$$Rw = (pf + 19.7) \times \frac{Wt}{2} + (40 + 13) \times \frac{dc}{2} + 52.5$$

5. Required continuous marriage wall pier footing. The footing area (Aftg) must be large enough so that the net allowable soil bearing pressure (Pso) is not exceeded under the full gravity dead. live and snow loads. Note that the pier and footing weight become additional dead load. The required footing area:

$$Aftg_{max} = \frac{Rpm + 588}{Pso}$$

6. Required exterior and interior chassis beam Pier Footing Area: The footing areas (Aftg) must be large enough so that the allowable soil bearing pressure (Pso) is not exceeded under the full gravity dead and live loads. Note that the pier and footing weight become additional dead load. The required footing areas:

$$Aftg_{ext} = Aftg_{int} = \frac{Rpe + 700}{Pso}$$

7. Required exterior foundation wall Footing Width: The footing width (Wf) must be large enough so that the allowable soil bearing pressure (Pso) is not exceeded under the full gravity dead and live loads. Note that the wall and footing weight become additional dead load. The required footing width becomes:

$$Wf = \frac{Rw + 425}{Pso}$$

F. Gravity Load Considerations for the Type E and I Multi-Section Units with a Superstructure Marriage wall containing one opening or two large adjacent openings.

- 1. Continuous marriage wall. The equation development presented in Section D.300.1.E for loads and footing sizes at exterior foundation wall and exterior and interior chassis beam line piers is identical to that when a continuous marriage wall exists and will not be repeated here.
- 2. One opening or two adjacent openings. The considerations for the foundation piers under the posts that define one opening, or two adjacent large openings within the length of the continuous marriage wall, is the same as that for the Type C Multisection unit presented in Section D.300.1D and illustrated in Figure

D-9D. The equation for the maximum reaction under the center post will be repeated here:

$$Rpm = \begin{bmatrix} (Pf + 19.7) \times Wt + \\ (40 + 13) \times dc + 10 + 19.8 \end{bmatrix} \times \left(\frac{x + x_1}{2}\right) + 32$$

[( snow+roofDL+attic LL)] (floor DL+LL)+floor bm+Ridge bm ) +post DL

Note: For a single opening  $x_1 = 0$  and all the equations still work.

3. Required marriage wall pier footing at center post. The pier and footing weight become additional dead load. The required footing area under the center post location repeats also:

 $Aftg_{max} = \frac{Rpm + 588}{Pso}$ 

**Note:** Regardless of Multi-Section Unit Type C, E or I the equations developed for piers under the continuous marriage walls and the equations developed for the pier under the center post, when two large marriage wall openings exist, do not change. The only exception is for the Type E5, (E6 uses E5 Tables) and E7 Multi-section units, which are presented further on in this Section D.300.1.

G. Gravity Load Considerations for the Type Cnw Multi-Section Unit with a continuous marriage wall (without any marriage wall piers).

- General: As illustrated in Figure D-9F, the foundation to support the superstructure gravity loads is provided by spaced piers under the exterior and interior chassis beams.
   Note: A marriage wall with large openings is not considered feasible for this foundation concept, since it would require piers under the posts.
- 2. Superstructure load to an interior or exterior chassis beam pier: Similar to that shown in Figure D-9A for the Type C multi-section unit; the snow load, the attic live load and the roof dead load are transferred between the marriage wall and the exterior walls as bearing walls. The marriage wall and the exterior wall in turn transfer their dead weight and the roof loads to the floor framing. The floor live and dead load is equally distributed each chassis beam line. These loads from both levels combine to reach the sop of the foundation pier as the total concentrated superstructure load (Rp) in proportion to the pier spacing. . .

Note: The only difference between the exterior pier load and the interior pier load is in the difference of the weight of the exterior wall and marriage wall. Since the exterior wall has a greater weight that the marriage wall, it will be used and thus the load to the exterior and interior chassis beam piers will be assumed equal.

$$Rpe = Rpi = \begin{bmatrix} (pf + 19.7) \times \frac{Wt}{2} + \\ (40 + 13) \times \frac{Wt}{2} \\ + (44.25 + 9) \end{bmatrix} \times spacing$$

3. Required exterior and interior chassis beam Pier Footing Area: The footing area (Aftg) must be large enough so that the allowable soil bearing pressure (Pso) is not exceeded under the full gravity dead and live loads. Note that the pier and footing weight become additional dead load. The required exterior and interior footing areas become:

$$Aftg_{ext} = Aftg_{int} = \frac{Rp + 700}{Pso}$$

H. Gravity Load Considerations for the Type E5 Multi-Section Unit with a Continuous Superstructure Marriage Wall.

1. General: As illustrated in Figure D-9G, the foundation to support the superstructure gravity loads is provided by spaced transverse steel girders (under the chassis beams) that span between pilasters built into the exterior foundation walls and by spaced piers under the continuous marriage wall. A crawlspace exists below the first floor. The transverse steel girder is assumed to be composed of two simple spans that run from exterior wall to the central marriage wall piers, rather than





create a continuous two span girder.

**Note:** A licensed professional shall be responsible for the design of the transverse steel girders.

2. Superstructure floor load transferred to the transverse steel girder and then to the exterior foundation wall pilaster. As shown in Figure D-9G the floor dead and live load transfer to the chassis beam lines and present concentrated loads to the transverse girder. This concentrated load is then assumed to transfer to the end of the transverse girder and bear on the pilaster. Based on the transverse girder spacing, the concentrated load (F1) becomes:

F1 = 
$$\begin{bmatrix} (40+13) \times \left(\frac{Wt - 2dc}{2} + \frac{1}{2}\right) + 9 \end{bmatrix} \times \text{spacing}$$

#### (floorLL+DL)

3. Superstructure load to the exterior foundation wall: As shown in Figure D-9G the snow load, the attic live load and the roof dead load are transferred between the marriage wall and the exterior walls as bearing walls. The exterior wall transfers this load down to the top of the foundation wall. A small portion of floor load is assumed to also go to the foundation wall. This is a uniform linear load (F2) as follows:



Type E5 Multi-Section Units w/Continuous Marriage Wall

Figure D - 9G

$$F2 = (Pf + 19.7) \times \frac{Wt}{2} + (40 + 13) \times \frac{dc}{2} + 44.25$$

(snow +roof DL+atticLL) (floorLL+DL) (exterior wallDL)

4. Superstructure total load to the exterior foundation wall: As shown in Figure D-9G the pilaster receives load (F1) and this load plus the transverse girder weight of 20 plf spreads at a 45° angle along the wall length based on an assumed wall depth of 2 feet. Therefore, the spread in the wall is 4 feet. This spread load combines with the roof and exterior wall load (F2) to produce a total reaction (Rw) to the footing as follows:

$$Rw = \frac{F1 + \left(20 \times \frac{Wt}{2}\right)}{4} + F2$$

5. Superstructure load at the marriage wall: As shown in Figure D-9G the snow load, the attic live load and the roof dead load are transferred between the marriage wall and the exterior walls as bearing walls. The continuous marriage wall transfers this load down to the floor level and to a short steel post as a concentrated load, based on the spacing of the transverse girders. This concentrated load (F3) is as follows:

$$F3 = \begin{bmatrix} (Pf + 19.7) \times Wt + 52.5 + \\ (13 + 40) \times dc \end{bmatrix} \times \text{spacing}$$

(snow +roofDL+LL) (marriage wall weight) (floor DL+LL)

> 6. Superstructure total load to a continuous marriage wall pier: As shown in Figure D-9G two concentrated floor loads (F1) plus the concentrated load (F3) in addition to the transverse girder weight of 20 plf are assumed to be transferred to the continuous marriage wall pier as a total concentrated load (Rpm) as follows:

 $Rpm = 2 \times F1 + F3 + 20 \times Wt$ 

7. Required exterior foundation wall Footing Width: The footing width (wf) must be large enough so that the allowable soil bearing pressure (Pso) is not exceeded under the full gravity dead and live loads. Note that the wall and footing weight become additional dead load. The required footing width becomes:

$$Wf = \frac{Rw + 425}{Pso}$$

**Note:** The width of the footing between pilasters is assumed to be the same as at the pilaster. It is uneconomical to continually jog footing forms. Plus the spread through the wall will almost encompass the the entire wall between pilasters anyway.

8. Required continuous marriage wall pier footing. The footing area (Aftg) must be large enough so that the net allowable soil bearing pressure (Pso) is not exceeded under the full gravity dead, live and snow loads. Note that the pier and footing weight become additional dead load. The required footing area:

$$Aftg_{max} = \frac{Rpm + 588}{Pso}$$

I. Gravity Load Considerations for the Type E7 Multi-Section Unit with a Continuous Superstructure Marriage Wall.

> 1. General: As illustrated in Figure D-9H, the load flow of the superstructure gravity loads is identical to that for the Type E5 multi-section unit, and the equation development is very similar. The only difference is that instead of a crawlspace, a full basement exists below the first floor. Thus, the exterior foundation

is a full depth basement wall and footing with space pilasters. Again, the transverse steel girder is assumed to be composed of two simple spans that run from exterior basement wall to the central marriage wall, where steel pipe columns and a spread footing are used instead of piers.

- Note: A licensed professional shall be responsible for the design of the basement wall for gravity loads and lateral earth pressures; as well as the transverse steel girders and the steel pipe column.
  - 2. Exterior foundation basement wall and footing assumptions. A 6'-8" headroom is assumed under the transverse girders that are assumed



- Type E7 Multi-Section Units w/Continuous Marriage Wall
  - Figure D 9H

to be 12 inches deep. The chassis beams are assumed to be 10" deep. Thus, the total wall height to the top of basement floor is 8'-6". To maximize the gravity loading the walls are assumed to be 8 " solid concrete, rather than the also acceptable reinforced concrete block. The linear footing proportions are set at 1 foot deep x 2 feet wide. Since the pilaster only exists at the spacing of transverse girders its weight has been ignored. The foundation dead load becomes:

Conc. wall: $0.67 \times 8.5 \times 150 \text{ pcf} =$	850 plf
footing: $1.0 \times 2.0 \times 150 \text{ pcf} =$	<u>300 plf</u>
total =	1150 plf

3. Foundation under the marriage wall: Steel pipe columns 3.5"φ are assumed spaced under the transverse girders with a base plate at the bottom and a cap plate at the top with holes for bolting. The footing is assumed to be 1'deep x 3' x 3'. The column/footing load is therefore:

Column: 7.6 plf  $\times$ 7 feet tall = 54 lbs. Footing: 150pcf $\times$ 1' $\times$ 3' $\times$ 3' = <u>1350 lbs.</u> total = 1404 lbs.

- 4. Superstructure floor load transferred to the transverse steel girder and then to the exterior foundation wall pilaster. The load (F1) is identical to that for the Type E5 Multi-Section unit found in section D.300.1.H.2.
- 5. Superstructure load to the exterior foundation wall: The load (F2) is

identical to that for the Type E5 Multi-Section Unit found in section D.300.1.H.3.

- 6. Superstructure load at the marriage wall: The load (F3) is identical to that for the Type E5 Multi-Section Unit found in section D.300.1.H.5.
- 7. Superstructure total load to the exterior foundation wall: The pilaster receives load (F1) and the transverse girder weight of 20 plf. This load spreads at a 45° angle along the wall length based on an assumed wall depth of 8'-6" below the superstructure. Therefore, the spread in the wall would be greater than the maximum 10 foot spacing for transverse girders. The maximum Code prescribed spread is thus the spacing (s). This spread load combines with the roof and exterior wall load (F2) to produce a total reaction (Rw) to the footing as follows:

$$Rw = \frac{F1 + \left(20 \times \frac{Wt}{2}\right)}{s} + F2$$

8. Superstructure total load to a continuous marriage wall pier: The total concentrated load to the steel pipe column is identical to that for the Type E5 Multi-section unit concentrated load to a pier, found in section D.300.1.H.6. The total concentrated load (Rpm) is repeated here as follows:

 $Rpm = 2 \times F1 + F3 + 20 \times Wt$ 

9. Required exterior foundation wall Footing Width: The footing width (wf) must be large enough so that the allowable soil bearing pressure (Pso) is not exceeded under the full gravity dead and live loads. Note that the wall and footing weight become additional dead load. The required footing width becomes:

$$Wf = \frac{Rw + 1150}{Pso}$$

10. Required continuous marriage wall pipe column footing. The footing area (Aftg) must be large enough so that the net allowable soil bearing pressure (Pso) is not exceeded under the full gravity dead, live and snow loads. Note that the steel column and footing weight become additional dead load. The required footing area:

$$Aftg_{mar} = \frac{Rpm + 1404}{Pso}$$

11. Basement longitudinal beams used to space steel pipe columns further apart: It would be possible to add longitudinal steel beams to support the transverse steel girders in order to avoid a large number of pipe columns. This produces concentrated loads to the longitudinal beams, which could be spaced (b) distance apart, assuming (b)>(s) by a significant amount. The value (n) is the number of transverse beams that occurs within the distance (b). The area of footing would then become:

$$Aftg_{mar} = \frac{b \times \left[\frac{2 \times F3 + F4}{s} + n \times 20 \times Wt\right] + 1404}{Pso}$$

Note: There are no tables in Appendix B to cover this situation. The steel pipe column, the transverse and longitudinal steel beams would require design by an engineer.

J. Gravity Load Considerations for the Type E5, E6 and E7 Multi-Section Units with a Superstructure Marriage Wall containing one opening or two large adjacent openings.

- 1. General: The presence of regularly spaced steel transverse girders in these foundation concepts complicates the equation development to account for randomly placed large openings along the marriage wall line. Any concentrated post load, defining the ends of an opening, that falls between transverse girders would require either another pier or column, that would in many cases be close enough to the grid of transverse girder piers and posts, as to overlap or abut- clearly uneconomical and impractical to construct.
- 2. Marriage wall openings: assumptions and limitations: It has been assumed and is now recommended in this Handbook, that opening widths for these three foundation concepts be a multiple of the transverse girder spacing for the practical reasons stated above. Any other assumptions would require the design of a licensed professional.
The equation development will again follow the logic and assumptions of Section D.300.1.D.2 and will not be repeated here. Thus, two adjacent openings will be considered, with the center post receiving the largest concentrated load. All three post locations will have their foundation sized based on that center post, thus introducing a degree of conservatism.

The equations for the exterior foundation footing width are identical to those of the individual concepts for the Type E5 (E6 uses E5) and E7 already developed for a continous marriage wall, and will not be repeated here.

3. Roof load to a center post between two large marriage wall openings: The given situation, illustrated in the roof plan of Figure D-9I, shows two adjacent marriage wall openings that follows the assumption of openings being a multiple of the transverse girder spacing; one opening twice the width of the other, hence x = 2s and  $x_1=s$  The tributary area of gravity loads carried by the center post as the concentrated load (P1) is as follows:

P1 = 
$$[(Pf + 19.7) \times Wt + 19.8] \times (\frac{x + x_1}{2}) + 32$$

(snow+roofDL+LL) (ridge bm) (postDL)

4. Floor load to a center post betweeen two large marriage wall openings: Refering to the floor plan of Figure D-9I, the tributary area illustrated produces the concentrated gravity load (P2) to the foundation below the post as follows:

$$P2 = [(40+13) \times Wt + 10 + 18] \times (\frac{2}{3}) \times (\frac{x+x_1}{2}) + 20 \times Wt$$

#### (floorLL+DL) (floor bm) (two chassis bms) (transverse girder wt)

Note: The 2/3rds factor in the above equation is to account for an average floor load situation as illustrated in Figure D-9I.

5. Total concentrated load (Rpm) to the foundation at a center post location: The roof and floor loads combine to produce the total reaction (Rpm) to the foundation pier or column as follows:

#### Rpm = P1 + P2

 Required, adjacent opening center post location, marriage wall pier footing for Foundation Concept Type E5 and E6. The footing area (Aftg) must be large enough so that the net allowable soil bearing pressure (Pso) is not exceeded under the full gravity dead, live and snow loads. Note that the pier and footing weight become additional dead load. The required footing area:

$$Aftg_{mar} = \frac{Rpm + 588}{Pso}$$

7. Required, adjacent opening center post location, marriage wall pier footing for Foundation Concept footing for Foundation Concept Type E7. The footing area (Aftg) must be large enough so that the net allowable soil bearing pressure (Pso) is not exceeded under the full gravity dead, live and snow loads. Note that the pier and footing weight become additional dead load. The required footing area:

 $Aftg_{mar} = \frac{Rpm + 1404}{Pso}$ 

Note: A foundation pier or column exists, centered below the larger marriage wall opening  $(x = 2 \times s)$  at a transverse girder line. The pier or column footing here should be sized only for the floor concentrated load (P2). Substitute (P2) for (Rpm) in the above two equations. This is left to the engineer and is not reflected in the Tables of Appendix B.





Figure D - 9I

D-300.2 REQUIRED VERTICAL AN-CHORAGE BASED ON WIND IN THE TRANSVERSE DIRECTION. Refer to Figures D-10 to D-12 for the free-body diagrams of the superstructure and foundation, illustrating the overturning forces due to wind and the element dead loads providing resistance. The foundation Types C, C1, E and I are included for single-section units. Figure D-4, D-5 and D-6 are also related to the equation development of this section. For allowable stress design methodology, the load combination from ASCE 7-93 is: (Wind) - DL.

A. Wind Load Considerations for the Type C Single-Section Unit.

- 1. General: The superstructure receives external and internal wind pressures or suctions (p) on the two walls and two sloping roof planes in accordance with the equation of section D-200.4.C.2. These wind pressures tend to overturn the superstructure, rotating it about the pivot point at the bottom of the chassis beam as shown on Figure D-10. The vertical anchorage force (Av) necessary to prevent this uplift action is located at the opposite foundation pier. The anchorage connection of superstructure to foundation must be capable of transferring the (Av) force to the pier. The dead load of the pier, footing and soil overburden must be equal to or greater than the (Av) force to keep the superstructure from overturning.
- 2. Wind Loads on the Superstructure: As shown in Figure D-10, the resultant wind force at the top and bot-

tom of the wall are (Pt) and (Pb) respectively. The vertical component of the resultant wind force on the windward and leeward slope are (Pvw) and (Pvl) respectively. They are calculated as follows:

$$Pt = Pb = (p_{ww} + |p_{wl}|) \times \frac{h_{p}}{2}$$
$$Pvw = p_{rw} \times \frac{Wt}{2}$$
$$Pvl = p_{rl} \times \frac{Wt}{2}$$

3. Overturning Moment of the Superstructure: The resultant wind loads on each surface rotate about the pivot point shown in Figure D-10. The summation of the force times distance values define the equation:

$$Mo = Pt \times (h_n + 0.833) + |Pvw| \times \left(\frac{3 \times Wt}{4} - dc\right) + |Pvl| \times \left(\frac{Wt}{4} - dc\right) + Pb \times (0.833)$$

4. Resisting moment of the superstructure: The total dead load provides the only gravity load resistance to overturning. Using the light dead load from section D-200.1.B:

$$Mr = DL \times \left(\frac{Wt}{2} - dc\right)$$

5. Required Vertical Anchorage Force: If the overturning moment (Mo) exceeds the resisting moment (Mr), an uplift force exists. The ASCE 7-93 restricts the usable dead load to 2/3rds of the actual dead load. This is the same as inverting the ratio and making the overturning moment 3/2 times the calculated value. Thus, the final equation for (Av) at a specific pier spacing is:

$$Av = \left[\frac{1.5 \times Mo - Mr}{Wt - 2 \times dc}\right] \times spacing$$

B. Wind Load Considerations for the Type C1 Single-Section Unit.

- 1. *General*: The same wind pressures as for Type C tend to overturn the superstructure, rotating it about the pivot point at the bottom of the chassis beam as shown on Figure D-10. The vertical anchorage force (Av) necessary to prevent this uplift action is a tie-down strap that wraps over the roof of the unit and down the side walls to anchorage below grade at concrete deadmen. The capacity of the steel straps must be capable of transferring the (Av) force to the deadman. The dead load of the concrete deadman and soil overburden must be equal to or greater than the (Av) force to keep the superstructure from overturning.
- 2. Wind Loads on the Superstructure: As shown in Figure D-10, the resultant wind forces are the same as for the Type C single-section unit. See equations in section D-300.2.A.2.
- 3. Overturning Moment of the Superstructure: The resultant wind loads on each surface rotate about the pivot point shown in Figure D-10. The equation is the same as for the Type C single-section unit.

- 4. Resisting moment of the superstructure: The resisting moment is the same as for the Type C singlesection unit.
- 5. Required Vertical Anchorage Force: The final equation for (Av) at a specific vertical tie-down strap or tie spacing is:

$$Av = \left[\frac{15 \times Mo - Mr}{Wt - dc}\right] \times spacing$$

# C. Wind Load Considerations for the Type E Single-Section Unit (excluding Types E3 and E4, which follows).

- 1. General: The applied wind loads to the superstructure are the same as for the Type C single-section unit. These wind pressures tend to overturn the superstructure, rotating it about the pivot point at the exterior foundation wall as shown in Figure D-11A. The vertical anchorage force (Av) necessary to prevent this uplift action is located at the opposite exterior foundation wall. The anchorage connection of superstructure to foundation must be capable of transferring the (Av) force to the wall. The dead load of the wall. footing and soil overburden must be equal to or greater than the (Av) force to keep the superstructure from overturning.
- 2. Wind Loads on the Superstructure: Same as for the Type C singlesection unit. The equations are shown is section D-300.2.A2.

structure: The resultant wind loads distance values define the equation: on each surface rotate about the pivot point shown in Figure D-11A. 3 Wt / 4 Wt/4 Pu (-)orv Wind ⊕ DL (light) Superstructure Free-body Diagram Direction Wt hn dc (+)pww (-)pwl windward leeward 0.833' (10") pivot JLAV Wt - 2 dc uplift compression Foundation ÷ Free-body Diagram Pso Type C Single-Section Unit 3 Wt / 4 Wt/4 Pvi Ŵ Wind ⊕ DL (light) Superstructure Free-body Diagram Direction Wt hn dc Ι 0.833' (10") ALAV pîvot - tie-down strap Wt - dc Ġ Foundation Free-body Diagram compression Av To uplift £ ∱Pso concrete deadman Type C1 Single-Section Unit Wind Related Overturning Loads - Transverse Direction

The summation of the force times

3. Overturning Moment of the super-

Figure D - 10

$$Mo = Pt \times h_n + |Pvw| \times \left(\frac{3 \times Wt}{4}\right) + |Pvl| \times \left(\frac{Wt}{4}\right)$$

4. Resisting moment of the superstructure: The total dead load provides the only gravity load resistance to overturning. Using the light dead load from section D-200.1.B:

$$Mr = DL \times \left(\frac{Wt}{2}\right)$$

5. Required Vertical Anchorage Force: Similar to Section D-300.A.5. Thus, the final equation for anchorage force (Av) to be transferred to the exterior foundation wall becomes:

$$Av = \frac{1.5 \times Mo - Mr}{Wt}$$

#### C-X. Wind Load Considerations for the

#### Type E3 and E4 Single-Section Unit.

1. *General*: The applied wind loads to the superstructure are the same as for the Type C single-section unit as shown in Figure D-10. These wind pressures tend to overturn the superstructure, rotating it about the pivot point at the exterior foundation wall as shown in Figure D-11B. The vertical anchorage force (Av) necessary to prevent this uplift action is located at the two chassis beam piers and the opposite exterior foundation wall. The anchorage connection of superstructure to these piers and foundation wall must be capable of transferring the (Av) force in proportion to their distance from the pivot. The dead load of the exterior wall, footing and soil overburden; plus the dead load of the two piers, footings and soil overburden must all be equal to



Figure D - 11A

or greater than the portion of the (Av) force each must resist to keep the superstructure from overturning.

- 2. Wind Loads on the Superstructure: Same as for the Type C singlesection unit. The equations are shown is section D-300.2.A2.
- 3. Overturning Moment of the superstructure: The resultant wind loads on each surface rotate about the pivot point shown in Figure D-11B. The summation of the force times distance values define the equation:

$$Mo = Pt \times h_n + |Pvw| \times \left(\frac{3 \times Wt}{4}\right) + |Pvl| \times \left(\frac{Wt}{4}\right)$$

4. Resisting moment of the superstructure: The total dead load provides the only gravity load resistance to overturning. Using the light dead load from section D-200.1.B:

$$Mr = DL \times \left(\frac{Wt}{2}\right)$$

5. Required vertical Anchorage Force: Assuming the anchorage force at the exterior wall to be (Av), and using triangle proportions, the intermediate vertical anchorage force at the furthest pier from the pivot  $(Av_1)$  becomes:

$$Av_1 = \left(\frac{Wt - dc}{Wt}\right) \times Av$$

**Note:** As illustrated in Figure D-11B the anchorage force at the pier closest to the pivot is very small and is ignored. The anchorage

force  $(Av_1)$  shall be used at both piers for conservatism.

The resisting moment created by these two anchorage locations is:

$$M_{AV} = Av \times Wt + Av_1 \times (Wt - dc)$$

Substitution of the anchorage force value  $(Av_1)$  into the above equation results in the following:

$$M_{AV} = Av \times \left[Wt + \frac{(Wt - dc)^2}{Wt}\right]$$

Since the anchorage moment  $(M_{AV})$ must balance the net overturning moment (1.5 x Mo-Mr), the maximum vertical anchorage force (Av), which is used in the Foundation Design Load Tables of Appendix B, Part 2 for the exterior wall per foot of length, becomes:

$$Av = \frac{(1.5 \times Mo - Mr)}{\left[Wt + \frac{(Wt - dc)^2}{Wt}\right]}$$

Note that the vertical anchorage force  $(Av_I)$  used in the Tables for anchorage at both piers under the chassis beams is based on pier spacing (s) and renamed  $(Av_{1pier})$  in the equation becomes:

$$Av_{1pier} = \left(\frac{Wt - dc}{Wt}\right) \times Av \times spacing$$

D. Wind Load Considerations for the Type I Single-Section Unit.

1. General: The applied wind loads to the superstructure are the same as for the Type C and E single-section unit. These wind pressures tend to overturn the superstructure, rotating it about the pivot point at the exterior foundation wall as shown in Figure D-12. The vertical anchorage force (Av) necessary to prevent this uplift action is located at the far side chassis beam at the interior pier spacing. The anchorage connection of superstructure to foundation must be capable of transferring the (Av) force to the pier. The dead load of the wall, footing and soil overburden must be equal to or greater than

the (Av) force to keep the superstructure from overturning.

- 2. Wind Loads on the Superstructure: Same as for the Type C singlesection unit. The equations are shown is section D-300.2.A.2.
- 3. Overturning Moment of the superstructure: Same as for the Type E single-section unit.

$$Mo = Pt \times h_n + |Pvw| \times \left(\frac{3 \times Wt}{4}\right) + |Pvl| \times \left(\frac{Wt}{4}\right)$$

4. Resisting moment of the superstructure: Same as for the Type E sin-



Wind Related Overturning Loads - Transverse Direction Figure D - 11B gle-section unit.

$$Mr = DL \times \left(\frac{Wt}{2}\right)$$

5. Required Vertical Anchorage Force: Similar to Section D-300.A.5. Thus, the final equation for anchorage force (Av) to be transferred to the exterior foundation wall becomes:

$$Av = \left[\frac{(1.5 \times Mo - Mr)}{(Wt - dc)}\right] \times spacing$$

### E. Wind Load Considerations for a Type C Multi-Section Unit.

1. General: The superstructure is assumed to behave as a single box for overturning. It receives wind loads and tends to overturn in a similar manner to the single-section unit as described in Section D-300.2.A.1. The pivot point is under the exterior chassis beam on one side. Anchorage connection of superstructure to foundation is either two tie-downs or four tie-downs as illustrated in Figure D-13 at the other chassis beams.

2. Wind Loads on the Superstructure: As shown in Figure D-13, the resultant wind force at the top and bottom of the wall are (Pt) and (Pb) respectively. The vertical component of the resultant wind force on the windward and leeward slope are (Pvw) and (Pvl) respectively. They are calculated as follows:



Wind Related Overturning Loads - Transverse Direction



$$Pt = Pb = (p_{ww} + |p_{wl}|) \times \frac{h_n}{2}$$
$$Pvw = p_{rw} \times Wt$$
$$Pvl = p_{rl} \times Wt$$

3. Overturning Moment of the Superstructure: The summation of the force times distance values defines the equation:

$$Mo = Pt \times (h_n + 0.833) + |Pvw| \times \left(\frac{3 \times Wt}{2} - dc\right) + |Pvl| \times \left(\frac{Wt}{2} - dc\right) + Pb \times (0.833)$$

4. Resisting Moment of the Superstructure: The total dead load provides the only gravity load resistance to overturning. Using the light dead load for a multi-section unit from section D-200.1.B:

$$Mr = DL \times (Wt - dc)$$

- 5. Required Vertical Anchorage Force:
  - a. Two tie-downs:

Av = 
$$\left[\frac{(1.5 \times Mo - Mr)}{2 \times (Wt - dc)}\right] \times spacing$$

b. Four tie-downs: by triangle proportions the intermediate vertical anchorage forces (Av) are:

$$Av_{1} = \left[\frac{Wt}{2 \times (Wt - dc)}\right] \times Av$$

$$Av_{2} = \left[\frac{Wt - 2 \times dc}{2 \times (Wt - dc)}\right] \times Av$$

The resisting moment created by the three anchorage locations is:

$$M_{AV} = Av_1 \times Wt + Av_2 \times (Wt - 2 \times dc) + Av \times 2 \times (Wt - dc)$$

Substitution of the anchorage force values into the above equation results in the following:

$$M_{AV} = AV \times \begin{bmatrix} \frac{(Wt - 2 \times dc)^2}{2 \times (Wt - dc)} + \\ \frac{(Wt)^2}{2 \times (Wt - dc)} + 2 \times (Wt - dc) \end{bmatrix}$$

Since the anchorage moment  $(M_{AV})$  must balance the net overturning moment (1.5 x Mo-Mr), the maximum vertical anchorage force (Av) concentrated at the exterior pier, which is used in the Foundation Design Load Tables of Appendix B, Part 2, becomes:

$$Av = \frac{(1.5 \times Mo - Mr)}{\left[\frac{(Wt - 2 \times dc)^{2}}{2 \times (Wt - dc)} + \frac{(Wt)^{2}}{2 \times (Wt - dc)} + 2 \times (Wt - dc)\right]} \times \text{spacing}$$

Note that the smaller vertical anchorage forces  $(Av_1)$  and  $(Av_2)$  are **not** used in the Tables.



F. Wind Load Considerations for a1. General: The piratType E Multi-Section Unit.at the exterior f

1. *General*: The pivot point is located at the exterior foundation wall on

Wind Related Overturning Loads: Type C - Multi-Section Unit - Transverse Direction Figure D - 13

one side. Anchorage connection of superstructure to foundation is accomplished at the opposite exterior wall and at specific pier locations resulting in either two tie-downs or four tie-downs as illustrated in Figure D-14. Foundation Concept Type E3 has six tie-downs. The illustration would be similar to that for four tie-downs; however, the calculations are included here.

- 2. Wind Loads on the Superstructure: Wind loads on the walls and roof planes are the same as for the Type C multi-section unit.
- 3. Overturning Moment of the Superstructure: The summation of the force times distance values defines the equation:

$$Mo = Pt \times h_{n} + |Pvw| \times \left(\frac{3 \times Wt}{2}\right) + |Pvl| \times \left(\frac{Wt}{2}\right)$$

4. Resisting Moment of the Superstructure: The total dead load provides the only gravity load resistance to overturning. Using the light dead load for a multi-section unit from section D-200.1.B:

 $Mr = DL \times Wt$ 

- 5. Required Vertical Anchorage Force:
  - a. **Two tie-downs**: at the exterior wall in lbs/ft:

$$Av = \left[\frac{(1.5 \times Mo - Mr)}{2 \times Wt}\right]$$

b. Four tie-downs: by triangle proportions the intermediate vertical anchorage forces (Av), also in lbs/ft, are:

$$Av_{1} = \left[\frac{Wt + dc}{2 \times Wt}\right] \times Av$$
$$Av_{2} = \left[\frac{Wt - dc}{2 \times Wt}\right] \times Av$$

The resisting moment created by the three anchorage locations is:

$$M_{AV} = Av_1 \times (Wt + dc) + Av_2 \times (Wt - dc) + Av \times 2 \times Wt$$

Substitution of the anchorage force values into the above equation results in the following:

$$M_{AV} = AV \times \left[ \frac{(Wt + dc)^2}{2 \times Wt} + \frac{(Wt - dc)^2}{2 \times Wt} + 2 \times Wt \right]$$

Since the anchorage moment  $(M_{AV})$  must balance the net overturning moment  $(1.5 \times Mo-Mr)$ , the maximum vertical anchorage force (Av) at the exterior wall in lbs/ft, becomes:

$$Av = \frac{(1.5 \times Mo - Mr)}{\left[\frac{(Wt + dc)^{2}}{2 \times Wt} + \frac{(Wt - dc)^{2}}{2 \times Wt} + 2 \times Wt\right]}$$

And the next largest anchorage force (in lbs.)  $(Av_1)$  at the first interior pier becomes:

$$Av_1 = \left[\frac{Wt + dc}{2 \times Wt}\right] \times Av \times spacing$$

b. Six tie-downs: by triangle proportions the intermediate vertical anchorage forces (Av), in lbs/ft of unit length, are:

$$Av_{1} = \left[\frac{2 \times Wt - dc}{2 \times Wt}\right] \times Av$$
$$Av_{2} = \left[\frac{Wt + dc}{2 \times Wt}\right] \times Av$$
$$Av_{3} = \left[\frac{Wt - dc}{2 \times Wt}\right] \times Av$$

The resisting moment created by the four anchorage locations is:

$$M_{AV} = Av_1 \times (2 \times Wt + dc) + Av_2 \times (Wt + dc) + Av_3 \times (Wt - dc) + Av \times 2 \times Wt$$

Substitution of the anchorage force values into the above results in the following:

$$M_{AV} = Av \times \left[ \frac{\frac{(2 \times Wt - dc)^2}{2 \times Wt} + \frac{(Wt + dc)^2}{2 \times Wt}}{\frac{(Wt - dc)^2}{2 \times Wt} + 2 \times Wt} \right]$$

Since the anchorage moment  $(M_{AV})$  must balance the net overturning moment  $(1.5 \times Mo-Mr)$ , the maximum vertical an-

chorage force (Av) at the exterior wall in lbs/ft, becomes:

$$Av = \frac{(1.5 \times Mo - Mr)}{\left[\frac{(2 \times Wt - dc)^{2}}{2 \times Wt} + \frac{(Wt + dc)^{2}}{2 \times Wt} + \frac{(Wt - dc)^{2}}{2 \times Wt} + 2 \times Wt\right]}$$

And the next largest anchorage force (in lbs.)  $(Av_1)$  at the first interior pier becomes:

$$Av_{1} = \left[\frac{2 \times Wt - dc}{2 \times Wt}\right] \times Av \times spacing$$

The smaller values of Av are not printed in the tables for fabrication economy.

# G. Wind Load Considerations for a Type I Multi-Section Unit.

- 1. General: The pivot point is located at the exterior foundation wall on one side. Anchorage connection of superstructure to foundation is accomplished at specific pier locations resulting in either two tie-downs or four tie-downs as illustrated in Figure D-15.
- 2. Wind Loads on the Superstructure: Wind loads on the walls and roof planes are the same as for the Type C or E unit.
- 3. Overturning Moment of the Superstructure: The summation of the force times distance values defines the equation:

$$Mo = Pt \times h_n + |Pvw| \times \left(\frac{3 \times Wt}{2}\right) + |Pvl| \times \left(\frac{Wt}{2}\right)$$

4. Resisting Moment of the Superstructure: The total dead load provides the only gravity load resistance to



Wind Related Overturning Loads: Type E - Multi-Section Unit - Transverse Direction Figure D - 14

overturning. Using the light dead load for a multi-section unit from section D-200.1.B:

 $Mr = DL \times (Wt)$ 

- 5. Required Vertical Anchorage Force:
  - a. **Two tie-downs**: Concentrated load in lbs. at the exterior pier becomes:

Av = 
$$\left[\frac{(1.5 \times Mo - Mr)}{(2 \times Wt - dc)}\right] \times spacing$$

b. Four tie-downs: by triangle proportions the intermediate vertical anchorage forces (Av) are similar to the Type E multisection unit.

The resisting moment created by the three anchorage locations is:

$$M_{AV} = Av_1 \times (Wt + dc) + Av_2 \times (Wt - dc) + Av \times (2 \times Wt - dc)$$

Substitution of the anchorage force values into the above equation results in the following:

$$M_{AV} = AV \times \begin{bmatrix} \frac{(Wt + dc)^2}{(2 \times Wt - dc)} + \\ \frac{(Wt - dc)}{(2 \times Wt - dc)} + \\ + (2 \times Wt - dc) \end{bmatrix}$$

Since the anchorage moment  $(M_{AV})$  must balance the net overturning moment  $(1.5 \times Mo$ -

Mr), the maximum vertical anchorage force (Av) at the exterior pier, used in the Foundation Design Load Tables of Appendix B, Part 2, becomes:

$$Av = \frac{(1.5 \times Mo - Mr)}{\left[\frac{(Wt + dc)^{2}}{(2 \times Wt - dc)} + \frac{(Wt - dc)^{2}}{(2 \times Wt - dc)} + (2 \times Wt - dc)\right]} \times \text{spacing}$$

And the next largest anchorage force  $(Av_1)$  at the first interior pier becomes:

$$Av_{1} = \left[\frac{Wt + dc}{(2 \times Wt - dc)}\right] \times Av$$

This  $(Av_1)$  force equation is **not** used in the Foundation Design Load Tables of Appendix B. It is shown here for engineers who wish to reduce the design (Av) force at interior pier locations.

**D-300.3 REQUIRED VERTICAL AN-CHORAGE BASED ON SEISMIC IN THE TRANSVERSE DIRECTION.** Refer to Figure D-16 to D-18 for the free-body diagrams of the superstructure and foundation for singlesection units, illustrating the overturning forces due to seismic activity and the element dead loads providing resistance.

**A. General.** The seismic provisions of ASCE 7-93 are a limit state methodology that must be modified to an allowable stress methodology for comparison to wind. This is accomplished in the load combination as follows:

The basic load combination from ASCE 7-93:

#### E - DL

The seismic equation from ASCE



Wind Related Overturning Loads: Type I - Multi-Section Unit - Transverse Direction

Figure D - 15

7-93:

 $\mathbf{E} = \pm \mathbf{Q}_{\mathbf{E}} \pm 0.5 \times \underline{\mathbf{A}} \mathbf{v} \times \mathbf{D} \mathbf{L}$ 

where  $Q_E$  is the effect of horizontal seismic. Substitution of E into the basic equation:

 $Q_E - D \times (1 - 0.5 \times \underline{A}v)$ 

Thus, for Seismic the net overturning equation generalizes to:

$$1.5 \times Mo - (1 - 0.5 \times Av) \times Mr$$

which includes the same 1.5 factor of safety as used for wind.

# B. Seismic Force Consideration for the Type C, C1, E or I Single-Section Units.

- Seismic Inertia Forces on the Superstructure: Determination of the horizontal forces was explained in section D-200.5. The "heavy" component dead loads were used to arrive at the inertia forces F<sub>xr</sub> and F<sub>xf</sub>.
- 2. Overturning Moment of the Superstructure: The moment components are force times distance from the pivot.
  - a. For Type C and C1 singlesection units:

$$Mo = F_{xr} \times (h_n + 0.833) + F_{xf} \times 0.833$$

b. For Type E or I single-section units:

$$Mo = F_{xr} \times h_n$$

- 3. Resisting moment of the Superstructure: The dead load and snow load, where applicable, constitute the gravity load resisting overturning. The "light" unit dead load was used for overturning resistance to be conservative, even though the "heavy" dead loads for single-section units were used for the calculation of the floor and roof inertia forces. Generally the equations become:
  - a. For Type C and C1 singlesection units:

$$\mathbf{Mr} = \left(\mathbf{DL} + \mathbf{\%P}_{\mathbf{f}} \times \mathbf{Wt}\right) \times \left(\frac{\mathbf{Wt}}{2} - \mathbf{dc}\right)$$

b. For Type E and I single-section units:

$$Mr = \left(DL + \%P_{f} \times Wt\right) \times \left(\frac{Wt}{2}\right)$$

- 4. Required Vertical Anchorage Force: Using the general equation described in section D-300.3.A and using the appropriate Mo and Mr equarions for each unit Type, the equations become:
  - a. For Type C single-section units:

$$Av = \left[\frac{1.5 \times Mo - (1 - 0.5 \times Av) \times Mr}{Wt - 2 \times dc}\right] \times spacing$$

b. For Type C1 single-section unit:

$$Av = \left\lfloor \frac{1.5 \times Mo - (1 - 0.5 \times Av) \times Mr}{Wt - dc} \right\rfloor \times spacing$$



Figure D - 16



 $\times$  spacing

force (Av), based on overturning in the transverse direction, will be the larger value of wind or seismic.



Type I Single-Section Unit

Seismic Related Overturning Loads - Transverse Direction

Figure D - 18

This is reflected in the Foundation Design Load Tables of Appendix B, Part 2. Note: should any (Av) value become negative, there is no uplift.

C. Seismic Force Considerations for the Type C, E and I Multi-Section Units.

- 1. General: The moment equilibrium equations for anchorage resistance are similar to those for the multisection units subjected to wind load as shown in Figures D-13 to D-15. The applied roof and floor inertia forces ( $F_{xr}$  and  $F_{xf}$  respectively) are based on heavy dead loads for multi-section units and positioned where shown in Figures D-16 to D-18. Calculation of the horizontal roof and floor forces was explained in section D-200.5.
- 2. Overturning Moment of the Superstructure:
  - a. For Type C multi-section units: Use the same equation found in section D-300.3.B.2.a., except calculate  $F_{xr}$  and  $F_{xf}$  from the expressions for Multi-Section units.
  - b. For Type E or I multi-section units: Use the same equation found in section D-300.3.B.2.b., except calculate  $F_{xr}$  and  $F_{xf}$  from the expressions for Multi-Section units.
- 3. Resisting Moment of the Superstructure:
  - a. For Type C multi-section units:

$$M_r = (DL + \mathscr{P}_f \times 2 \times Wt) \times (Wt - dc)$$

b. For Type E or I multi-section units:

 $M_r = (DL + \%P_f \times 2 \times Wt) \times Wt$ 

- 4. Required Vertical Anchorage Force: Using the general equation described in section D-300.3.A the equations become:
  - a. For Type C multi-section units: The concentrated force at the exterior pier for **two tie-downs**:

$$Av = \left[\frac{1.5 \times Mo - (1 - 0.5 \times Av) \times Mr}{2 \times (Wt - dc)}\right] \times spacing$$

with **four tie-downs**: The maximum concentrated (Av) force that is used in the Foundation Design Load Tables of Appendix B, Part 2 is:

$$Av = \frac{(1.5 \times Mo - (1 - 0.5 \times Av) \times Mr)}{\left[\frac{(Wt - 2 \times dc)^{2}}{2 \times (Wt - dc)} + \frac{(Wt)^{2}}{2 \times (Wt - dc)} + 2 \times (Wt - dc)\right]} \times \text{spacing}$$

Note: that the smaller vertical anchorage forces  $(Av_1)$  and  $(Av_2)$  derived in Section D-300.2.E.5 are not used in the tables. Note: negative values of (Av) produce no uplift.

 b. For Type E multi-section units, anchored at the exterior walls, the (Av) value is in units of lbs/ft. With two tie-downs:

$$Av = \left[\frac{1.5 \times Mo - (1 - 0.5 \times Av) \times Mr}{2 \times Wt}\right]$$

For **four tie-downs:** The maximum vertical anchorage force (Av) that is used in the Foundation Design Load Tables of Appendix B, Part 2 at the exterior wall in units of lbs/ft is:

$$V = \frac{\left(1.5 \times \text{Mo} - (1 - 0.5 \times \text{Av}) \times \text{Mr}\right)}{\left[\frac{\left(\text{Wt} + \text{dc}\right)^{2}}{2 \times \text{Wt}} + \frac{\left(\text{Wt} - \text{dc}\right)^{2}}{2 \times \text{Wt}} + 2 \times \text{Wt}\right]}$$

The next largest anchorage force  $(Av_1 \text{ in } lbs.)$  at the first interior pier as used in the Appendix B, Part 2 Tables becomes:

$$Av_1 = \left[\frac{Wt + dc}{2 \times Wt}\right] \times Av \times spacing$$

For six tie-downs: This condition exists only for the Type E3 Foundation Concept. The maximum vertical anchorage force (Av) that is used in the Foundation Design Load Tables of Appendix B. Part 2 at the exterior wall in units of lbs/ft is:

$$Av = \frac{(1.5 \times Mo - (1 - 0.5 \times Av) \times Mr)}{\left[\frac{(2 \times Wt - dc)^{2}}{2 \times Wt} + \frac{(Wt + dc)^{2}}{2 \times Wt} + \frac{(Wt - dc)^{2}}{2 \times Wt} + \frac{(Wt - dc)^{2}}{2 \times Wt} + 2 \times Wt\right]}$$

The next largest anchorage force  $(Av_1 \text{ in } lbs.)$  at the first interior pier as used in the Appendix B, Part 2 Tables becomes:

$$Av_{1} = \left[\frac{2 \times Wt - dc}{2 \times Wt}\right] \times Av \times spacing$$

c. For Type I multi-section units: The concentrated force at the exterior pier for **two tie-downs**:

$$Av = \left[\frac{1.5 \times Mo - (1 - 0.5 \times Av) \times Mr}{2 \times (Wt - dc)}\right] \times spacing$$

with **four tie-downs:** The maximum vertical anchorage force (Av in Lbs.) at the exterior pier, which is used in the Foundation Design Load Tables, Part 2, is:

$$Av = \frac{(1.5 \times Mo - (1 - 0.5 \times Av) \times Mr)}{\left[\frac{(Wt + dc)^{2}}{(2 \times Wt - dc)} + \frac{(Wt - dc)^{2}}{(2 \times Wt - dc)} + (2 \times Wt - dc)\right]} \times \text{spacing}$$

And the next largest anchorage force  $(Av_1)$  at the first interior pier is:

$$Av_{1} = \left[\frac{Wt + dc}{(2 \times Wt - dc)}\right] \times Av$$

This  $(Av_1)$  force equation is **not** used in the Foundation Design Load Tables of Appendix B. It is shown here for engineers who wish to reduce the design (Av)force at interior pier locations.

D-300.4 REQUIRED HORIZONTAL AN-CHORAGE BASED ON WIND IN THE TRANSVERSE DIRECTION. Refer to Figures D-19 and D-21 for the free-body diagrams of the superstructure and foundation for single section and multi-section units, illustrating the horizontal forces due to sliding and element dead loads providing resistance. Horizontal sliding is not influenced by the foundation Type C, E or I; thus the same analysis applies to all of the foundation types. Figure D-4, D-5 and D-6 are also related to the equation development of this section. A roof slope of 10-15° (20° also) (approx. 3 in 12 slope) was used so as to utilize the maximum exterior pressure coefficient on the windward slope (Cp = +0.2) to produce the largest horizontal windward force component, and thus the largest sliding force. An external windward slope uses a Cp=-0.9 to produce the smallest resistance force. These were conservative assumptions for the Tables. Note that internal pressures on the walls cancel; therefore, only internal pressures of +GCpi on the roof planes are considered (see Figure D-5). For allowable stress design methodology, the load combination from ASCE 7-93 is: (Wind - DL). Figure D-20 illustrates that a tributary width approach is used to calculate the forces to each foundation horizontal load resisting plane.

### A. Wind Load Considerations for the Type C, E and I Single-Section Unit.

1. General: As shown in Figure D-19 the external wind pressure on the windward wall and the external suction on the leeward wall are transferred into the roof (plus ceiling) and floor diaphragms. The roof (plus ceiling) diaphragm transfers the force into superstructure shear walls perpendicular to the unit length, and then in turn to the floor diaphragm, assuming all connections are properly designed to resist the horizontal wind forces. From the floor diaphragm the horizontal



Figure D - 19

force is transferred into the foundation shear wall or vertical X-bracing plane. Reference Figure 6-4. It is assumed that the location of superstructure shear walls coincides with the foundation shear wall locations.

2. Wind Loads on the Superstructure: As shown in Figure D-19, the resultant wind force at the top and bottom of the wall are (Pt) and (Pb) respectively. The vertical component of the resultant wind force on the windward and leeward slope are (Pvw) and (Pvl) respectively. The horizontal components of the roof wind loads both contribute to sliding, and are calculated as follows:

$$Pt = Pb = (p_{ww} + |p_{wl}|) \times \frac{h_n}{2}$$
$$Pvw = p_{rw} \times \frac{Wt}{2}$$

For calculation of (Fr) use (Cp) = -0.9 in the above equation.

$$Pvl = p_{rl} \times \frac{Wt}{2}$$
$$P_{HW} = p_{rw} \times \left(\frac{Wt}{2}\right) \times \tan 20^{\circ}$$

For calculation of  $(F_{SL})$  use (Cp) = +0.2 in the above equation.

$$\mathbf{P}_{\rm HL} = \left| \mathbf{p}_{\rm rl} \right| \times \left( \frac{\rm Wt}{2} \right) \times \tan 20^{\circ}$$

3. Sliding Force on the Superstructure: The sliding force is a function of the number of foundation shear walls (transverse foundation walls) that are used. Note that all four sliding force horizontal components point in the same direction and thus are additive.

 a. For two end shear (transverse) walls: the end wall sliding force distribution is illustrated in Figure D-20 and calculated as follows:

$$F_{SL_{end}} = (Pt + Pb) \times \left(\frac{L}{2}\right) + (P_{HW} + P_{HL}) \times \left(\frac{L}{2}\right)$$

b. For **four** shear (transverse) walls: the interior and end wall sliding force distribution is illustrated in Figure D-20 and calculated as follows:

$$F_{SL_{int}} = (Pt + Pb) \times \left(\frac{L}{3}\right) + (P_{HW} + P_{HL}) \times \left(\frac{L}{3}\right)$$

$$F_{SL_{end}} = (Pt + Pb) \times \left(\frac{L}{6}\right) + \left(P_{HW} + P_{HL}\right) \times \left(\frac{L}{6}\right)$$

c. For six shear (transverse) walls: the interior and end wall sliding force distribution is illustrated in Figure D-20 and calculated as follows:

$$F_{SL_{int}} = (Pt + Pb) \times \left(\frac{L}{5}\right) + \left(P_{HW} + P_{HL}\right) \times \left(\frac{L}{5}\right)$$
$$F_{SL_{end}} = (Pt + Pb) \times \left(\frac{L}{10}\right) + \left(P_{HW} + P_{HL}\right) \times \left(\frac{L}{10}\right)$$

4. Resisting Force supplied by the Superstructure: At the shear walls the sliding force  $(F_{SL})$  is resisted by the friction from the dead load of the

structure, reduced by the differential uplift pressure on the roof planes. Note that the "light" unit dead load was assumed for the calculations. The coefficient of static friction is assumed to be 0.4 for wood against concrete or masonry.

a. For **two** end shear (transverse) walls: the frictional resistance is a function of dead load as illustrated in Figure D-20 and calculated as follows:

$$\operatorname{Fr}_{end} = (DL - |P_{vL}| - |P_{vw}|) \times 0.4 \times \left[\frac{\operatorname{spacing}}{2}\right]$$

Spacing has been conservatively set to 4 feet, regardless of actual pier spacing. If  $(Fr_{end})$  is negative, set  $Fr_{end} = 0$ .

b. For **four** shear (transverse) walls: the frictional resistance is distributed to an end and interior shear wall location as illustrated in Figure D-20 and calculated as follows:

$$Fr_{int} = (DL - |P_{VL}| - |P_{VW}|) \times 0.4 \times spacing$$

$$\operatorname{Fr}_{end} = \left( \operatorname{DL} - \left| \operatorname{P}_{vL} \right| - \left| \operatorname{P}_{vw} \right| \right) \times 0.4 \times \left[ \frac{\operatorname{spacing}}{2} \right]$$

Spacing has been conservatively set to 4 feet, regardless of actual pier spacing. If  $(Fr_{int} \text{ or } Fr_{end})$  is negative, set  $Fr_{int}$  or  $Fr_{end} = 0$  as appropriate.

c. For six shear (transverse) walls: the frictional resistance is distributed to an interior and end wall the same as for four shear walls as illustrated in Figure D-20.

5. Required Horizontal Anchorage Force: If the horizontal sliding force exceeds the horizontal sliding resistance, then sliding occurs. This net sliding force (Ah) must be resisted by connections between the superstructure and the foundation shear walls or vertical X-bracing planes with an appropriate factor of safety, generally assumed to be 1.5 as for overturning. Refer to section D-300.2.A.5 for a full description. The equation requires substitution of the above (F<sub>SL</sub>) and (Fr<sub>int</sub> and Fr<sub>end</sub>) values for the selected 2, 4 or 6 shear walls. For the interior shear wall locations:

$$Ah_{int} = \frac{1.5 \times F_{SL_{int}} - Fr_{int}}{Wt}$$

and for the end shear wall locations:

$$Ah_{end} = \frac{1.5 \times F_{SL_{end}} - Fr_{end}}{Wt}$$

**B.** Wind Load Considerations for a Type C, E or I Multi-Section Unit.

1. General: Comparing Figures D-19 and D-21, it is clear that the behavior of a multi-section unit is identical to the single-section unit in regards to sliding. The behavior described in section D-300.4.A. can be applied here, except that the multisection unit is twice as wide  $(2 \times Wt)$ .



Foundation Shear Wall Planes - Sliding - Transverse Direction

Figure D - 20

2. Wind Loads on the Superstructure: As shown in Figure D-21, the same wind force components are required, except that the roof forces are twice as large for the multisection unit as follows:

$$Pt = Pb = (p_{ww} + |p_{wl}|) \times \frac{h_n}{2}$$
$$Pvw = p \quad \times Wt$$

For calculation of (Fr) use (Cp) = -0.9 in the above equation.

 $Pvl = p_{rl} \times Wt$ 

 $P_{HW} = p_{rw} \times Wt \times tan 20^{\circ}$ 

For calculation of  $(F_{SL})$  use (Cp) = +0.2 in the above equation.

#### $P_{HL} = \dot{p}_{rl} \times Wt \times tan 20^{\circ}$

- Sliding Force on the Superstructure: The sliding force equations for single-section units from section D-300.4.A.3 are applicable, substituting the force values from section D-300.4B.2 for multi-section units.
- 4. Resisting Force supplied by the Superstructure: The resisting force equations for single-section units from section D-300.4.A.4 with the same notes are applicable, substituting the "light" dead load for a multisection unit and the wind force values from section D-300.4.B.2.
- 5. Required Horizontal Anchorage Force: Similar equations are utilized as for the single-section units except for unit width (2 x Wt). The



Wind Related Sliding - Transverse Direction

Figure D - 21

equation requires substitution of the above  $(F_{SL})$  and  $(Fr_{int} \text{ and } Fr_{end})$  values for the selected 2, 4 or 6 shear walls. For the interior shear wall location:

$$Ah_{int} = \frac{1.5 \times F_{SL_{int}} - Fr_{int}}{2 \times Wt}$$

and for the end shear wall location:

$$Ah_{end} = \frac{1.5 \times F_{SL_{end}} - Fr_{end}}{2 \times Wt}$$

C. Horizontal Anchorage with X-Bracing. The calculation of (Ah) is necessary to proceed to analyze X-bracing alternatives. Refer to Figure 6-10 and section 602-5.G for illustration and explanation of two horizontal anchorage options:

- 1. To use steel straps to complete the transverse foundation walls, or
- 2. To use steel straps instead of trans-

#### verse foundation walls.

D-300.5 REQUIRED HORIZONTAL AN-CHORAGE BASED ON SEISMIC IN THE TRANSVERSE DIRECTION. Refer to Figures D-22 and D-23 for the free-body diagrams of the superstructure and foundation for single section and multi-section units, illustrating the horizontal forces due to seismic induced sliding. No gravity load frictional resistance is considered due to the dynamic vertical component of acceleration. Horizontal sliding is not influenced by the foundation Type C, E or I; thus the same analysis applies to all of the foundation types. Figure D-7 is related to the equation development for the calculation of horizontal inertia floor and roof forces.

### A. Seismic Force Considerations for the Type C, E and I Single-Section Units.

1. *General*: Figure D-22 shows all the applied and resisting forces involved in the horizontal equilibrium equations.





- 2. Seismic Inertia Forces on the Superstructure: Determination of the horizontal forces was explained in section D-200.5. The "heavy" component dead loads were used to arrive at the inertia forces for singlesection units.
- 3. Sliding Force on the Superstructure: The sliding force is a function of the number of foundation shear walls (transverse foundation walls) that are used.
  - a. For two end shear (transverse) walls: the end wall sliding seismic force distribution is illustrated in Figure D-20 and calculated as follows:

$$\mathbf{F}_{\mathrm{SL}_{\mathrm{end}}} = \left(\mathbf{F}_{\mathrm{xr}} + \mathbf{F}_{\mathrm{xf}}\right) \times \left(\frac{\mathrm{L}}{2}\right)$$

b. For **four** shear (transverse) walls: the interior and end wall sliding seismic force distribution is illustrated in Figure D-20 and calculated as follows:

$$F_{SL_{int}} = (F_{xr} + F_{xf}) \times \left(\frac{L}{3}\right)$$
$$F_{SL_{end}} = (F_{xr} + F_{xf}) \times \left(\frac{L}{6}\right)$$

c. For six shear (transverse) walls: the interior and end wall sliding seismic force distribution is illustrated in Figure D-20 and calculated as follows:

$$F_{SL_{int}} = (F_{xr} + F_{xf}) \times \left(\frac{L}{5}\right)$$
$$F_{SL_{read}} = (F_{xr} + F_{xf}) \times \left(\frac{L}{10}\right)$$

4. Resisting Force supplied by the Superstructure: The unreliability of friction to provide horizontal resistance to sliding during a seismic event requires :

Fr = 0 for interior and end wall resistance.

5. Required Horizontal Anchorage Force: The equations require substitution of the above  $(F_{SL})$  values for the selected 2, 4, or 6 shear walls. The horizontal sliding force for interior shear wall locations is:

$$h_{int} = \frac{1.5 \times F_{SL_{int}}}{Wt}$$

The horizontal sliding force for the end shear wall locations is:

$$Ah_{end} = \frac{1.5 \times F_{SL_{end}}}{Wt}$$

### **B.** Seismic Force Considerations for the Type C, E and I Multi-Section Units.

- 1. General: Figure D-23 shows all the applied and resisting forces involved in the horizontal equilibrium equations.
- 2. Seismic Inertia Forces on the Superstructure: Determination of the horizontal forces was explained in section D-200.5. The "heavy" com-

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ponent dead loads for multi-section units were used to arrive at the inertia forces.

- 3. Sliding Force on the Superstructure: The sliding force is a function of the number of foundation shear walls (transverse foundation walls) that are used. Reference Figure D-20 as a similar illustration, changing the unit width from (Wt) to  $(2 \times Wt)$ . The equations for horizontal sliding are the same as for single-section units, except that the magnitude of the inertia forces is for multi-section units as described in section D.200.5.B and D.200.5.E.7.a. and D-200.5.E.8. The sliding  $(F_{SL})$  equations then duplicate as shown in section D-300.5.A.3 with the larger  $F_{xr}$  and  $F_{xf}$  values used in the equations.
- 4. Resisting Force supplied by the Superstructure: The unreliability of

friction to provide horizontal resistance to sliding during a seismic event requires :

Fr = 0 for interior and end wall resistance.

5. Required Horizontal Anchorage Force: The equations require substitution of the above (F<sub>SL</sub>) Multi-Section unit values for the selected 2, 4 or 6 shear walls. The horizontal sliding force for the interior shear wall locations is:

$$Ah_{int} = \frac{1.5 \times F_{SL_{int}}}{2 \times Wt}$$

and the horizontal sliding force for the end shear wall location is:

Anchorage

$$h_{end} = \frac{1.5 \times F_{SL_{end}}}{2 \times Wt}$$

C. Horizontal

with



Type C, E or I Multi-Section Units

Seismic Related Sliding - Transverse Direction



**X-Bracing.** The calculation of (Ah) is necessary to proceed to analyze X-bracing alternatives. Refer to Figure 6-10 and section 602-5.G for illustration and explanation of two horizontal anchorage options:

- 1. To use steel straps or rods to complete the transverse foundation walls, or
- 2. To use steel straps or rods instead of transverse foundation walls.

**D-300.6 REQUIRED HORIZONTAL AN-CHORAGE BASED ON WIND IN THE LONGITUDINAL DIRECTION.** Refer to Figure D-24 for the free-body diagram of the superstructure and foundation for single section and multi-section, illustrating the horizontal forces due to longitudinal sliding from wind loading. The longitudinal sliding force (Ah) is not influenced by the foundation Type C, E or I. The same free-body diagram is used for the analysis; however, the detailing does differ based on foundation Type C, or E and I. The

Type E or I foundation, where structural exterior longitudinal foundation walls are used, is illustrated in Figure D-25. A Type C unit, where non-structural exterior longitudinal walls are typically used, incorporates vertical Xbracing planes along the chassis beam lines for longitudinal sliding resistance as illustrated in Figure D-26. Figure D-4 is also related to the equation development of this section. A roof slope of 20 degrees (approx. 4 in 12 slope) was used so as to maximize the end wall area to produce the largest horizontal windward and leeward forces. Note that internal pressures GCpi on the end walls cancel (see Figure D-5). For allowable stress design methodology, the load combination from ASCE 7-93 is: (Wind -DL). Figures D-25 and D-26 also illustrate that a tributary width approach is used to calculate the (Ah) force transferred to each foundation horizontal load resisting plane.

### A. Wind Load Considerations for the Type C, E and I Single-Section Units.







Figure D - 24

the external wind pressure on the windward wall and the external suction on the leeward wall are transferred into the roof (plus ceiling) and floor diaphragms. The roof (plus ceiling) diaphragm transfers the force into the exterior superstructure shear walls parallel to the unit length, and then in turn to the floor diaphragm, assuming all connections are properly designed to resist the horizontal wind forces. From the floor diaphragm the horizontal force is transferred into the exterior (longitudinal) foundation shear walls for Type E or I units, or is transferred from the exterior walls to the vertical X-bracing planes under chassis beam lines for Type C units as shown in Figures D-25 and

D-26 respectively. Also, reference Figure 6-6 for further illustration of both longitudinal resistance systems. **Note**: it is assumed that the exterior superstructure shear walls can transfer their force through the floor diaphragm and send the total sliding force over to the chassis beam lines for the Type C foundation.

2. Wind Loads on the Superstructure: The resultant wind forces occur on the end elevations of the singlesection unit. The windward pressure  $(p_{WE})$  and the leeward suction  $(p_{LE})$  include exterior effects only (internal effects cancel) as shown in Figures D-4 and D-5. The areas over which these pressures act are



Type E or I - Foundation Shear Wall Plans - Wind Related Sliding - Longitudinal Direction

Figure D - 25

illustrated in Figure D-27 for singlesection units, and is calculated as follows:

$$A_{end_1} = Wt \times h_n + \left(\frac{Wt}{2}\right)^2 \times tan 20^\circ$$

The combined longitudinal resultant force for the windward and leeward end walls of a single-section unit is:

 $P_{HE} = (p_{WE} + |p_{LE}|) \times A_{end}$ 

For selection of external pressure coefficients (Cp) on the leeward side, use 
$$Cp = -0.2$$
 for single-section units

3. Sliding Force on the Superstructure: The sliding force is distributed to the two longitudinal exterior superstructure walls and then to the floor diaphragm as follows:

 $F_{SL} = \frac{P_{HE}}{2 \times I}$ 



Type C - Foundation Vertical X-Bracing - Wind Related Sliding - Longitudinal Direction

Figure D - 26

- 4. Resisting Force supplied by the Superstructure: Superstructure gravity dead loads are distributed differently to the Type C and Type E or I foundations as described in section D-300.1.A to C. Also, the roof planes are subjected to external and interior combined suctions as shown in Figures D-4 and D-5 that would offset much of the dead load in most cases. Note: the "light" unit dead load was assumed. For these reasons, and for simplicity in the analysis, no frictional resistance was assumed to exist. This is a conservative approach. It should be pointed out that for wind speeds of 80 and 90 MPH incorporating the Cp=-0.7 on both roof sloping planes would have resulted in no sliding, meaning values of F<sub>SL</sub> that are negative. This was ignored for additional conservatism.
- 5. Required Horizontal Anchorage Force: The longitudinal sliding force (A<sub>h</sub>), without any assumed frictional resistance, is the same magnitude as the sliding force on the superstructure  $(F_{SI})$ . This sliding force (Ah) must be resisted by connections between the superstructure and the longitudinal foundation shear walls for Type E or I Foundations, and it must be resisted by vertical X-bracing planes for Type **C** foundations. The appropriate factor of safety is assumed to be 1.5 (as for overturning). Refer to section D-300.2.A.5 for a full description. The longitudinal sliding force per foot of length of unit is:

#### $Ah = 1.5 \times F_{SL}$

### B. Wind Load Considerations for the Type C, E and I Multi-Section Units.

- 1. General: The analysis process is the same as for single-section units, except that the end elevation area is greater than the single section unit. Figures D-24 to D-27 illustrate the multi-section unit information required.
- 2. Wind Loads on the Superstructure: The resultant wind forces occur on the end elevations of the multisection unit. The windward pressure  $(p_{WE})$  and the leeward suction  $(p_{LE})$  include exterior effects only (internal effects cancel) as shown in Figures D-4 and D-5. The area over which these pressures act is illustrated in Figure D-27 and is calculated as follows:

 $A_{end_2} = (2 \times Wt) \times h_n + (Wt)^2 \times tan 20^\circ$ 

The combined longitudinal resultant force for a multi-section unit is:

$$\mathbf{P}_{\mathrm{HE}} = \left(\mathbf{p}_{\mathrm{WE}} + \left|\mathbf{p}_{\mathrm{LE}}\right|\right) \times \mathbf{A}_{\mathrm{end}_2}$$

and Cp = -0.275 for multi-section units in the calculation of  $(p_{LE})$  as required above.

3. Sliding Force on the Superstructure: The sliding force is distributed to the two longitudinal exterior superstructure walls and then to the floor diaphragm as follows:

$$F_{SL} = \frac{P_{HE}}{2 \times L}$$

4. Resisting Force supplied by the Superstructure: Same discussion applies as for single-section units.

5. Required Horizontal Anchorage Force: The same discussion applies as for single-section units. The longitudinal sliding force, distributed to each exterior longitudinal wall, per foot of length of unit is:

 $Ah = 1.5 \times F_{st}$ 

Note if 4 lines of vertical X-bracing are to carry the sliding force ( $F_{SL}$ ) as depicted in Figure D-26 then:

$$Ah = \frac{1.5 \times F_{SL}}{2}$$

C. Horizontal Anchorage with X-Bracing. The calculation of (Ah) is necessary to proceed to analyze X-bracing. Refer to Figure 6-11 and section 603-6.F for illustration and explanation of the horizontal anchorage with X-bracing in the longitudinal direction:

Note: X-bracing is typically used for Type C units. Only Perimeter longitudinal foundation walls would typically be required for Type **E** or **I** units.

D-300.7 REQUIRED HORIZONTAL AN-CHORAGE BASED ON SEISMIC IN THE LONGITUDINAL DIRECTION. Refer to Figure D-28 for the free-body diagram of the superstructure and foundation for single section and multi-section units, illustrating the horizontal forces due to longitudinal sliding from seismic forces. The longitudinal sliding force (Ah) is not influenced by the foundation Type C, E or I. The same free-body diagram is used for the analysis; however, the detailing does differ based on foundation Type C, or E and I. The Type E or I foundation, where structural exterior longitudinal foundation walls are used, is similar to that illustrated for wind in Figure D-25. A Type C unit, where non-structural exterior longitudinal walls are typically used, incorporates vertical X-bracing planes along the chassis beam lines for longitudinal sliding resistance is similar to that illustrated for wind in Figure D-26. Figure D-7 illustrates the seismic terms and is related to the equation development found in section D-200.5.B. and E.7. and E.8. for the calculation of horizontal inertia floor and roof forces. These forces are the same magnitude in the transverse and longitudinal directions. For allowable stress design methodology, the load combination from ASCE 7-93 is: (Seismic)-DL.



Figure D - 27

### A. Seismic Force Considerations for the Type C, E and I Single-Section Units.

1. General: Figure D-28 shows all the applied and resisting forces involved in the horizontal equilibrium equations. The seismic inertia floor and roof forces are transferred into the roof (plus ceiling) and floor diaphragms. The roof (plus ceiling) diaphragm transfers the force into the exterior superstructure shear walls parallel to the unit length, and then in turn to the floor diaphragm, assuming all connections are properly designed to resist the horizontal inertia forces. From the floor diaphragm the horizontal force is transferred into the exterior (longitudinal) foundation shear walls for Type E or I units, or is transferred from the exterior walls to the vertical X-bracing planes under chassis beam lines for Type C units. Figures D-25 and D-26,

drawn for wind loads, can be similarly applied. Also, reference Figure 6-6 for further illustration of both longitudinal resistance systems. It is assumed that the exterior superstructure shear walls can transfer their force through the floor diaphragm and send the total sliding force over to the chassis beam lines for the Type C foundation.

- 2. Seismic Loads on the Superstructure: Calculation of the seismic inertia forces is the same as that determined for the transverse direction seismic related sliding found in section D-200.5.B and E.7. and E.8.
- 3. Sliding Force on the Superstructure: The sliding force is distributed to the two longitudinal exterior superstructure walls and then to the floor diaphragm in lbs/ft of length as follows:



Seismic Related Sliding - Longitudinal Direction



$$F_{\rm SL} = \frac{\left(F_{\rm xr} + F_{\rm xf}\right)}{2}$$

4. Resisting Force supplied by the Superstructure: The unreliability of friction to provide horizontal resistance to sliding during a seismic event requires :

Fr = 0: for all foundation types

5. Required Horizontal Anchorage The longitudinal sliding Force: force (A<sub>h</sub>), without any assumed frictional resistance, is the same magnitude as the sliding force on the superstructure (F<sub>SL</sub>). This sliding force (Ah) must be resisted by connections between the superstructure and the longitudinal foundation shear walls for Type E or I Foundations, and it must be resisted by vertical X-bracing planes for Type C foundations. The appropriate factor of safety is assumed to be 1.5 (as for overturning). Refer to section D-300.2.A.5 for a full description. The longitudinal sliding force per foot of length of unit is:

 $Ah = 1.5 \times F_{SL}$ 

# **B.** Seismic Load Considerations for the Type C, E and I Multi-Section Units.

1. General: The analysis process is the same as for single-section units, except that the dead load for the multi-section unit is greater than the single section unit, and the inertia forces will be greater. Figures D-24 to D-26, although illustrating wind loads, are similar for the multisection unit information required for seismic forces.

- 2. Seismic Loads on the Superstructure: Calculation of the seismic inertia forces is the same as that determined for the transverse direction seismic related sliding.
- 3. Sliding Force on the Superstructure: The sliding force is distributed to the two longitudinal exterior superstructure walls and then to the floor diaphragm in lbs/ft of unit length as follows:

$$F_{SL} = \frac{\left(F_{xr} + F_{xf}\right)}{2}$$

- Resisting Force supplied by the Superstructure: Same discussion applies as for single-section units. Thus, (Fr) = 0.
- 5. Required Horizontal Anchorage Force: The same equation applies as for single-section units. The longitudinal sliding force per foot of length of unit is:

$$Ah = 1.5 \times F_{SL}$$

C. Horizontal Anchorage with X-Bracing. The calculation of (Ah) is necessary to proceed to analyze X-bracing. Refer to Figure 6-11 and section 603-6.F for illustration and explanation of the horizontal anchorage with X-bracing in the longitudinal direction:

Note: X-bracing is typically used for Type C units. Only Perimeter longitudinal foundation walls would typically be required for Type E or I units.
# APPENDIX E OWNER'S SITE ACCEPTABILITY WORKSHEET

Owner's Name:	
Address:	
-	
-	
Telephone:	
Site Location:	
Legal Description:	
-	
_	
Have you provided a	a copy of a map pinpointing the site? yes no
Have you submitted (See #10 of Manufac	

#### **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) ft.
- 2. Is the building in a flood-prone area? (201-2)yes noIf 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 no
·	7.	Provide geotechnical report if adverse site conditions are found or suspected. (203)	yes no
	8.	Provide site-drainage plan complying with CABO R301.3 or local requirements. (301)	yes no
	9.	Provide fill specifications if site is to be prepared with earth fill. (303-2)	yes no
	10.	If a geotechnical report is required, what is the net allowable soil bearing pressure? (202)	psf.
	11.	If no adverse soil conditions are known or suspected, and if the home is individually sited, assume a soil bearing pressure of 1,000 psf. and use this value when a determination of soil bearing pres- sure is called for.	1,000 psf.
		•	

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# APPENDIX E MANUFACTURER'S WORKSHEET

Manufacturer's Company Name:		· · · · · · · · · · · · · · · · · · ·	
Address:		entre en la construcción de la construcción de la construcción de la construcción de la construcción de la cons La construcción de la construcción d	
		n an an an an an an an an an an an an an	
			······································
Telephone:			
	Building Structure and Size hall provide the following inform	n an an an an an an an an an an an an an	
The manufacturer s			
1. Type of unit	in an an an an an an an an an an an an an		Single-Section Multi-Section
2. Method, loca Refer to Figu Is the home a	res 6-7 and 6-8 and Section $601-$		
3. Length of un	it $\mathbf{L}_{\mathrm{constraint}}$ , the constraint of the factors	n an an an an an an an an an an an an an	ft.
4. Actual width			ft.
5. Height of ext	erior wall **	en de la deserver. Transformer	ft.
6. Height of roc	f peak **	e tettelli serene e	ft.
7. Roof slope **			
8. Self weight o	f total unit (W) including mechar	nical equipment **	lbs.
9. Distance betw	veen chassis members		ft.
10. One foundati (C1-C4; E1-)	on design concept (See Appendix E8; or I)	A)	

11. Recommended pier spacing \*\*

	a. Exterior		_ ft.
	b. Interior		_ 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)		ft.
	(Number)	(Spacing)	
12.	One installation method recommendations (include documenta- tion showing connection details pertinent to geographic area for seismic or wind). **	vec no	
		yes no	
13.	Interior shear wall locations (include documentation showing lo- cations). **	yes no	
14.	Design wind speed used in designing connection details for hori- zontal anchorage (Ah) and vertical anchorage (Av) in the trans- verse direction. **		
·	verse direction.		mph.
15.	Seismic acceleration values used in designing connection details <u>Av</u> for horizontal anchorage (Ah) in the transverse and longitudinal directions. ** Aa		
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 **	(or lbs./tie-do	lbs./ft.
	The set of the first of the first of the set		
	c. Rated connection capacity for sliding in transverse direction **	(or lbs./diag.	lbs./ft. strap)
	d. Rated connection capacity for sliding in longitudinal direction **		lbs./ft.
	e. Vertical X-bracing tension strap capacity **	lbs./diag. stra	.p

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:		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·		2
Address:	· · · · · · · · · · · · · · · · · · ·				
Builder's Name:					1 .
Site Location:					
	PART 1: SITE ( (Accompanie)		an an an an an an an an an an an an an a		
1. Has the Man	ufacturer's Worksheet been prov	vided?		ves no	r.
Existing Grade Ele	evation (201-1)				
(Answer yes flood zone; 3	require a survey? if: 1) elev. to be altered by grade ) subdivision. Answer no if ind of building site.)		ur	ves no	
3. If yes to above	ve, what is the surveyed existing	grade elevation?			_ ft.
Flood Protection E	Elevation (201-2)				
	ng site in a flood zone? hen answer 5, 6, 7 & 8. If no, sk	tip to 9.)	, y	es no	
5. What is the E tion (use high	Base Flood Elevation or the Floo nest value)?	d Protection Eleva	111  -  - 		_ ft.
6. Is the site to l (If no, skip to	be graded, filled, or bermed?		У	es no	
7. If yes to 6, ha	ave all permits been provided?			es no	
tions?	en are the buildings to be built or andbook cannot be used. Refer	an an an an an an an an an an an an an a	y y	es no	

## Frost Penetration Depth (201-3)

9.	What is the maximum frost penetration depth? (see Appendix H, page H-4)			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	
10Ъ.	Does foundation plan show base of footing extending below top- soil layer (min. 12") to undisturbed soil?	yes	no	: · ·
Grou	nd 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 record Geotechnical Engineer will be required (applies to subdivisions and individed)			-
	Organic soil (8" topsoil layer)	yes	no	
<i>,</i>	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 of above, move to next step.)	yes.	If no, to	o all
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.)	· · · · · · · · · · · · · · · · · · ·	•	
15.	Has applicant complied with CABO R-308 or local ordinance for construction procedures and treatment? (If yes, continue; if no, refer applicant to CABO requirements.)	yes	no	

.

### **PART 2: SITE PREPARATION** (Accompanies Chapter 3) 16. Acceptable surface drainage plan provided? (301) yes no (If no, one must be provided for subdivision) 17. Grading plan provided? (302) yes no 18. Fill specifications conforming to those cited in HUD Land Planning Data Sheet (79g)? (303) yes no (If fill is used, below the home's foundation, a report by Geotech. Eng. should be submitted to provide fill specifications.) 19. Finish grade elevation? (304) (Check answers to Part 1: #4 & #5. The finish grade elevation must be higher than #5 if in flood zone.) PART 3: DESIGN LOADS (Accompanies Chapter 4) Information from Manufacturer's Worksheet 20. Has all the information been provided on the Manufacturer's Worksheet? (Appendix E) ves no 21. What is the building self weight (W)? lbs. (Mfg. Wksht. #8) 22. What is the building length (L)? ft. (Mfg. Wksht. #3) 23. What is the distributed weight per foot of unit length? (w=W/L)Ibs./ft. (402-1.B, C) 24. What is the building type? Single-Section (Mfg. WkSht. #2) Multi-Section C, E, or I Foundation design concept? (C1, C2, C3, C4, E1, E3, E4, E5, E6, E7, E8, I)

# Dead Load (402-1)

25.	What is the light dead load value from Table 4-1?		*
	(402-1.A.1)	(lbs./ft.)	-
26.	What is the heavy dead load value from Table 4-1? (402-1.A.2)	(lbs./ft.)	*
27.	Does the answer from Question #23 fall within the values in #25 and #26? (402-1.D) (If the answer is yes, continue. If no, the foundation is not within the limits of this document and must be redesigned by a structural engineer.)	yes no	
Snow	Load (402-2) / Minimum Roof Live Load (402-2.C)		
28a.	What is average annual ground snowfall (Pg)? (See Ground Snow Load map, pages H-11, H-12 and H-13.)	(lbs./sq.ft.)	*
28b.	What is 0.7 multiplied by Pg?		psf.
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)		psf.
30.	Record the larger magnitude of item 28b or item 29b. Use this magnitude for roof load where required.		psf.
Wind	Load (402-3)		
31a.	What is the basic wind speed (V)? (See Wind Speed map, page H-14.)		mph
31b.	If V is less than 80 mph, record MPS min. 80 mph for wind design. (402-3.A)		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)				_ 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.)	n Norman (* 1	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 clarifica-tion.)		yes	no	
Seisn	nic Load		an an an an an an an an an an an an an a		
38a.	What are the seismic acceleration values? (See Seismic maps, pages H-15 and H-16)	<u>Aa</u>	<u></u>		* '
		<u>Av</u>	<u></u>		*
38b.	Is $\underline{Av} < 0.15$ ? (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.)	: . <u>/</u>			
40.	What is the applicant's proposed design concept? (Design Wksht. #24)		<u></u>		*
41.	Do the Foundation Design Concept Tables approve the foundation system for use in seismic areas of Question #38 above? (See Ap- pendix 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)	з÷.	· . · · · ·		
42.	What is the actual building width? (Mfg. Wksht. #4)		·····		ft.

v.

43.	The nominal building width to be used in the Foundation Design Tables, (Aftg, Av & Ah) is Wt: (600-2.A and Figure 6-1)	1	ft.
44.	Where are the foundation supports located? Check drawings submitted by the owner and Foundation Design Concepts in Appendix A. Circle the support locations shown on the Manufacturer's foundation concept plan.	Chassis Beam Exterior Wall Marriage Wal	.S
45.	Do these locations match the Foundation Concept shown in Ap- pendix 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)		*
48.	(Mfg. Wksht. #11)	4' 5' 6' 7' 8' 4' 5' 6' 7' 8' 4' 5' 6' 7' 8'	
			А.
	Largest or Average Marriage Wall Opening: Tie Down (C1)		ft.
Requ	APPENDIX B ired 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.)		*
	The Required Exterior Square Footing size is: Type C	· · · · · · · · · · · · · · · · · · ·	sq.ft.
	• Type E or I	(width)	ft.

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5	<ol> <li>The Required Interior Footing area is: (Also exterior piers for foundation type E)</li> </ol>	sq.ft.
51	a. The Required Continuous Marriage Wall Footing area is:	sq.ft.
51	b. The Required Footing area under posts at the ends of marriage wall opening(s) is:	sq.ft.
Ve	rtical Anchorage Requirements in the Transverse Direction (602-4)	
52	a. Using the Foundation Design Load Tables (Appendix B, Exterior Av Part 2), determine the Required Vertical Anchorage.	* (lbs./pier spacing; lbs./ft for E type; lbs./tie-down spacing)
521	b. Number of vertical tie-down locations for multi-section units:	2 or 4 or 6
52	c. For units with additional vertical anchorage at the interior piers, determine the Required Vertical Anchorage. Interior Av	* (lbs./int pier spacing)
5:	3. What is the manufacturer-supplied value?       Exterior         (#16b, Mfg. WkSht.)       Interior	
54	<ol> <li>Is this value (#53) greater than the value given in #52a?</li> <li>(If yes, continue. If no, return to owner for clarification.)</li> </ol>	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	4	6	
•				
	yes	yes	yes	
	no	no	no	
		· · ·		
				ft.

			trial 1	trial 2	trial 3	T
56.	Using the tables, find the Required Horizontal Anchorage (Ah). (Appendix B; Part 3)	End Wall Ah				lbs./ft.
		Int Wall Ah				lbs./ft.
		In wan An				103./10.
57a.	What is the manufacturer's-supplied rated ca- pacity for sliding? (#16c, Mfg. WkSht.)	na 1997 Maria Maria				lbs./ft.
57b.	If answer to item #55b is yes, record manufac- turer or product supplier rated strap tension ca- pacity					lbs./strap
58a.	Is value #57a greater than item #56?	· · · ·	yes	yes	yes	
- - - -	If yes, continue. If no, return to section 602-4.C and to question #55a and select a	en antra a sub- a sub-	no	no	no	
	If the maximum number selected (6) does not work, return to owner (who may wish to con- tact the manufacturer for clarification).	· .				
58b.	If answer to #55b is yes, required tension in diagonal ( $T_t$ ). (Complete procedure in Section 602.5.G.1.)					lbs.
58c.	If yes, continue to item #62. If no, return to		yes no	yes no	yes no	
58b.	pacity 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 con- tact the manufacturer for clarification). If answer to #55b is yes, required tension in di- agonal (T <sub>t</sub> ). (Complete procedure in Section 602.5.G.1.) Is value #57b greater than #58b?		no yes	no	no	lbs.

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.)

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



		trial 1	trial 2	trial 3	lbs./
	c. Required horizontal anchorage (C) value, based on for- mula. (602-5.G.2.c)		an an an a' a' a' a' a' a' a' a' a' a' a' a' a'		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 ca- pacity? (#16, Mfg. WkSht.) (or capacity defined by literature supplied by product supplier)				lbs. *
61a	Is value #57 greater than value #59c?	yes	yes	yes	
014.	If yes, continue. If no, return to Section 602-5.G and to	no	no	no	
	question #59 and select a greater number of X-brace loca-			1	
	tions as a next trial. Repeat until answer is yes, then con-		• . •		
	tinue.				
61b.	Is value #60 greater than value #59e?	yes	yes	yes	
	If yes, continue. If no, return to section 602-5.G and to	no	no	no	
	question #59 and select a greater number of X-bracing loca-				
	tions. If the maximum number selected does not work, re- turn to owner (who may wish to contact the manufacturer for clarification or product supplier for clarification).				
Horiz	contal Anchorage Requirements In The Longitudinal Direct	ion (602	-6)		
62a.	Using the tables, find the required horizontal anchor- age (Ah) in the longitudinal direction. (Appendix B, Part 4) (602.6.E) Exteri	or Wall .	Ah		lbs./ft.
62b.	If using vertical X-bracing planes (and the formulas in sec- tion 602-6.F) determine anchorage value for X-bracing planes. (If using exterior long walls, skip to item #63.)				
		trial 1	trial 2	trial 3	
	1. Number of chassis beam lines used for vertical X- bracing planes.	2 or 4	2 or 4	2 or 4	
					-

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	trial 1	trial 2	trial 3	
Number of X-bracing planes proposed under each chas- sis beam along the length of the unit.				
2. Horizontal anchorage (B) required force, based on for- mula.				lbs.
3. Assumed height (h-b) based on Figure 6-11.				ft.
4. Tension $(T_L)$ based on formula. (602-6.F.(3)).				lbs.
63. What is the manufacturer-supplied value for horizontal an- chorage? (#16d, Mfg. WkSht.)				lbs./ft.
<ul><li>4a. For shear walls: is value #63 greater than #62a?</li><li>If yes, skip to item #67. If no, contact owner for clarifica- tion.</li></ul>	yes no	yes no	yes no	
4b. For X-bracing: is value #63 greater than value #62b.2? If yes, return to item #62b.3. If no, increase number of ver- tical 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)		· .		lbs.
56. 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	

### Withdrawal Resistance Verification (603-2.B)

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.



<b>a.</b>	<b>71</b>	Reinforced Concrete
		Masonry-Fully Grouted Masonry-Grouted @ 48" o.c. All-Weather Wood / Footing
 	<ol> <li>Using Table C-1, which capacity is greater than required Av? (603-2.B.(1)) (#52a)</li> </ol>	lbs./ft.
	<ol> <li>Using Table C-1, what is the height of the wall + footing for required withdrawal resistance? (hw + 6")</li> </ol>	in.
	3) What is the height of the wall + footing for frost protec- tion? (frost depth (#9) + 12")	in.
	4) What is the greatest height #67a.2 or #67a.3?	in.
an di sa Manana ang kanana ang kan Manana ang kanana ang ka	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?	"
	<ul><li>7) Is item #67a.6 greater than or equal to item #49?</li><li>If yes, continue. If no, change footing width to item #49.</li></ul>	yes no
18°.	8) Record design exterior wall footing width.	in.
b.		12" rost epth Wf =
	Reinfor	ced Concrete ced Masonry - fully grouted ced Concrete Dead-man
		*

				Exterior	Interior	
			••••••••••••••••••••••••••••••••••••••		(when used)	
		1)	Using Table C-2, which capacity is greater than required Av? (#52a and #52c) (603-2.B.(2))			lbs./pier *
		2)	Using Table C-2, what is the height of the pier + footing for required withdrawal resistance? (hp + 8")	tean an an the <u>an an the second</u>	· · ·	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.
8 - L			$\boldsymbol{\omega}$	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.	foc	ost depth for marriage walls. What is the required depting below grade for frost protection? (frost depth (#9 withdrawal resistance)	<b>-</b> ·		in.
Verti (603-2			horage and Reinforcement for Longitudinal Found	lation Walls a	and Piers	
68.	fou typ	inda be E	Appendix C, Table C-3, C-4A or C-4B, verify that the ation anchors will resist uplift. Answer question #68a . Answer question #68b for types C, I, or type E with the anchorage.	for		
	а.		rtical Anchor Capacity for longitudinal foundation w pe E). (603-2.D.2)	vall		
		1).	Using Table C-4A (concrete & masonry), which capa is greater than the required Av? (#52a, Design Wksht If treated wood wall, skip to item #68a.3.	)	/lineal ft. of v	vall

`

	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.
	<ul> <li>B) Using Table C-4B (wood), which capacity is greater than the required Av? (#52a, Design Wksht.)</li> <li>If using concrete or masonry wall, skip to item #68b.</li> </ul>	./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.
. (	Vertical Anchor Capacity for Piers Types C. I. or type E with interior pier anchorage) 603-2.D.1)	
	<u>Exterior</u>	Interior (when used for anchorage in multi-section units)
	) Using Table C-3, which capacity in the table is greater than the required Av? (From #52a, Design Wksht.)	lbs./pier

•

	Exterior	Interior	-
2) Using Table C-3:			
a) Number of anchor bolts	1 or 2	1 or 2	
b) Anchor diameter	1/2" or 5/8"	1/2" or 5/8"	
3) Using Table C-3A:			
a) Rebar size	#4 or #5	#4 or #5	
b) Lap splice	· · · ·		in.
c) Rebar hook length			in.
Horizontal Anchorage and Reinforcement for Transverse Foun	dation Walls	s (603-3)	
tion anchorage will resist sliding at the transverse end founda walls. Use for types C, E, or I.	End Wall	Interior Wall	
a. For continuous foundations.			
a. For continuous journations. Using Table C-5A (concrete & masonry) or C-5B (wood), which capacity is greater than the required (Ah) (603-3) (item #56)?			lbs./ft.
Using Table C-5A (concrete & masonry) or C-5B (wood), which capacity is greater than the required			lbs./ft.
Using Table C-5A (concrete & masonry) or C-5B (wood), which capacity is greater than the required (Ah) (603-3) (item #56)?			lbs./ft.
Using Table C-5A (concrete & masonry) or C-5B (wood), which capacity is greater than the required (Ah) (603-3) (item #56)? 1) Using Table C-5A, find:			
<ul> <li>Using Table C-5A (concrete &amp; masonry) or C-5B (wood), which capacity is greater than the required (Ah) (603-3) (item #56)?</li> <li>1) Using Table C-5A, find:</li> <li>a) Required anchor bolt diameter</li> </ul>			in.
<ul> <li>Using Table C-5A (concrete &amp; masonry) or C-5B (wood), which capacity is greater than the required (Ah) (603-3) (item #56)?</li> <li>1) Using Table C-5A, find: <ul> <li>a) Required anchor bolt diameter</li> <li>b) Required anchor bolt spacing</li> </ul> </li> </ul>			in.
<ul> <li>Using Table C-5A (concrete &amp; masonry) or C-5B (wood), which capacity is greater than the required (Ah) (603-3) (item #56)?</li> <li>1) Using Table C-5A, find: <ul> <li>a) Required anchor bolt diameter</li> <li>b) Required anchor bolt spacing</li> <li>c) Using Table C-3A:</li> </ul> </li> </ul>			in. in.
<ul> <li>Using Table C-5A (concrete &amp; masonry) or C-5B (wood), which capacity is greater than the required (Ah) (603-3) (item #56)?</li> <li>1) Using Table C-5A, find: <ul> <li>a) Required anchor bolt diameter</li> <li>b) Required anchor bolt spacing</li> <li>c) Using Table C-3A:</li> <li>(1) Rebar size</li> </ul> </li> </ul>			in. in.
<ul> <li>Using Table C-5A (concrete &amp; masonry) or C-5B (wood), which capacity is greater than the required (Ah) (603-3) (item #56)?</li> <li>1) Using Table C-5A, find: <ul> <li>a) Required anchor bolt diameter</li> <li>b) Required anchor bolt spacing</li> <li>c) Using Table C-3A:</li> <li>(1) Rebar size</li> <li>(2) Lap splice</li> </ul> </li> </ul>			in. in. * in.

	End Wall	Interior Wal	
b) Minimum plywood thickness			in.
c) Required anchor bolt diameter			_ in.
d) Required anchor bolt spacing		· · · · · · · · · · · · · · · · · · ·	_ in.
b. For transverse short foundation walls completed with (603-5)	diagonal brac	es.	
Using Appendix C, Table C-5A, verify the diagonal anchorage capacity to the short foundation wall.			1 - J
and a start of the start for a start of the start of the start of the start of the start of the start of the st The start of the star	End	Interior	
<ol> <li>Record the required horizontal force (Ah × Wt) from 602-5.G.1.a and item #56.</li> </ol>			_ lbs.
<ol> <li>Table C-5A capacity for one 1/2" diameter bolt at 12" o.c.</li> </ol>	1800	1800	_ Ibs.
<ol> <li>Number of bolts (Ah × Wt ÷ 1800; one minimum) at concrete or masonry top of short wall.</li> </ol>		· · · · · · · · · · · · · · · · · · ·	*
4) Size of anchor bolts			in.
5) Using Table C-3A:			
a) Rebar size		<u> </u>	*
b) Lap splice	. <u></u>		in.
c) Rebar hook length			in.
c. For vertical X-bracing planes in the transverse direction (603-6)	on.		
Using Appendix C, Table C-5A, verify the diagonal and to the pier footings and the tension capacity of the diagonal to the pier footings and the tension capacity of the diagonal descent of the diago			
1) Record the required horizontal force (C) from item #	#59c.		lbs.
2) Table C-5A capacity for one 1/2" diameter bolt at 12	2" o.c.	1800	lbs.

<ol> <li>Number of bolts (C ÷ 1800; one minimum) at top of a footing.</li> </ol>	*
4) Record the required tension force $(T_t)$ from item #59e.	lbs./diag.
<ol> <li>Select tension strap capacity greater than or equal to T<sub>t</sub> from owner's product supplier or manufacturer's supplied capacity (item #60).</li> </ol>	lbs./diag.
6) Record diagonal strap data	
Horizontal Anchorage for Longitudinal Coundation Walls (603-4)	
<ul> <li>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.</li> </ul>	
a. For continuous exterior foundation walls.	
Using Table C-5A (concrete and masonry) or Table C-5B (wood), which capacity is greater than the required exterior Ah? (602-6.E) (item #62a)	lbs./ft.
1) Using Table C-5A, find:	
a) Required anchor bolt diameter	in.
b) Required anchor bolt spacing	in.
c) Using Table C-3A:	
(1) Rebar size	*
(2) Lap splice	in.
(3) Rebar hook length	<u> </u>
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. <u>1800</u> lbs.
- 3) Number of bolts ( $B \div 1800$ ; one minimum)
- 4) Record the required tension force  $(T_L)$  from item #62b.4.
- 5) Select tension strap capacity greater than or equal to  $T_L$  from owner's product supplier or manufacturer's supplied capacity (item #60).
- 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.

Required Effective Footing Area from questions #49, #50, & #51.

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)



lbs./diag.

lbs./diag.

	<b></b>	Pi	ers	_	
	Marriage W		ge Wall	•	
	<u>Exterior</u>	Interior	Cont.	At Post	
Pier Footing Sizes (largest of			4 .		
above)			· · · ·		sq.ft.
<u>.</u>					
"Dead-man" footing size.		sq.ft.			

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

		Ex	terior	Interior	
	Number of anchor bolts		· .	<u>.</u>	
	Anchor bolt diameter	  	·	· · · · · · · · · · · · · · · · · · ·	in.
	Rebar size	 			
	Lap splice	<u> </u>		. <u></u>	in.
	Rebar hook length			Marriage	in.
	Externation Footing depth: grade to bottom of footing	rior Int	erior	Wall	in.
	Pier footing and "dead-man" footing reinford	ing bars:		#4 at 10" o.c.	
	"Dead-man" footing depth: grade to bottom	of footing			in.
2.	Long Foundation wall footing: type E or I:				
	Required Effective Footing Width				
	Required Footing Width for soil bearing (#4	<b>)</b> )	· ·		ft.
	Required Footing Width to resist uplift with (#67a.6)	irawal		· 	ft.
	Wall Footing Size (largest of above)				ft.
	Footing Depth: Grade to bottom of footing (a	‡67a.5)			in.

		Footing reinforcing bars.		2 #4 bars	-
		<u>Reinforcing for longitudinal foundation walls:</u> Re swers from item #68a and record sizes and spacing	cord an- gs.		
		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 #68 record sizes and spacings.	3a.4 and		
		Required nailing			
		Minimum plywood thickness.			in.
		Required anchor bolt diameter			
		Required anchor bolt spacing			in
b.		orizontal anchorage in the transverse direction - f tion walls	oun-		
	1.	Continuous foundation walls (#69a)	·		
		Number of transverse foundation walls (#55a)		2 4 6	
		Required Footing Width (minimum)		12	in.
		From #69a.1: concrete / masonry:	·		
			End Wall	Interior Wall	
		Anchor bolt diameter	· · · ·		in.

•

η.

		End Wall	Interior Wal	1
	Anchor bolt spacing		<u> </u>	_ in.
	Rebar size			_
	Lap splice	·		_ in.
	Rebar hook length	. · · · · · · · · · · · · · · · · · · ·	<u>.</u>	_ in.
	From #69a.2: wood:			_
	Required nailing	· · · · · · · · ·		
	Minimum plywood nailer			-
	Anchor bolt diameter			-
	Anchor bolt spacing		<del>_</del>	- in.
2.	For transverse short foundation walls completed wit agonal braces (#69b)	h di-		_
	Number of pairs of diagonals (1 for single- section units, 2 for multi-section units) times number of short walls (end or interior) (#55a)	End	Interior	-
	Diagonal spacing (same as number of short walls)	<u> </u>	<u></u>	_
	From #69b: concrete / masonry:	· · · · ·	·	-
	Anchor bolt diameter	· · ·		_ in:
	Number of bolts	· · · · · · · · · · · · · · · · · · ·	- · ·	_
	Rebar size			_
	Lap splice			_ in.
	Rebar hook length			in.

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

Number of X-brace locations (#59)

Spacing of vertical X-brace planes (#59)	ft.
Items from #69c.3 and #69c.5	
Required anchor bolt diameter	in.
Number of bolts at top of footing to connect diagonal	
Diagonal strap size	i
Connection to top flange of chassis beam (describe)	
c. Horizontal anchorage in the longitudinal direction - exterior foundation walls	
1. Continuous foundation walls	
<u>Reinforcing for longitudinal foundation walls:</u> record only if larger sizes or closer spacing than recorded for vertical anchorage (#71a.2).	ž
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	• <u> </u>
Anchor bolt spacing	in.

# APPENDIX G SAMPLE PROBLEMS

All the data necessary for the approval of the adequacy of a permanent foundation for the manufactured home can be located in this handbook and on worksheets submitted by the homeowner. The HUD field office (or user) must refer to Design Worksheet as a guide through the process of collecting and verifying data.

There are two steps in the approval process: (1) the Owner's Site Acceptability / Manufacturer's Worksheets, with accompanying forms as required, from the owner, and (2) the Design Worksheet. The reader is referred to the completed worksheet samples in Appendix E.

**Example #1** is a proposed site for a multisection manufactured home in Champaign, Illinois. The marriage wall has two adjacent large openings of 16 and 12 feet respectively. The remainder of the wall is continuous. Both the Owner's Site Acceptability / Manufacturer's Worksheet and the Design Worksheet for Example 1 have been filled out. Asterisks (\*) on the Design Worksheet mark the items that were filled in based on data submitted by the owner. The remaining data on the Design Worksheet must be collected from the handbook as described herein.

#### COMMENTS - EXAMPLE # 1

#### Item # DESIGN WORKSHEET

#### Part 1 -- Site Conditions

9. Refer to the Average Depth of Frost Penetration map on page H-4. The average frost depth for Champaign Illinois is 30 inches.

- 14. Refer to the Termite Infestation map on page H-10. The site is in a moderate to heavy infestation region.
- 15. The owner has indicated compliance with CABO R.308.

#### Part 3 -- Design Loads

21. Calculate the distributed weight per foot of length by dividing the total weight of the home by its length: 33,040/56=590 lbs./ft.

#### Dead Load

- 25. From Table 4-1 (402-1.A1). The light dead load value is 560 lbs./ft.
- 26. From Table 4-1, the heavy dead load value is 805 lbs./ft.

27. Yes, the distributed weight of the home is within the limits defined by this document. The design tables may be used.

#### Snow Load

- 28. Refer to the Ground Snow Load (Pg) map on page H-12 for the central United States. The average ground snow load is 20 psf.
- 29. Refer to Section D-200.2.B for minimum roof live load based on roof slope. For a 2 in 12 roof slope, the minimum roof live load is 20 psf.
- 30. Comparison of roof snow load (14 psf) and minimum roof live load, minimum

roof live load is greater; therefore, it controls.

#### Wind Load

- 31. Refer to the Design Windspeed map on page H-14. The site location is near the 70 mph design wind isobar. Use minimum 80 mph for MPS in lieu of map value.
- 32. Based on the map provided by the owner, the site is not near a hurricane coastline. The site is Inland.

#### Seismic Load

- 38a. Refer to the maps for Seismic acceleration <u>Aa</u> and <u>Av</u> on pages H-15 and H-16. The site has Seismic acceleration values: <u>Aa</u> = 0.05 and <u>Av</u> = 0.05.
- 38b. Residential construction is exempt from seismic considerations if  $\underline{Av}$  is less than 0.15.
- 41. Checking the Foundation Design Concept Tables for Type E1, this foundation type is not recommended for seismic areas where <u>Aa</u> and <u>Av</u> are greater than or equal to 0.3. This is because the piers are unreinforced. The Type E1 concept is permitted in seismic areas where <u>Aa</u> and <u>Av</u> are greater than 0.3, if the piers are reinforced.

#### Part 4 -- Final Design Procedure

- 42. From the table (600-2.A.1), the nominal width for a 13'-6" home width is 14'-0".
- 44. The user will compare the Foundation Design Concept, Figures 6-7 and 6-8 with foundation drawings and details provided by the owner. The concept drawings identify the bearing and vertical anchorage locations. An anchorage system for the

transverse and longitudinal directions must be clearly shown on the documents provided by the owner.

#### Required Footing Size

49. In order to determine the Required Footing sizes, the user needs the data from the following items on the Owner's Site Acceptability Worksheet: Nos. 10 or 11 and on the Design Worksheet: Nos. 24, 30, 43, 48.

Item Number

#30

#43

#48

- #10 or #11 Net allowable soil bearing pressure = 1000 psf
- #24 Foundation System, Multi-Section type E1
  - Ground snow load Pg = 20psf. Use 30 psf for the Foundation Design Table. The 30 psf value with load factors applied is equivalent to a minimum live load of 20 psf.

Nominal Building width: Wt = 14'-0"

Pier Spacing: Interior and exterior piers, 5'-0"; Continuous Marriage wall piers, 8'-0".

Next the user will locate the Required Effective Footing Area tables in Appendix B, Part 1. The user locates the table for a multi-wide E with a nominal width of 14 feet.

- 49. The user finds a note which indicates that the minimum longitudinal foundation wall footing width is 1 foot.
  - 50. Interior pier and exterior pier

- 1) For the interior and exterior piers, the user finds the block of values for minimum roof live load of 20 psf.
- Next, the user finds the two rows of values for a Net Allowable Soil pressure of 1000 psf (read ext, int row).
- Under the column for a pier spacing of 5 feet, the required pier footing area is 2.1 square feet (1'-6" x 1'-6").
- 51a. Continuous Marriage Wall Piers
  - Refer to the same block of values as for the exterior/interior footings.
  - Next the user finds the second line of values for a Net Soil Pressure of 1000 psf (labeled mar).
  - Under the column for a marriage wall pier spacing of 8 feet, the required pier footing area is 6.9 square feet (2'-8" x 2'-8").
- 51b. Marriage Wall Openings
  - 1) Refer to the lower block of values as for the ext/int footing.
  - Next, the user finds the average of two adjacent openings from item#48 (14 feet). Read area of footing at piers under posts as 11.4 sq.ft. (3'-6"x3'-6").

Vertical Anchorage Requirements In The Transverse Direction

52. In order to determine the Required Vertical Anchorage the user needs the data from the following items on the Design Worksheet: Nos. 24, 31, 32, 43. With this information, the user can determine Vertiral Anchorage in the transverse direction by using the appropriate table in Appendix B, Part 2.

- The user locates the Tables for a Multi-Section E with a nominal width of 14 feet and 2 tie-downs.
- 2) Then the user finds a block of values for the Inland condition.
- 3) To the right of the 80 mph wind value, the user finds a value of 130 lbs./ft along the longitudinal exterior walls.
- 53. The user verifies that the manufacturer's design value (200 lbs./ft.) shown on line 16b of the Manufacturer's Worksheet is greater than the required value shown on line 52a. Otherwise repeat the process with four tie-downs.

Horizontal Anchorage Requirements In The Transverse Direction

- 55. Two (2) transverse foundation shear walls are initially selected in order to compare the required horizontal anchorage with the values provided by the manufacturer. This is trial #1.
- 56. In order to determine the Required Horizontal Anchorage the user needs data from the same items on the Design Worksheet that were required for Approval item number 52a plus item No. 22 (namely, the building length L = 56'-0''), No. 30, roof snow/minimum roof live load and No. 36, Seismic Acceleration values. Proceed knowing that you are exempt from seismic considerations.

Next, the user will locate the Required Horizontal Anchorage table in Appendix B, Part 3.

- The user locates the tables for a Multi-Section E with a width of 14 feet and two (2) transverse walls.
- Then the user finds the block of values for the Inland condition and the line of values for a design wind speed of 80 mph.
- Then the user finds Seismic <u>Aa</u> range 0.05-0.2 and snow load range 0-100 psf. Only one row of values remains.
- For a length L of 56 feet, the user rounds the value to the next highest number shown on the top line of the table -- 60 feet.
- 5) Under the column of values for 60 feet, the user finds the required anchorage Ah = 420 pounds per lineal foot along the length of each transverse shear wall. Note that the value was not grayed over, indicating the force calculations were controlled by wind.

Note: if the manufacturer has specified (1) diagonal metal straps to complete the transverse short foundation walls, or (2) vertical x-bracing in place of transverse foundation walls, for comparative purposes, the user shall use the formulas in section 602-5.G.1 or 602-5.G.2 and proceed with item #55b or #59 respectively.

58. Verify the Manufacturer's design value shown on line 57a (400 plf) is greater than the required value shown on line 56. Since it is not (420 > 400), attempt trial #2 ans consider 4 short walls. Repeat steps 1) to 5). Read (Ah) exterior 140 plf and (Ah) interior 280 plf, both less than the manufacturer's value 400 plf. Thus, 4 short walls will provide adequate sliding resistance.

#### Horizontal Anchorage in the Longitudinal Direction

62a. In order to determine the Required Horizontal anchorage in the longitudinal direction the user needs the same data as used in steps 52 and 56 from the Design Worksheet.

> Next, the user will locate the Required Horizontal Anchorage in the Longitudinal Direction tables in Appendix B, Part 4.

- 1) The user locates the table for a Multisection unit Type E with a nominal width of 14 feet.
- Then the user finds Seismic <u>Aa</u> range 0.05-0.1 and snow load range 0-100 psf.
- Then the user finds the block of values for the Inland condition and the row of values for a design wind speed of 80 mph.

 For a length L of 56 feet, the user rounds the value to the next highest number shown on the top row of the table -- 60 feet.

5) Under the column for 60 feet, the user finds the required anchorage force Ah = 67 plf along each of the longitudinal exterior shear walls. Note that the value was not grayed over indicating that the force calculations were controlled by wind, not seismic.

Note: if the manufacturer has specified a diagonal metal strap X-bracing in place of the shear wall, for comparative purposes, the user shall use the introduce in section 602-5.F, which are based n the required anchorage (Ah) found in the tables. This could be the case for Type C or I units.

64. Verify the manufacturer's design value on line 63 is greater than the required value shown on line 62a.

#### Withdrawal Resistance Verification

- 67. For type E foundations answer item 67a.
- 67a. For this example, a masonry foundation fully grouted was depicted on the documents submitted by the owner.
  - Checking the tabular columns of Table C-1, Appendix C, for Masonry-Fully Grouted, the lowest value greater than (Av) is 231 lbs. per foot. Thus, 231 > 130 (from item #52).
  - 2) The footing depth (Hw) is found in the far left column, hw = 2'0'. This value corresponds to the minimum depth of the footing below grade which is shown in the illustration above the table.
  - 3) The width of the footing is found at the top of the column, 12".
  - 4) Based on item #9, the frost depth for Champaign, IL. is 30 inches. Based on Table C-1, the depth of the base of the footing below grade is :

from Table C-1:

hw = 24" + 6" (footing thickness) 30" for withdrawalresistance

for frost protection:

hw = 30" (depth below grade) + 12" (min. wall height above grade) 42"

therefore; frost protection controls over withdrawal resistance

42" <u>- 12"</u> (min. wall height above grade)

30" (bottom of footing to grade)

for establishing the number of block courses:

42" <u>-6</u>" (footing depth) 36" min. required foundation wall height

Use hw = 40", which is a multiple of the 8" masonry unit -40" = 5 block courses.

- 5) Interior piers under (item #67b.3.) chassis beams do not participate in vertical anchorage for this example. Frost depth considerations are accounted for at the perimeter walls. Interior piers may be set below the 18 " of topsoil on undisturbed soil. See item #50 for required footing size.
- 6) Item #67c.; Marriage wall piers do not participate in vertical anchorage in any case, and do not need to set at frost depth. Again, set footings below the 18" of topsoil onto undisturbed soil.

#### Vertical anchorage and reinforcement for longitudinal foundation walls and piers

68. For type E foundations answer item 68a.

68a.

1) From item #52, the value for (Av) was 130 lbs./ft. Using Table C-4A for a ma-

sonry foundation wall, the first value in the left hand column is 146 lbs. per foot of wall. The 146 lbs./ft. value utilizes the maximum recommended anchor spacing by code as 6'-0" o.c. The wood material connected to the anchor bolt with a standard washer controls the final capacity. (Note the similarity in capacities with a treated wood foundation wall, Table C-4B, since wood bearing on washer controls).

- 2) For a masonry wall grouted solid, the following sizes are required:
  - On Table C-4A on the same line as +146 lbs./ft., read:
    - a) Anchor Bolt diameter = 1/2"
    - b) Anchor Bolt spacing = 72"
  - On Table C-3A on the same line as 1/2" anchor bolt diameter read:
  - c.1) Rebar size = #4
    - 2) Lap splice = 16''
    - 3) Rebar hook length = 6''

#### Horizontal Anchorage and Reinforcement for Transverse Foundation Walls

69a. From item number 56, the value for transverse (Ah) is 140 lbs. per foot along the transverse end (shear) wall and 280 lbs. per foot along the interior transverse walls. Using Table C-5A for a masonry foundation wall, the first value in the left hand column is 300 lbs. per foot of wall which is greater than either end or interior (Ah). The 300 lbs./ft. value is based on the maximum recommended anchor spacing of 6'-0" o.c. by code. The mate-

rial connected to the anchor bolt will control the final capacity.

- 1) For masonry walls grouted solid, the following sizes are required:
  - On Table C-5A: On the same line as Ah = 300 lbs./ft., read:
    - a. Anchor bolt diameter = 1/2"
    - b. Anchor bolt spacing 72" (cores must be grouted solid)

On Table C-3A: On the same line as 1/2" anchor bolt diameter, read:

- c.1) Rebar = #4
  - 2) Lap splice = 16"
- 3) Rebar hook length = 6''

#### Horizontal Anchorage and Reinforcement for Longitudinal Foundation Walls

70a. From item #62a, the value for longitudinal (Ah) is 67 plf. From Table C-5A, again the 300 plf value is adequate. All other information for reinforcement is the same along the exterior longitudinal walls.

#### Summary Sheet

The values can be brought forward on to the summary sheet and the design approved.

#### EXAMPLE 2

**Example #2** is a proposed site for a singlesection manufactured home in Tampa Florida. 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 data on the Manufacturer's Worksheet, regarding the superstructure, remains the same as Example #1 with the exception of the following items:

#### Item #

- 1. Single-section (Nominal 14' wide unit)
- 2. Type C
  - 7. Roof slope = 4 in 12
  - 8. Unit weight = 16,500 lbs.

Data

- 10. Type C1
- 11a. Pier Spacing = 7 ft.
- 11b. NA
- 11c. NA
- 11d. 7 Tie-down straps at 8'-8" spacing
  Note: Tie-downs are required to be at 2'-0" in from each end of the unit. (Section 601-2.B.)
- 14. Design wind = 120 mph
- 16b. Uplift capacity = 3,150 lbs./tie-down
- 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

Asterisks (\*) on the HUD Approval Worksheet mark the items that were filled in based on data submitted by the owner. As demonstrated in Example #1, the remaining data must be collected from the handbook as described herein.

#### Item # DESIGN WORKSHEET

#### Part 1 -- Site conditions

- Refer to the Frost Penetration map on page H-4. The average frost depth for Tampa Florida is zero inches.
- 14. Refer to the Termite Infestation map on page H-10. The site is in a very heavy infestation area.
  - 15. Yes, the owner has indicated compliance with CABO R-308.

Part 3 -- Design Load

23. The distributed weight is the weight of the home divided by its length:

16,500 / 56 = 295 lbs./ft.

- 25. From Table 4-1 (402-1), the light dead load value is 290 lbs./ft.
- 26. From Table 4-1, the heavy dead load value is 425 lbs./ft.
- 27. Yes, the distributed weight of the home is within the limits defined by this document. The design tables may be used.

Snow Load

- 28. Refer to the Ground Snow Load map on page H-13 for the Eastern United States. The average ground snow load is zero.
- 29. Based on a 4 in 12 roof slope, the minimum roof live load is 15 psf (D-200.2.B).
- 30. The **15 psf minimum roof live load** controls.

#### Wind Load

- 31. Refer to the Design Wind Load map for the Eastern United States on page H-14. The average wind load is near the 100 mph design wind isobar, which exceeds the *MPS* minimum of 80 mph. Thus, **100 mph wind speed** is used for the foundation design.
- 32. Based on the map provided by the owner, the site is located on a hurricane coastline. The site is **Coastal**.
- 33-36. The manufacturer should supply details consistent with a coastal high wind site.

Seismic Load

- 38. Refer to the Seismic Acceleration maps on pages H-15 and H-16. The seismic coefficients for Hillsborough County, <u>Aa</u> and <u>Av</u> = 0.05. Residential construction is exempt from seismic consideration since <u>Av</u> < 0.15.
- 41. Checking the Foundation Design concepts for Type C1, it is permitted for use when seismic coefficient Av < 0.15. It is not acceptable for use in areas where <u>Aa</u> and <u>Av</u> greater than or equal to 0.3.

#### **Part 4 -- Final Design Procedure**

- 43. From the Section 600-2.A table, the nominal width for a 13'-8" home width is 14'-0".
- 44. The user will compare the Foundation Design concept illustrations with foundation drawings and details provided by the owner. The concept drawings identify the anchorage locations. An anchorage system must be clearly shown on the documents provided by the owner.

#### **Required Footing Size**

49. In order to determine the Required Footing size, the user needs the data from the following items on the Owner's Site Acceptability Worksheet item #10 or #11 and on the Design Worksheet: Nos. 24, 28-30, 43, 48.

#### Item Number

- #10 or #11 Net allowable soil bearing pressure = 1000 psf from Owner's Worksheet.
  - #24 Foundation System, Singlesection type C1

- #28-#30 Ground Snow Load Pg = 0 psf. Use a minimum roof live load of 15 psf for the Foundation Design Load Tables.
  - #43 Building nominal width: Wt = 14'-0"

#48 Pier Spacing: Exterior = 7'-0"

Next the user will locate the Required Effective Footing Area Tables in Appendix B, Part 1.

- 1) The user locates the tables for a Singlesection Type C with a width of 14 feet.
- Find the block of values for a Minimum Roof Live Load of 15 psf.
- 3) Next the user finds the row of values for a net allowable soil pressure of 1000 psf.
- Last, the user finds the intersection of that row with the column for a 7'-0" foot pier spacing. The required footing area is 5.3 square feet (2'-4" x 2'-4").

#### Vertical Anchorage Requirements in the Transverse Direction

- 52a. In order to determine the Required Vertical Anchorage the user needs the data from the following items on the Design Worksheet: Nos. 24, 31, 32, 43 and 48. With this information, the field officer can locate and determine the Required Vertical Anchorage tables in Appendix B, Part 2.
  - Use the tables for a Type C1 system. Then multiply Av x Tie-down spacing.

Item No. Data
- #24 Foundation System: Type C1 Singlesection
- #31 Design Windspeed: 100 mph
- #32 Site Location: Coastal
- #43 Building Nominal Width: 14'-0"
- #48 Tie-down Spacing: st = 8'-8". Number of tie-downs is 7 from (N):

$$N = \frac{L - 2 \times 2'}{s} + 1$$

- The user locates the Required Vertical Anchorage (Appendix B, Part 2) tables for a Single-section Type C1 with a nominal width of 14 feet.
- 2) Then the user finds a block of values for the Coastal condition.
- 3) Locate the row for a wind speed 100 mph. The user finds the required vertical anchorage Av = 350 lbs./ft. of home length and multiplies this by a tie-down spacing of 8.667 feet (3033 lbs.) or conservatively move across the row to the next largest anchor spacing (10') and reads 3460 lbs. as an approximate check.
- 4) The Required Vertical Anchorage force for a tie-down is 3033 lbs.
- 54. The manufacturer's supplied value, item #53, is 3,150 pounds, which is more than the Required Vertical Anchorage of 3,033 pounds. Note: see optional details in Appendix A for Type C1. If the manufacturer's supplied value had been less than Av, the owner would have been notified. The owner would need to contact the manufacturer in order to have a licensed

structural engineer verify the existing design or modify the anchor design or spacing to comply with the required anchorage.

## Horizontal Anchorage in the Transverse Direction

56. In order to determine the Required Horizontal Anchorage, the user needs data from the same items on the Design Worksheet that were required for Approval item number 52a and item No. 22 (the building length L = 56'-0''). Also required is item #9 (6'-10'') from the Manufacturer's Worksheet.

Next, the user will locate the Required Horizontal Anchorage table in the transverse direction in Appendix B, Part 3.

- The user locates the tables for a Singlesection Type C, E or I with a nominal width of 14 feet and initially selects two transverse walls for trial #1. This is required to initiate the process of selecting vertical X-bracing planes for horizontal anchorage in the transverse direction.
- Then the user finds the block of values for the Coastal condition and the row of values for a design wind speed of 100 mph. All Seismic is on the same horizontal line, even though it need not be checked.
- For a length L of 56 feet, the user rounds the value to the next highest number shown on the top row of the table -- 60 feet.
- 4) Under the column of values for 60 feet, the user finds the required anchorage (Ah) of 1240 pounds per lineal foot

along the length of each transverse foundation wall (2 shear walls).

59c. The required horizontal anchorage per Xbrace set (C) is calculated using the procedure of Section 602-5.G.2, illustrated in Figure 6-10.

Process always begins by selecting 2 short walls, then:

1. From item #56, Ah = 1240 lbs./ft.

2. Solving equation for H:

 $H = \frac{1240 \times 13.67 \times 2}{56} = 605 \text{ lbs./ft. of unit length}$ 

Note: actual unit width, rather than nominal width is used here.

 For a first trial, set spacing equal to a multiple of pier spacing: try 14'-0". Solving equation for horizontal force at each X-brace set (C):

 $C = 605 \times 14'-0'' = 8475$  lbs./X-brace set.

Note: number of vertical X-brace planes =

$$\frac{L}{pacing} + 1 = \frac{56}{14} + 1 = 5$$

therefore, number of X-braced planes equals 5.

61a. Verify that the Manufacturer's design value on line #57a is greater than the required value (C) shown on line #59c. In this example, the manufacturer's design value of 4800 lbs. (#57) is less than the Required Horizontal Anchorage (C) = 8475 lbs. This indicates that the connection of unit to a foundation diagonal is inadequate for sliding resistance.

The owner would be contacted at this point and notified that the horizontal anchorage is not adequate. If an inspector or owner wanted to determine how many vertical X-bracing planes would be required, they could use the following:

#### <u>Trial #2:</u>

Piers must be present at the extremities of any vertical X-bracing plane; therefore, the next logical choice is the actual pier spacing of 7'-0".

1. From item #56, Ah = 1240 lbs./ft.

2. Solving equation for H:

 $H = \frac{1240 \times 13.67 \times 2}{56} = 605 \text{ lbs./ft. of unit length}$ 

Note: actual unit width, rather than nominal width is used here.

3.  $C = 605 \times 7'-0'' = 4235$  lbs./X-brace set.

Number of vertical planes =

$$\frac{56'}{7'} + 1 = 9$$

The required horizontal anchorage of 4235 is less than the manufacturer's rated capacity of 4800 lbs., thus 9 vertical Xbracing planes are required at the same spacing as the piers (7'-0").

59d. The user must estimate a height (h) on Figure 6-10, which can be revised later if necessary. Try h = 4 feet. 59e. From item #9, Manufacturer's Worksheet, Wt - 2 dc = 6.83':

$$\cos\theta_{t} = \frac{6.83}{\sqrt{4^2 + (6.83)^2}} = 0.863$$

therefore:  $\theta_t = 30.4^\circ$ 

$$T_t = \frac{4235}{0.863} = 4907$$
 lbs. tension in strap

61b. The rated capacity of a strap in tension, item #60 is greater than the required  $T_t$ (item #59e) for 9 vertical X-bracing planes 5600 > 4907, therefore OK.

Horizontal Anchorage Requirements in the Longitudinal Direction

62a. In order to determine the Required Horizontal Anchorage (Ah) in the Longitudinal Direction, the user needs data from the same items in the Design Worksheet that were required for item #56.

> Next, the user will locate the Required Horizontal Anchorage Table in the Longitudinal Direction (Appendix B, Part 4).

- The user locates the table for a Singlesection, Type C, E, or I with a nominal width of 14 feet.
- Then, the user finds the block of values for <u>Aa</u> = 0.05-0.10, ground snow 0-100 psf and coastal site.
- 3) The user finds the row of values for wind speed of 100 mph.
- For a length (L) of 56 feet, the user rounds to the next highest length shown across the top row of the table - 60 feet.

- 5) Under the column for 60 feet, the user finds the intersection value with the row for 100 mph wind speed. Read Ah = 47 lbs./ft. of length along the longitudinal exterior foundation walls, if shear walls exist.
- 62b For this example of a Type C1 foundation, no structural exterior longitudinal walls exist, thus vertical X-bracing planes are required between piers under chassis beam lines. Follow the procedure of Section 602-6.F and use the illustration in Figure 6-11 and Figure D-26.

Begin Trial 1 with the minimum required vertical X-bracing planes: n = 2; one pair under each chassis at both ends of the unit length. Follow the equation:

 $B = \frac{47 \text{ plf} \times 56}{2} = 1316 \text{ lbs. of horizontal}$ force carried by each X-brace set.

- 64. Verify that the manufacturer's rated value (item #63) is greater than the required horizontal anchorage force (B) of item #62b.2. In this example the manufacturer's value of 4800 lbs. is greater than B. Thus, vertical X-bracing planes at both ends of the unit and under each chassis beam line is adequate.
- 62b.3 Approximate the height (h) in Figure 6-11 by assuming the chassis beam is 1 foot deep, thus: h = 4' 1' = 3'.

62b.4 Return to the calculation procedure of section 602.6.F and determine the tension force in a diagonal strap:

first: 
$$\cos\theta_{\rm L} = \frac{7}{\sqrt{3^2 + 7^2}} = 0.919$$

therefore:  $\theta_L = 23.2^{\circ}$ 

next: 
$$T_L = \frac{1316}{919} = 1432$$
 lbs.

66. Verify that the manufacturer's (or product supplier) rated value (item #65) is greater than the required tension  $(T_L)$  from item #62b.4. In this example, the manufacturer's value of 5600 lbs. is greater than  $(T_L)$ . Thus, the straps proposed are adequate as tension diagonals.

#### Withdrawal Resistance Verification

67b. For Type C1 foundation answer item 67b for concrete "deadman" footings.

For this example, square concrete footings used as "deadmen" are depicted on the documents submitted by the owner to anchor the tie-down straps. See Appendix A - concept details for Type C1 foundation.

- 1. From item number 52a, the value for Av is 3033 lbs. per tie-down anchor.
- Use Table C-2, The Withdrawal Resistance for Piers, in Appendix C. Table C-2 can conservatively be used for concrete footings used as "deadman" anchors. The footing depth (hp) in the far left column can either be hp = 3'-4" for a 3'-0" sq. ft. footing or hp = 2'-0" for a 4'-0" sq. ft. footing. Assume the least costly solution is the 3'-0" square footing.

3. Based on item #9, the frost depth for Tampa, FL. is 0". Thus, the "deadman" footings are at an adequate depth. The pier footings under the chassis beams can be set 8" below grade, if undisturbed soil (not organic material) is available, otherwise, footing must extend to firm bearing strata.

# Vertical Anchorage and Reinforcement for Long Foundation Walls and Piers

- 68. For type C foundations answer item 68b.
  - From item number 52a, the value for Av is 3033 lbs. per foot. The lowest value greater than Av on Table C-3 is 4240 pounds.
  - For the size of bolt set in concrete "deadman" to complete connection to the tie-down rod, from Table C-3:
    - a) Number of anchor bolts = 1
    - b) Anchor bolt diameter = 1/2"
  - 3) Use Table C-3A for the reinforcement of the piers under the chassis beams. Even though these piers do not directly receive anchorage overturning force, it is desirable to reinforce them to assist in force distribution in the vertical Xbracing planes.
    - a) Rebar size = #4
    - b) Lap splice = 16''
    - c) Rebar hook length = 6''

# Horizontal Anchorage and Reinforcement for Transverse Foundation Walls

69c. From item number 59c (Assume the owner decided to use 9 X-bracing planes), the value for (C) is 4235 lbs. per diagonal. Use Table C-5A for concrete. The horizontal capacity of a single bolt is shown at a spacing of 12".

<u>Bolt si</u>	ze		Capacity
1/2"		a ng gana tang sa ka	1800 lbs.

Three 1/2" bolts would be required to connect the diagonal to the footing. Detail the pier footing as shown in Table C-5A. Verify that the rated capacity of the strap exceeds the required tension (T<sub>t</sub>).

# Horizontal Anchorage and Reinforcement for Longitudinal Foundation Walls

70b. From item #62b.2, record the horizontal anchorage force (B) as 1316 lbs. per Xbrace. Again, from Table C-5A, the shear capacity of a 1/2" diameter bolt in concrete is 1800 lbs. One anchor bolt is sufficient into the concrete footing. Detail the pier footing as shown in Table C-5A. Verify that the rated strap capacity exceeds the required tension  $(T_L)$ .

#### Summary Sheet

The values can be brought forward on to the summary sheet and the design approved.

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# APPENDIX E OWNER'S SITE ACCEPTABILITY WORKSHEET

Owner's Name:	JOHN DOE
Address:	1600 5. FIRST ST.
	CHAMPAIGN, IL
an an an an an an an an an an an an an a	
Telephone:	
Site Location:	CHAMPAIGN, IL
Legal Description:	
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на на селото на селото на селото на селото на селото на селото на селото на селото на селото на селото на селот 1974 г. – Динистра на селото на селото на селото на селото на селото на селото на селото на селото на селото на 1976 г. – Динистра на селото на селото на селото на селото на селото на селото на селото на селото на селото на	
Have you provided	a copy of a map pinpointing the site? (yes) no
Have you submitted (See #10 of Manufa	a foundation plan? cture's Worksheet)

# **Preliminary Site Information**

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

- 1. Provide survey results showing existing grade elevation. (201-1)
- 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.

<u>N</u> .	<u>Å.</u>	ft.
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	по	
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)	-	 	-	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 G - Example 1)

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# APPENDIX E MANUFACTURER'S WORKSHEET

Manufacturer's Company Name:	HOWARD SMITH CO., INC.	
Address:	1904 W. 75TH ST.	
- Mui055.	NEW YORK N.Y. 10031	
Telephone:	(314) 329 - XXXE	
	f Building Structure and Size shall provide the following information:	·
		n
1. Type of un	Multi-Section	
Refer to Fi	cation and types of support: gures 6-7 and 6-8 and Section 601-4 e a C, E, or I?	
3. Length of u	init L <u>56</u>	ft.
4. Actual wid	th of unit Wt 13-8	ft.
5. Height of e	exterior wall **	ft.
6. Height of r		ft.
7. Roof slope	2:12	
8. Self weigh	t of total unit (W) including mechanical equipment ** <u>33040</u>	lbs.
9. Distance b		ft.
	ation design concept (See Appendix A) <u>E1</u> C1-E8; or I)	

11. Recommended pier spacing \*\*

a. Exterior

b. Interior

c. Continuous Marriage Wall

Length of largest isolated marriage wall opening or average of largest two adjacent openings  $\frac{16+12}{2} = 14$ 

d. Tie-down Strap (C1 concept only) \_\_\_\_\_\_\_\_(Number)

12. One installation method recommendations (include documentation showing connection details pertinent to geographic area for seismic or wind). \*\*

- 13. Interior shear wall locations (include documentation showing locations). \*\*
- 14. Design wind speed used in designing connection details for horizontal anchorage (Ah) and vertical anchorage (Av) in the transverse direction. \*\*
- 15. Seismic acceleration values used in designing connection details for horizontal anchorage (Ah) in the transverse and longitudinal directions. \*\*
- 16. Shear wall connection details with rated capacity for wind and seismic are provided. \*\* †
  - a. Connection locations at foundation end and interior walls shown? \*\*
  - b. Rated connection capacity for uplift and overturning \*\*

c. Rated connection capacity for sliding in transverse direction \*\*

d. Rated connection capacity for sliding in longitudinal direction \*\*

e. Vertical X-bracing tension strap capacity \*\*

万、0<sub>ft.</sub> 5.0 ft. 8.0 ft. 14.0 ft. <u> いん</u> ft. (Spacing) no yes

mph. 0.05 Av Aa

no

yes

no 'nο

<u>200</u> lbs./ft. (or lbs./tie-down)

400 lbs./ft. (or lbs./diag. strap)

400 lbs./ft.

N.A. Ibs./diag. strap

E-4

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.

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# APPENDIX F DESIGN WORKSHEET

Own	er's Name:	JOHN DOE	· · · · ·
Addı	ress:	1600 5. FIRST ST. C	HAMPAIGN, IL
Build	ler's Name:	ACME, LTD	
Site ]	Location:	CHAMPAIGN, IL	
		PART 1: SITE CONDITIONS (Accompanies Chapter 2)	
1.	Has the Man	ufacturer's Worksheet been provided?	yes) no
Exist	ing Grade El	evation (201-1)	
2.	(Answer yes flood zone; 3	require a survey? if: 1) elev. to be altered by grade or fill; 2) site near b) subdivision. Answer no if individually-sited with of building site.)	yes no
3.	If yes to above	ve, what is the surveyed existing grade elevation?	N.A. ft.
Flood	l Protection E	Elevation (201-2)	
4.		g site in a flood zone? hen answer 5, 6, 7 & 8. If no, skip to 9.)	yes no
5.	What is the B tion (use high	Base Flood Elevation or the Flood Protection Eleva- nest value)?	ft.
6.	Is the site to b (If no, skip to	be graded, filled, or bermed?	yes no
7.	If yes to 6, ha	we all permits been provided?	yes no
8.	tions?	an are the buildings to be built on elevated founda- andbook cannot be used. Refer to FEMA Manual.)	yes no

(Appendix G - Example 1)

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# **Frost Penetration Depth (201-3)**

9.	What is the maximum frost penetration depth? (see Appendix H, page H-4)	<u> </u>
10a.	Does foundation plan show base of footing extending below frost penetration depth? (If yes proceed; if no, applicant should revise plans.)	yes no
10ь.	Does foundation plan show base of footing extending below top- soil layer (min. 12") to undisturbed soil?	yes no
Grou	nd 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.)

as a

Condition

18" layer of topsoil

Organic soil (8" topsoil layer)

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?** 

no MODERATE TO HEAVY

no

yes

yes

yes

yes

yes

no

[no]

ΠO

по

(See Appendix H, Termite Infestation Map, page H-10) (If no, skip to 16.)

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.)

	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 Plan- ning 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.)	*
	PART 3: DESIGN LOADS (Accompanies Chapter 4)	and an an an an an an an an an an an an an
Infor	mation 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)	<u>33,040</u> Ibs.
22.	What is the building length (L)? (Mfg. Wksht. #3)	<u>56</u> ft.
23.	What is the distributed weight per foot of unit length? (w=W/L) (402-1.B, C)	
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)	<u> </u>

## 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.)

# 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.

#### 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)
   yes no

560 (lbs./ft.) 805 (lbs./ft.)

по ves

 $\frac{20}{(lbs./sq.ft.)} *$   $\frac{14}{2::12}$ 20 psf.

ZC psf.

mph.

8C mph. Inland Coastal

(Appendix G - Example 1)

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

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

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

#### Seismic Load

- 38a. What are the seismic acceleration values? (See Seismic maps, pages H-15 and H-16)
- 38b. Is <u>Av</u> < 0.15? (if no, proceed. If yes, seismic need not be considered, skip questions 39 to 41.)
- Seismic performance category.
   (See H-300 for Special Requirements of Foundation Design.)
- 40. What is the applicant's proposed design concept? (Design Wksht. #24)
- 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.)

# PART 4-FINAL DESIGN PROCEDURE

(Accompanies Chapter 6)

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

yes no

mph. \*

yes no

yes no

0.05 Aa 0.09 Av no

yes no

13-8 ft.

- 43. The nominal building width to be used in the Foundation Design Tables, (Aftg, Av & Ah) is Wt: (600-2.A and Figure 6-1)
- 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.
- 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.)
- 46. Is Vertical Anchorage present?
  (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? (From Part 3: #24; Mfg. Wksht. #2)
- 48. What is the spacing between piers? (Mfg. Wksht. #11) (602-2)

4-0 ft.

Chassis Beams Exterior Walls Marriage Wall



- \_<u>E1</u>\*
- Interior: 4' (5') 6' 7' 8'

Exterior: 4'(5')6' 7' 8'

Continuous Marriage Wall: 4' 5' 6' 7'(8')

 $\frac{16+12}{2} = 14$  Largest or Average Marriage Wall Opening: <u>14</u> ft. Tie Down (C1) N.A. 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.)

The Required Exterior Square Footing size is:

Type E or I  $\underbrace{1.0}_{\text{(width)}}$  ft. MIN.

E1.

50.	The Required Interior Footing area is: (Also exterior piers for foundation type E)	<u>2.1</u> sq.ft.
51a.	The Required Continuous Marriage Wall Footing area is:	<u>6.9</u> sq.ft.
51b.	The Required Footing area under posts at the ends of marriage wall opening(s) is:	<u>11.4</u> sq.ft.
Verti	cal Anchorage Requirements in the Transverse Direction (602	-4)
52a.	Using the Foundation Design Load Tables (Appendix B, Ex Part 2), determine the Required Vertical Anchorage.	terior Av <u>130</u> * (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.	nterior Av <u>N</u> , A * (lbs./int pier spacing)
53.	What is the manufacturer-supplied value? (#16b, Mfg. WkSht.)	Exterior $200 \times 10^{+}$
54.	Is this value (#53) greater than the value given in #52a? (If yes, continue. If no, return to owner for clarification.)	yes no
Hori	zontal Anchorage Requirements In The Transverse Direction	(602-5)
		trial 1 trial 2 trial 3
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.		yes yes yes no no no
	Estimate height (h) for appropriate illustration in Figure 6-10.	N.A.

			trial 1	trial 2	trial 3	
56.	Using the tables, find the Required Horizontal Anchorage (Ah). (Appendix B; Part 3)	End Wall Ah	420	140		lbs./ft.
· x		Int Wall Ah	-	280		lbs./ft.
57a.	What is the manufacturer's-supplied rated ca- pacity for sliding? (#16c, Mfg. WkSht.)		400	400		lbs./ft.
57b.	If answer to item #55b is yes, record manufac- turer or product supplier rated strap tension ca-		N.A.	N.A.		lbs./strap
58a.	pacity 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		yes no	yes no	yes no	
	larger number of transverse foundation walls. If the maximum number selected (6) does not work, return to owner (who may wish to con- tact the manufacturer for clarification).					
58b.	If answer to #55b is yes, required tension in diagonal ( $T_t$ ). (Complete procedure in Section 602.5.G.1.)			N.A.		lbs.
580	Is value #57b greater than #58b?		yes	yes	yes	
500.	If yes, continue to item #62. If no, return to owner for product with greater capacity.		no	по	no	
59.	If using vertical X-bracing planes in lieu of transection 602-5.G.2), determine anchorage value (If shear walls are selected in item #55, skip to	s and sizes for a	alls (and liagonal	the form member	ulas in s.	
			trial 1	trial 2	trial 3	]
: ·	a. Vertical X-bracing spacing proposed.	an an an an an an an an an an an an an a	N.A	N.A.		ft. *
	b. Number of vertical X-bracing locations pro	oposed.				*
	(Item #13, Mfg. WkSht. for trial 1.)		1			1

		trial 1	trial 2	trial 3	]
	c. Required horizontal anchorage (C) value, based on for- mula. (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 ca- pacity? (#16, Mfg. WkSht.) (or capacity defined by literature supplied by product supplier)				lbs. *
61a.	Is value #57 greater than value #59c? If yes, continue. If no, return to Section 602-5.G and to	yes no	yes no	yes no	
·	question #59 and select a greater number of X-brace loca- tions as a next trial. Repeat until answer is yes, then con- tinue.				
61b.	Is value #60 greater than value #59e?	yes	yes	yes	
	If yes, continue. If no, return to section 602-5.G and to question #59 and select a greater number of X-bracing loca-	no	no	no	
	tions. If the maximum number selected does not work, re- turn to owner (who may wish to contact the manufacturer for clarification or product supplier for clarification).		-		

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)
- 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 Xbracing planes.

Exterior Wall Ah 61 lbs./ft.

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

(Appendix G - Example 1)



## **APPENDIX C**

# Withdrawal Resistance Verification (603-2.B)

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"	
All-Weather Wood / Foo	
1) Using Table C-1, which capacity is greater than required Av? (603-2.B.(1)) (#52a) 231 lbs.	/ft.
<ul> <li>2) Using Table C-1, what is the height of the wall + footing for required withdrawal resistance? (hw + 6") 30 in.</li> </ul>	
3) What is the height of the wall + footing for frost protec- tion? (frost depth (#9) + 12") 30	
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") 42 in.	
6) Using Table C-1, what is the required width of the wall footing for withdrawal?	
7) Is item #67a.6 greater than or equal to item #49? If yes, continue. If no, change footing width to item #49.	-
8) Record design exterior wall footing width. $12"$ in.	
b. Withdrawal Resistance for Piers. (Types C, Cl (concrete dead-man), I or type E with interior pier anchorage - multi-section units.) Exterior Grade 30 = Frost (ttem #9) = Frost Wf =	
Circle pier type: Reinforced Concrete Reinforced Masonry - fully groute Reinforced Concrete Dead-man	ed
Kennoree Deal-man	

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(Appendix G - Example 1)

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					(when used)	
	1	)	Using Table C-2, which capacity is greater than required Av? (#52a and #52c) (603-2.B.(2))	N.A.		lbs./pier *
	2	)	Using Table C-2, what is the height of the pier + footing for required withdrawal resistance? $(hp + 8")$	<u>N.A.</u>		in. *
.'	3	)	What is the required height of pier + footing for frost protection? (frost depth $(#9) + 12$ ")	<u>min.18</u>	min.18	in. Clisturbe
	. 4	)	What is the greatest height #67b.2 or #67b.3?			in.
			Circle the height which controls.	Withdrawal Frost Depth	Witherawal Frøst Depth	•
	5	5)	Record the bottom of footing depth from grade.	min. 8	min. 8	in.
·····			(Item #67b.4 - 12")		······································	
·		5)	Using Table C-2, what is the required width of the square footing if withdrawal resistance con- trols or if frost depth controls?	<u>N.A.</u>	-	. in. *
	:	foc	ost depth for marriage walls. What is the required of the below grade for frost protection? (frost depth of withdrawal resistance)	(#9)) <b>w</b> bele	in. 18 in topso level	in. 1 C undisti
Verti (603-2		n	chorage and Reinforcement for Longitudinal Fo	oundation Walls	and Piers	:
68.	Usin	ng	Appendix C, Table C-3, C-4A or C-4B, verify that ation anchors will resist uplift. Answer question #	t the 68a for		

- 68. Using foundation anchors will resist uplift. Answer question #68a for type E. Answer question #68b for types C, I, or type E with interior pier anchorage.
  - a. Vertical Anchor Capacity for longitudinal foundation wall (type E). (603-2.D.2)
    - 1) Using Table C-4A (concrete & masonry), which capacity is greater than the required Av? (#52a, Design Wksht.) If treated wood wall, skip to item #68a.3.

lbs./lineal ft. of wall

Interior

Exterior

Circle correct washer choice for the capacity selected

- 2) Using Table C-4A (masonry and concrete):
  - a) Required anchor bolt diameter
  - b) Required anchor bolt spacing
  - c) Using Table C-3A:
    - (1) Rebar size
    - (2) Lap splice
    - (3) Rebar hook length
- Using Table C-4B (wood), which capacity is greater than the required Av? (#52a, Design Wksht.) If using concrete or masonry wall, skip to item #68b.
- 4) Using Table C-4B (wood):
  - a) Required nailing
  - b) Minimum plywood thickness
  - c) Required anchor bolt diameter

d) Required anchor bolt spacing

(From #52a, Design Wksht.)

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)
ty in the table is	N.A.	lbs /pier

1) Using Table C-3, which capacity in the table is greater than the required Av?

\*

- \_\_\_\_\_ in.
- \_\_\_\_\_ in.

\_\_\_\_\_ in.

Standard Washer Oversized Washer

1/2 0 in. in. max, allow.

16 in. in.

lbs./lineal ft. of wall

# <

(Appendix G - Example 1)

	Exterior	Interior
2) Using Table C-3:		
a) Number of anchor bolts	1 or 2	1 or 2
b) Anchor diameter	1/2" or 5/8"	1/2" or 5/8"
3) Using Table C-3A:		21
a) Rebar size	#4 or #5	#4 or #5
b) Lap splice		in.
c) Rebar hook length		in.
Horizontal Anchorage and Reinforcement for Transverse F	oundation Walls	; (603-3)

Interior Wall

300

1/2 0

12

16 in.

#4

6

lbs./ft.

in.

\_\_\_\_ in.

\_ in.

End Wall

300

1/2 0

#4

16

6

max allow

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.

a. For continuous foundations.

Using Table C-5A (concrete & masonry) or C-5B (wood), which capacity is greater than the required (Ah) (603-3) (item #56)?

1) Using Table C-5A, find:

a) Required anchor bolt diameter

b) Required anchor bolt spacing

c) Using Table C-3A:

(1) Rebar size

(2) Lap splice

(3) Rebar hook length

2) Using Table C-5B, find:

a) Required nailing

(Appendix G - Example 1)

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	_End Wall_	Interior Wall	
b) Minimum plywood thickness		·	in.
c) Required anchor bolt diameter	: · · · · · · · · · · · · · · · · · · ·		in.
d) Required anchor bolt spacing			in.

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

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

		End	Interior	_
1)	Record the required horizontal force $(Ah \times Wt)$ from 602-5.G.1.a and item #56.	<u>N.A.</u>		_ lbs.
2)	Table C-5A capacity for one 1/2" diameter bolt at 12" o.c.	1800	1800	_ lbs.
3)	Number of bolts (Ah $\times$ Wt $\div$ 1800; one mini- mum) 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	·	<u> </u>	in.
·	c) Rebar hook length			_ in.
	or vertical X-bracing planes in the transverse direct 603-6)	ion.		

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

		End Wall	Interior Wall	
	Anchor bolt spacing	72	72	in.
	Rebar size	#4	#4	
	Lap splice	16	16	in.
÷	Rebar hook length	6	6	in.
•	From #69a.2: wood:	a da ang ang ang ang ang ang ang ang ang an	•	
·	Required nailing			
	Minimum plywood nailer			
•	Anchor bolt diameter			
	Anchor bolt spacing			in.
2.	For transverse short foundation walls completed wi agonal braces (#69b)	th di-	:	
		End	Interior	
	Number of pairs of diagonals (1 for single- section units, 2 for multi-section units) times number of short walls (end or interior) (#55a)			
	Diagonal spacing (same as number of short walls)			
	From #69b: concrete / masonry:			-
	Anchor bolt diameter			in.

. سنبه

in.

in.

Anchor bolt diameter

Number of bolts

Rebar size

Lap splice

Rebar hook length

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

Number of X-brace locations (#59)

(Appendix G - Example 1)

	Spacing of vertical X-brace planes (#59)		ft.
	Items from #69c.3 and #69c.5		
* <u>.</u>	Required anchor bolt diameter		in.
··· .	Number of bolts at top of footing to connect diagonal		
	Diagonal strap size	<u> </u>	
	Connection to top flange of chassis beam (describe)		
	orizontal anchorage in the longitudinal direction - exte- or 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	same)	in.
	Anchor bolt spacing		in.
	Rebar size	<u> </u>	
	Lap splice -		in.
	Rebar hook length		in.
	<u>From #70a.2: wood:</u> 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.

Required anchor bolt diameter.

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?
- 73. If #72 yes, approve. If no, return to applicant.

yes no ( APPROVE

N.A.

\_ ft.

in.

# DISAPPROVE

# APPENDIX E OWNER'S SITE ACCEPTABILITY WORKSHEET

Owner's Name:	JOHN SMITH
Address:	35 BRANDYWINE
-	TAMPA, FL
Telephone:	
Site Location:	
Legal Description:	
Have you provided	a copy of a map pinpointing the site? (yes) no
Have you submitted (See #10 of Manufa	a foundation plan? (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)
- 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

ft.

'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	по
9.	Provide fill specifications if site is to be prepared with earth fill. (303-2)	yes	no
10.	If a geotechnical report is required, what is the net allowable soil bearing pressure? (202)		psf.
11.	If no adverse soil conditions are known or suspected, and if the home is individually sited, assume a soil bearing pressure of 1,000 psf. and use this value when a determination of soil bearing pres- sure is called for.	1997 - 1997 - 1997 1997 - 1997 - 1997 - 1997 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1	1,000 psf.

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# APPENDIX E MANUFACTURER'S WORKSHEET

ţ

	ufacturer's pany Name:	N	EW Ha	DMES	· · ·	
Addı	ess:	39	PEACHTE	REE LA	INE	1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 -
	n ga shi Antoni a shi	ATLA	NTA , C	5A		· · ·
Teler	phone:	210	7 / 3333	-1792		
Dete	rmination of H	Building Structur	e and Size	e La companya La companya		
The r	nanufacturer sl	hall provide the fo	llowing informa	tion:		
1.	Type of unit	in a star second second second second second second second second second second second second second second se		· · · · · · · · · · · · · · · · · · ·		ngle-Section ulti-Section
2.	Method, loca Refer to Figu Is the home a	tion and types of s res 6-7 and 6-8 and <b>C, E, or I</b> ?	upport: d Section 601-4			<u> </u>
3.	Length of uni	t L		· · · ·	<u></u>	56_ft.
4.	Actual width	of unit Wt			· · . 	13'-8 ft.
5.	Height of exte	erior wall **		e i	· · · ·	7 <u>-6</u> ft.
6.	Height of roo	f peak **	ta ja articular	e e la constance de la constance de la constance de la constance de la constance de la constance de la constanc		2-4_ft.
7.	Roof slope **	£				4::12
8.	Self weight of	f total unit (W) inc	luding mechanic	cal equipment **	14	500 Ibs.
9.	Distance betw	veen chassis memb	bers		·	6-10 ft.
10.	One foundatio (C1-C4; E1-I	on design concept E <b>8; or I</b> )	(See Appendix A	<b>A</b> )		<u>C1</u>

- 11. Recommended pier spacing \*\*
  - a. Exterior
  - b. Interior
  - c. Continuous Marriage Wall

Length of largest isolated marriage wall opening or average of largest two adjacent openings

d. Tie-down Strap (C1 concept only)

(Number)

- One installation method recommendations (include documentation showing connection details pertinent to geographic area for seismic or wind). \*\*
- Interior shear wall locations (include documentation showing locations). \*\*
- 14. Design wind speed used in designing connection details for horizontal anchorage (Ah) and vertical anchorage (Av) in the transverse direction. \*\*
- 15. Seismic acceleration values used in designing connection details for horizontal anchorage (Ah) in the transverse and longitudinal directions. \*\*
- 16. Shear wall connection details with rated capacity for wind and seismic are provided. \*\* †
  - a. Connection locations at foundation end and interior walls shown? \*\*
  - b. Rated connection capacity for uplift and overturning \*\*
  - c. Rated connection capacity for sliding in transverse direction \*\*
  - d. Rated connection capacity for sliding in longitudinal direction \*\*
  - e. Vertical X-bracing tension strap capacity \*\*

ft. ft. ft. ft. ft. (Spacing)

no

no

yes

20 mph. 0.05 Av 0.05 <u>Aa</u> yes no yes no 3150 lbs./ft. (or lbs./tie-down)

4800 lbs./ft. (or lbs./diag. strap)

4 800 lbs./ft.

bs./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	
	35 BRANDYWINE, T.	AMPA FL
Address:		
Builder's Name:	GRAPPO INDUSTRIE	<u></u>
Site Location:	TAMPA, FL.	<b></b>
	PART 1: SITE CONDITIONS (Accompanies Chapter 2)	
1. Has the Man	ufacturer's Worksheet been provided?	yes no
Existing Grade El	evation (201-1)	
(Answer yes flood zone; 3	require a survey? if: 1) elev. to be altered by grade or fill; 2) site near 3) subdivision. Answer no if individually-sited with of building site.)	yes no
3. If yes to abo	ve, what is the surveyed existing grade elevation?	<u>    28    ft</u> .
Flood Protection ]	Elevation (201-2)	
4. Is the buildin (If yes to 4,	ng site in a flood zone? then answer 5, 6, 7 & 8. If no, skip to 9.)	yes no
	Base Flood Elevation or the Flood Protection Eleva-	ft.
6. Is the site to (If no, skip)	be graded, filled, or bermed? to 9.)	yes no
7. If yes to 6, 1	nave all permits been provided?	yes no
tions?	hen are the buildings to be built on elevated founda- handbook cannot be used. Refer to FEMA Manual.)	yes no

# Frost Penetration Depth (201-3)

9.	What is the maximum frost penetration depth? (see Appendix H, page H-4)	in.
1 <b>0</b> a.	Does foundation plan show base of footing extending below frost penetration depth? (If yes proceed; if no, applicant should revise plans.)	yes no
1 <b>0</b> b.	Does foundation plan show base of footing extending below top- soil layer (min. 12") to undisturbed soil?	ves no
Grou	nd 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
1.	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?

no VERY HEAVY

yes

no

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

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.)

# **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.)

# **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) (402-1.B, C)

(C1), C2, C3, C4, E1, E3, E4, E5, E6, E7, E8, I)

24. What is the building type? (Mfg. WkSht. #2)

Foundation design concept?

500 lbs. 56 ft.

no

ves

yes

no

no

no

295 lbs./ft.

Single-Section Multi-Section

C, E, or I

(Appendix G - Example 2)

#### 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.)

#### 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.

#### 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)



no

yeś



15 psf.

mph.







- 34. If yes to #33, what design wind speed has the manufacturer used in designing connection details? (Mfg. Wksht, #14)
- 35. Are the connection locations shown? (Mfg. Wksht. #16a)
- 36. Are connection details provided for foundation shear walls? (For an answer of yes, all questions under Mfg. Wksht #16 must be answered satisfactorily.)
- 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.)

#### Seismic Load

- 38a. What are the seismic acceleration values? (See Seismic maps, pages H-15 and H-16)
- 38b. Is <u>Av</u> < 0.15? (if no, proceed. If yes, seismic need not be considered, skip questions 39 to 41.)
- 39. Seismic performance category.(See H-300 for Special Requirements of Foundation Design.)
- 40. What is the applicant's proposed design concept? (Design Wksht. #24)
- 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.)

#### PART 4-FINAL DESIGN PROCEDURE

(Accompanies Chapter 6)

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



no



yes



-8 ft.

(Appendix G - Example 2)

- 43. The nominal building width to be used in the Foundation Design Tables, (Aftg, Av & Ah) is Wt: (600-2.A and Figure 6-1)
- 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.
- 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.)
- 46. Is Vertical Anchorage present?
  (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? (From Part 3: #24; Mfg. Wksht. #2)
- 48. What is the spacing between piers? (Mfg. Wksht. #11) (602-2)

14'-0 ft.

Chassis Beams Exterior Walls Marriage Wall

yes no no

Exterior: 4' 5' 6' (7')8'

Interior: 4' 5' 6' 7' 8' N.A.

Continuous Marriage Wall: 4' 5' 6' 7' 8' N.A.

Largest or Average Marriage Wall Opening: <u>N.A.</u> ft.

Tie Down (C1) <u><u>8</u><sup>-</sup>8 ft.</u>

#### 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.)

Type C <u>5.3</u> sq.ft.

The Required Exterior Square Footing size is:

Type E or I \_\_\_\_\_ ft. (width)

50.	The Required Interior Footing area is: (Also exterior piers for foundation type E)	sq.ft.
51a.	The Required Continuous Marriage Wall Footing area is:	sq.ft.
51b.	The Required Footing area under posts at the ends of marriage wall opening(s) is:	sq.ft.
Verti	cal Anchorage Requirements in the Transverse Direction (602-4)	
52a.	Using the Foundation Design Load Tables (Appendix B, Part 2), determine the Required Vertical Anchorage. $350^{16/FT} \times 8.667 = 3035^{16}$	<u>3033</u> * (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	NA. * (lbs./int pier spacing)
53.	$(\#1CL) Mf_{m} W//(Ch+)$	<u>3150</u> * <u>3150</u> *
54.	Is this value (#53) greater than the value given in #52a? (If yes, continue. If no, return to owner for clarification.)	yes no
Hori	zontal Anchorage Requirements In The Transverse Direction (602-5)	
	trial 1 tr	ial 2 trial 3

- 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	
56.	Using the tables, find the Required Horizontal Anchorage (Ah). (Appendix B; Part 3)	End Wall Ah	1240			lbs./ft.
		Int Wall Ah	N.A.			lbs./ft.
57a.	What is the manufacturer's-supplied rated ca- pacity for sliding? (#16c, Mfg. WkSht.)		4800			lbs./ft.
57b.	If answer to item #55b is yes, record manufac- turer or product supplier rated strap tension ca- pacity					lbs./strap
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 con- tact the manufacturer for clarification).		yes no	yes no	yes no	
58b.	If answer to #55b is yes, required tension in diagonal $(T_t)$ . (Complete procedure in Section 602.5.G.1.)					lbs.
58c.	Is value #57b greater than #58b? If yes, continue to item #62. If no, return to owner for product with greater capacity.		yes no	yes no	yes no	
59.	If using vertical X-bracing planes in lieu of tran section 602-5.G.2), determine anchorage values (If shear walls are selected in item #55, skip to i	and sizes for d				
			trial 1	trial 2	trial 3	
	a. Vertical X-bracing spacing proposed.		14	7		ft. *

b. Number of vertical X-bracing locations proposed. (Item #13, Mfg. WkSht. for trial 1.)





- 62a. Using the tables, find the required horizontal anchorage (Ah) in the longitudinal direction. (Appendix B, Part 4) (602.6.E)
- 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 Xbracing planes.

4 Exterior Wall Ah lbs./ft.

2 pr 4 2 or 4 2	<u>al 3</u>
	or 4

	trial 1	trial 2	trial 3	
each chas-	2			
ed on for-	1316			lbs.
ng several ing s	3'			ft.
). 	1432			Ibs.
izontal an-	4800			lbs./ft.
clarifica-	yes no	yes no	yes no	<i>۵</i> .А.
52b.2? aber of ver- d 62b.2 until 4 lines of	yes no	yes no	yes no	
nsion?	5600		• .	lbs.
traps with crease the r is yes.	yes no	yes no	yes no	

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.
- 3. Assumed height (h-b) based on Figure 6-11.
- 4. Tension  $(T_L)$  based on formula. (602-6.F.(3)).
- 63. What is the manufacturer-supplied value for horizontal anchorage? (#16d, Mfg. WkSht.)
- 64a. For shear walls: is value #63 greater than #62a?If yes, skip to item #67. If no, contact owner for clarification.
- 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.
- 65. What is the manufacturer-supplied rated strap tension? (#16e, Mfg. WkSht. or product supplier)
- 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.

#### APPENDIX C

#### Withdrawal Resistance Verification (603-2.B)

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.



				Masonry- Masonry- All-Weath	Fully Grou Grouted @	ited 48" o.c.
	1)	Using Table C-1, which capacity is greater than Av? (603-2.B.(1)) (#52a)	required			lbs./ft.
	2)	Using Table C-1, what is the height of the wall for required withdrawal resistance? (hw $+ 6$ ")	+ footing			in.
	3)	What is the height of the wall + footing for frost tion? (frost depth $(#9) + 12$ ")	t protec-	· · · · ·		in.
• • • •	4)	What is the greatest height #67a.2 or #67a.3?	a <sup>1</sup> e are	·		in.
		Circle the height which controls.			thdrawal ost 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 t footing for withdrawal?	he wall		· · · · ·	in.
• •	7)	Is item #67a.6 greater than or equal to item #495 If yes, continue. If no, change footing width to i		y	es no	
	8)	Record design exterior wall footing width.				in.
b.	(cc	ithdrawal Resistance for Piers. (Types C,C1) oncrete dead-man), I or type E with interior pier chorage - multi-section units.)		12" Frost Depth	8",	bi-4 ble C-2)
	Ci	ter de la construcción de la construcción de la construcción de la construcción de la construcción de la constr En la construcción de la construcción de la construcción de la construcción de la construcción de la construcción	D-!-6-			
		rcle pier type:		rced Concre rced Mason	-	grouted
				rced Concre		
	. 1		N N			

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

**Reinforced** Concrete

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		<u>Exterior</u>	Interior (when used)	
1)	Using Table C-2, which capacity is greater than required Av? (#52a and #52c) (603-2.B.(2))	3540		lbs./pier *
2)	Using Table C-2, what is the height of the pier + footing for required withdrawal resistance? (hp + 8")	48 <sup>11</sup>		in. *
3)	What is the required height of pier + footing for frost protection? (frost depth $(#9) + 12$ ")	12		in.
4)	What is the greatest height #67b.2 or #67b.3?	_ 48_		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")	36	<b></b>	in.
6)	Using Table C-2, what is the required width of the square footing if withdrawal resistance con- trols or if frost depth controls?	36"		in. *
fo	<i>ost depth for marriage walls.</i> What is the required below grade for frost protection? (frost depth ( o withdrawal resistance)	depth of #9))	н.А.	in.

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

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

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

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

lbs./lineal ft. of wall

c. Frost depth for

	Circle correct washer choice for the capac	ity selected	Standard Washer Oversized Washer
2)	Using Table C-4A (masonry and concrete)	):	-
<u>.</u>	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.
	Using Table C-4B (wood), which capacity the required Av? (#52a, Design Wksht.) If using concrete or masonry wall, skip to		s./lineal ft. of wall
4)		•	· *
	a) Required nailing	an an an Afrika An San Afrika. An	т 
	b) Minimum plywood thickness	and the second sec	in.
	c) Required anchor bolt diameter	алан алан алан алан алан алан алан алан	in.
τ.	d) Required anchor bolt spacing		in.
[]	<i>Tertical Anchor Capacity for Piers</i> Types C, I, or type E with interior pier anchor 503-2.D.1)	orage)	
		Exterior	Interior (when used for anchorage in multi-section units)
1)	) Using Table C-3, which capacity in the ta	able is 4240	lbs./pie

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	Exterior	<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	16		in.
c) Rebar hook length	6		in.
Horizontal Anchorage and Reinforcement for Transverse Fo	oundation Walls	; (603-3)	
69. Using Appendix C, Table C-5A or C-5B, verify that the f tion anchorage will resist sliding at the transverse end four walls. Use for types C, E, or I.	ounda- Indation	·	·
a. For continuous foundations.	End Wall	Interior Wall	
Using Table C-5A (concrete & masonry) or C-5B (wood), which capacity is greater than the required (Ah) (603-3) (item #56)?		·	lbs./ft.
1) Using Table C-5A, find:			
a) Required anchor bolt diameter		<u> </u>	in.
b) Required anchor bolt spacing		:	in.
c) Using Table C-3A:			
(1) Rebar size	<u></u>		*
(2) Lap splice			_ in.
(3) Rebar hook length			_ in.
2) Using Table C-5B, find:	e Maren <u>a</u> n di Karan Marena		
a) Required nailing			- *

(Appendix G - Example 2)

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			End Wall	Interior Wall
		b) Minimum plywood thickness		
•		c) Required anchor bolt diameter		
÷		d) Required anchor bolt spacing	national and a second s	
	b.	For transverse short foundation walls completed with (603-5)	diagonal brac	es.
			e de la construction de	•
ý		Using Appendix C, Table C-5A, verify the diagonal anchorage capacity to the short foundation wall.		
•		and a start of the second second second second second second second second second second second second second s Second second	End	Interior
		1) Record the required horizontal force $(Ah \times Wt)$		
		from 602-5.G.1.a and item #56.	- <u></u>	]
		<ol> <li>Table C-5A capacity for one 1/2" diameter bolt at 12" o.c.</li> </ol>	1800	1800
		<ol> <li>Number of bolts (Ah × Wt ÷ 1800; one mini- mum) at concrete or masonry top of short wall.</li> </ol>		
		4) Size of anchor bolts		i
		5) Using Table C-3A:	$\chi \to \chi F \phi$	
		a) Rebar size		· :
	. •	b) Lap splice	<u></u>	
		c) Rebar hook length	<u></u>	· · · · · · · · · · · · · · · · · · ·
	c.	For vertical X-bracing planes in the transverse direction (603-6)	ion.	u.
		Using Appendix C, Table C-5A, verify the diagonal and to the pier footings and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the diagonal data and the tension capacity of the data and tension capacity of the data and tension capacity of the data and tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension capacity of tension ca		
		1) Record the required horizontal force (C) from item	#59c.	4235
		2) Table C-5A capacity for one 1/2" diameter bolt at 1	l2" o.c.	1800

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- 3) Number of bolts (C ÷ 1800; one minimum) at top of a footing.
- 4) Record the required tension force  $(T_t)$  from item #59e.
- Select tension strap capacity greater than or equal to T<sub>t</sub> from owner's product supplier or manufacturer's supplied capacity (item #60).
- 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 1 (wood), which capacity is greater than the require Ah? (602-6.E) (item #62a)		lbs./ft.
1) Using Table C-5A, find:		
a) Required anchor bolt diameter	· · · · · · · · · · · · · · · · · · ·	in.
b) Required anchor bolt spacing	the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s	in.
c) Using Table C-3A:		
(1) Rebar size		*
(2) Lap splice		<u>in.</u>
(3) Rebar hook length		in.
2) Using Table C-5B, find:		
a) Required nailing	en de participation de la companya de la companya de la companya de la companya de la companya de la companya En la companya de la companya de la companya de la companya de la companya de la companya de la companya de la c	*
b) Minimum plywood thickness		in.
c) Required anchor bolt diameter	te statut de la composition de la composition de la composition de la composition de la composition de la comp	in.
d) Required anchor bolt spacing	<u> </u>	in.
· · · · · · · · · · · · · · · · · · ·		

lbs./diag.

ちんつつ Ibs./diag. A36 plate 14×1

#### 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.
- 2) Table C-5A capacity for one 1/2" diameter bolt at 12" o.c.
- 3) Number of bolts ( $B \div 1800$ ; one minimum)
- 4) Record the required tension force  $(T_L)$  from item #62b.4.
- 5) Select tension strap capacity greater than or equal to  $T_L$  from owner's product supplier or manufacturer's supplied capacity (item #60).
- 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.

Required Effective Footing Area from questions #49, #50, & #51.

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)

	Pie		ge Wall	
Exterior	Interior	_Cont.	<u>At Post</u>	
5.3			sq.	.ft.
Х				
· · · · ·				
N.A		sq.ft.		

1316 lbs. 1800 lbs. 432\_lbs./diag.

5600 lbs./diag. 14"×1" 36 P

		_,	Piers		
		· · · · ·	Mar	riage Wall	
		Exterior Inte	erior Cont	<u>At Post</u>	
	<u>Pier Footing Sizes</u> (largest of above)	5.3 (Z'	4×2-4)	! 	sq.ft.
	"Dead-man" footing size.	<u>9.0</u> sq.ft (3'-0×3'		•	
	Reinforcing for pier footings: Bring forward answers from previou (Types C, I, or E with interior pier a	is questions. (#68		• • •	
			Exterior	Interior	
	Number of anchor bolts	14 A.	· · · · ·		
· . :	Anchor bolt diameter		1/2 \$		in.
مر به م	Rebar size		#4		
	Lap splice	: i .	16		in.
	Rebar hook length		6		in.
		Exterior	Interior	Marriage Wall	:
	Footing depth: grade to bottom of footing	0'- 8"			in.
	Pier footing and "dead-man" footing	g reinforcing bar	s:	<u>#4 at 10" o.c</u>	. E.W.
	"Dead-man" footing depth: grade to	bottom of footi	ng	36	in.
2.	Long Foundation wall footing: type	e E or I:			
	Required Effective Footing Width				
	Required Footing Width for soil be	aring (#49)			_ ft.
	Required Footing Width to resist up (#67a.6)	plift withdrawal			_ ft.
	Wall Footing Size (largest of above	e)	، بر این این این این این این این این این این	-	_ ft.
	Footing Depth: Grade to bottom of	footing (#67a.5)	)		_ in.

(Appendix G - Example 2)

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	Footing reinforcing bars.		2 #4 bars	
	<u>Reinforcing for longitudinal foundation walls:</u> swers from item #68a and record sizes and spa			
	From 68a.2: masonry and concrete:	•		
	Required anchor bolt diameter			in.
	Required washer size	Standard	Oversized	
,	Required anchor bolt spacing	and a second second second second second second second second second second second second second second second Second second s		in
. • .	Rebar size		<u> </u>	•
	Lap splice		<u> </u>	in.
	Rebar hook length	· · · · ·	······································	in.
	From 68a.4: wood: Record answers from item record sizes and spacings.	1 #68a.4 and	-	
	Required nailing			
	Minimum plywood thickness.			in.
	Required anchor bolt diameter			
	Required anchor bolt spacing			in
	orizontal anchorage in the transverse direction walls	on - foun-		
1.	Continuous foundation walls (#69a)			
	Number of transverse foundation walls (#55a)		2 4 6	)
	Required Footing Width (minimum)	per de la companya de la companya de la companya de la companya de la companya de la companya de la companya de	12	in.
	From #69a.1: concrete / masonry:			
		End Wall	Interior Wall	
:	Anchor bolt diameter			_ in.

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		End Wall	Interior Wall	
	Anchor bolt spacing			in.
	Rebar size			
	Lap splice			in.
	Rebar hook length			in.
	From #69a.2: wood:			
	Required nailing			
-	Minimum plywood nailer			
	Anchor bolt diameter			
·	Anchor bolt spacing		· · ·	in.
2.	For transverse short foundation walls completed will agonal braces (#69b)	th di-		
	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>	Interior	
	Diagonal spacing (same as number of short walls)		4) 	
	From #69b: concrete / masonry:			
	Anchor bolt diameter			in
	Number of bolts			•
	Rebar size			-
	Lap splice	· · · · ·	· · · · · · · · · · · · · · · · · · ·	in
	Rebar hook length		·	in

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

Number of X-brace locations (#59)

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	Spacing of vertical X-brace planes (#59)	7	_ ft.
	Items from #69c.3 and #69c.5		
· ·	Required anchor bolt diameter	1/2 0	_ in.
 	Number of bolts at top of footing to connect diagonal	3	-
	Diagonal strap size	A36 +-	14"×1"
	Connection to top flange of chassis beam (describe) $wft_{r}$	44'1	
	orizontal anchorage in the longitudinal direction - exte- or foundation walls		
1.	Continuous foundation walls		
	<u>Reinforcing for longitudinal foundation walls:</u> 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	<u>`</u>	
	Minimum plywood nailer		
	Anchor bolt diameter		
	Anchor bolt spacing	• •	in.

(Appendix G - Example 2)

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.

Required anchor bolt diameter.

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?
- 73. If #72 yes, approve. If no, return to applicant.

2 49 ft. 1/2 0 in. A36 +: 4"x1" w+ no yes,



## DISAPPROVE

# APPENDIX H MAPS

**H-100. GENERAL.** The following collection of maps is intended to assist the user in the foundation selection and design process. The maps provide information for geographic locations within the 50 States of the United States covering a wide range of issues: flooding, frost penetration, expansive soils, landslides, subsidence, termites, snow, wind and earthquakes. The maps have been accumulated from various sources, most notably the U.S. Department of Commerce Weather Bureau, the U.S. Army Corps of Engineers Waterways Experiment Station, and the American Society of Civil Engineers.

H-200. SEISMIC PERFORMANCE CATEGORIES. Table H-1 is a condensed version of the ASCE 7-93 Seismic Performance Category Table as it applies to manufactured housing.

# H-300. SPECIAL SEISMIC DE-SIGN CONSIDERATIONS FOR FOUNDATIONS.

H-300.1. General. Based on the Seismic Performance Category for the geographic location involved, special requirements must be satisfied that involve the foundation:

A. Seismic Performance Category A. There are no special requirements for the foundations of manufactured housing assigned to this Category.

**B.** Seismic Performance Category B. The site coefficient has been assumed as 2.0 for all Tables in Appendix B. The resulting capacities of the foundations, subjected to the prescribed seismic forces of the Tables in Appendix B shall meet the following requirements:

 Structural Components. The design strength of foundation components subjected to seismic forces alone or in combination with other prescribed loads and their detailing requirements shall conform to the requirements of the applicable material codes (wood, concrete or masonry) referenced by the local authority having jurisdiction.

2. Soil Capacities. For the load combination including earthquake, the capacity of the foundation soil in bearing or the capacity of the soil interface between pile, pier or caisson and the soil must be sufficient to resist loads at acceptable strain considering both the short duration of loading and the dynamic properties of the soil.

**C.** Seismic Performance Category C. Foundations for buildings assigned to Category C shall conform to all of the Foundations for Categories A and B and to the following additional requirements of this section.

> 1. Investigation. The authority having jurisdiction may require the submission of a written report that shall include, in addition to the evaluations required in this section, the results of an investigation to deter

mine the potential hazards due to slope instability, liquefaction and surface rupture due to faulting or lateral spreading, all as a result of earthquake motions.

2. Foundation Ties. Individual drilled piers shall be interconnected by ties. All ties shall have a design strength in tension or compression, greater than a force equal to 25 percent of the effective peak velocity related acceleration (Av) time the larger column dead plus live load. 3. Special Pile Requirements. For uncased concrete drilled piers, there shall be a minimum of four longitudinal bars (with a minimum reinforcement ratio of 0.005) and No. 3 closed ties with maximum spacing of 3 inches.

**D.** Seismic Performance Category D. Category D does not add any additional requirements for manufactured housing. The requirements of Category C plus A and B shall be followed.













H-8

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H-12





BUILDINGS AND OTHER STRUCTURES

H-14



BUILDINGS AND OTHER STRUCTURES

Contour Map for Coefficient A.



BUILDINGS AND OTHER STRUCTURES

Effective Peak Velocity-Related Acceleration A.	Seismic Performance Category
$A_v < 0.05$	- A
$0.05 \le A_v < 0.10$	В
$0.10 \le A_v < 0.20$	С
$0.20 \leq A_v$	D

# <u>Table H-1</u> Seismic Performance Category for Seismic Hazard Exposure Group I

Manufactured Housing of Category A and B (one story detached one and two family dwellings which are located in seismic map area having an effective peak velocity-related acceleration  $(A_v)$  value less than 0.15) are exempt from the requirements of these provisions.

Manufactured Housing of Category C and D shall comply with all the requirements of these provisions.

# APPENDIX I REFERENCES AND ADDITIONAL RESOURCES

### REFERENCES

American Society for Testing Materials. Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort. ASTM: D 1557-91. Philadephia, PA.: ASTM, 1995.

American Society of Civil Engineers. Minimum Design Loads for Buildings and Other Structures. (ASCE 7-93) Revision of ANSI / ASCE 7-88. New York, NY: American Society of Civil Engineers, 1993.

Council of American Building Officials. CABO One and Two Family Dwelling Code (including Appendix C). Falls Church, VA: Council of American Building Officials, 1989.

Federal Emergency Management Agency, ed. Manufactured Home Installation in Flood Hazard Areas. Washington DC: Government Printing Office, September, 1985.

National Academy of Sciences Report. Reducing Losses From Land Subsidence in U.S.

National Bureau of Standards. Construction of Housing in Mine Subsidence Areas. NBSIR 81-2215.

U.S. Department of Agriculture. Rural Housing Loan Policies, Procedures, and Authorizations. Subpart A of Part 1924 and Subpart A of Part 1944 of Chapter XVIII, Federal Register, Volume 51, Number 12, January 17, 1986. Rural Housing and Community Development Service, formerly the Farmers Home Administration. Washington DC: Government Printing Office, 1986.

U.S. Department of Housing and Urban Development. Architectural Processing and Inspections for Home Mortgage Insurance. HUD Handbook 4145.1 REV-3 Change 1, Issued February 14, 1992.

U.S. Department of Housing and Urban Development. Land-planning Data Sheet. HUD Handbook 4140.3. Washington DC: Government Printing Office, 1983.

U.S. Department of Housing and Urban Development. Manufactured Home Construction and Safety Standards. Part 3280, 1994. Interpretive Bulletins to the Standard, including changes effective July 13 and October 25, 1994. Code of Federal Regulations Housing and Urban Development.

U.S. Department of Housing and Urban Development. Minimum Property Standards (MPS) for Housing, 1994 Edition. HUD Handbook 4910.1, 1994 Edition. Washington DC: Government Printing Office, 1994.

U.S. Department of Housing and Urban Development. Procedures for Approval of Single Family Proposed Construction Applications in New Subdivisions. HUD Handbook 4135.1 REV. 2, March 1981.

U.S. Department of Housing and Urban Development. Value Analysis for Home Mortgage Insurance. HUD Handbook 4150.1 REV-1, February 1990. Vann, W.P. and McDonald, J.R. An Engineering Analysis: Mobile Homes in Windstorms. Lubbock, TX: Institute for Disaster Research, 1978.

### ADDITIONAL RESOURCES

American Plywood Association. Permanent Wood Foundation Plans for Double-Wide Manufactured Homes. Plan F, Tacoma, WA: American Plywood Association, January, 1985.

Bernhardt, Arthur D. Building Tomorrow. Cambridge, MA: MIT Press, 1980.

Breyer, Donald E. Design of Wood Structures, 3rd Edition. New York, NY: McGraw-Hill Book Company, 1993.

Building Research Advisory Board, ed. Criteria for Selection and Design of Residential Slabs-on-ground. Publication 1571. Washington DC: National Academy of Sciences, 1968.

Cidras, Joseph M.; Kumar, V.K.; and Stern, E.G. Mass-produced Foundations for Massproduced Houses: A progress report. VPI Bulletin 103. Blacksburg, VA: Virginia Polytechnic Institute and State University, 1971.

Cooke, P.W., and Zelenka, L.P. Mobile Home Construction Standards Adopted by State Regulatory Programs - An Analysis. Washington DC: National Bureau of Standards, 1975. NBSIR 75-680.

**Cooke, P.W., et.al.** Model Documents for the Evaluation, Approval and Inspection of Manufactured Buildings. NBSBSS 87. Washington DC: National bureau of Standards, 1976.

Hays, W.W., ed. Facing Geologic and Hydrologic Hazards: Earth Science Considerations. Geological Survey Professional Paper 1240-B, Washington DC: Government Printing Office, 1981.

HUDAC. Precast Foundation System for Low-rise Housing. HUDAC, Toronto, 1973.

Illinois Department of Public Health. Illinois Mobile Home, Tie-down Act 1980, Rules and Regulations. Springfield, IL: Illinois Department c<sup>\*</sup> Public Health, Division of Engineering, 1980.

Indiana Administrative Building Council. Indiana Standard for the Permanent Installation of Manufactured Homes. Indianapolis, IN: Administrative Building Council, 1982.

Jones, Rudard A. Sectionalized Houses. Research Report 62-2. Champaign-Urbana, IL: University of Illinois Small Homes Council-Building Research Council, 1962.

Kumar, Viswanath Krushna. Industrialized Foundations for Low-rise Light-weight Buildings. VPI Bulletin 109. Blacksburg, VA: Virginia Polytechnic Institute and State University, 1972.

NAHB Research Foundation. An Investigation of Precast Concrete Foundation Systems for Residential Construction. Rockville, MD: NAHB, 1973.

National Conference of States on Building Codes and Standards, Inc. American National Standard: Manufactured Home Instaliations/1994. NCSBCS / ANSI A225.1: 1994. Herndon, VA: National Conference of States on Building Codes and Standards, Inc., 1994. National Conference of States on Building Codes and Standards, Inc. Effect of Earthquake Forces on Manufactured Homes. Housing and Building Technology, a Division of NCSBCS, March 24, 1995.

National Forest Products Assn., Permanent Wood Foundation System, Design, Fabrication, Installation Manual. Washington DC: National Forest Products Assn., January, 1987.

National Institute of Building Sciences. A Study of the Standards Referenced in the Federal Mobile Home Construction and Safety Standards. Washington DC: National Institute of Building Sciences, 1980.

National Institute of Standards and Technology (NIST). Recommended Performance Based Criteria for the Design of Manufactured Home Foundation Systems to Resist Wind and Seismic Loads, August 1995. Gaithersburg, MD: Building and Fire Research Laboratory, National Institute of Standards and Technology. NISTIR 5664.

Nutt-Powell, Thomas E., ed. Manufactured Homes: Making Sense of a Housing Opportunity. Boston, MA: Auburn House Publishing Co, 1982.

Nutt-Powell, Thomes E., ed. Manufactured Housing: A Look at the Issues. Cambridge, MA: Joint Center for Urban Studies of MIT and Harvard University, 1982.

Penner, E. and Crawford, A. Frost Action and Foundations. Ottawa, Canada: National Research Council of Canada, 1983. Robinson, G.D. and Spieker, A.M., ed. Nature to be Commanded: Earth Science Maps Applied to Land and Water Management. Geological Survey Professional Paper 950, Washington DC: Government Printing Office, 1978.

Smalt Homes Council-Building Research Council. 19th Annual Short Course in Residential Construction. Champaign-Urbana, IL: University of Illinois, Small Homes Council-Building Research Council, 1964.

Stern, E. George. Nailed Flinch Beams and Girders Providing New Opportunities in Wood Construction. Preprint 82-002, Las Vegas, NV: Proceedings of American Society of Civil Engineers, 1982.

Stern, E. George. Up-grading of Wood Structures by Use of Improved Mechanical Fasteners. Preprint 80-525, Florida: Proceedings of American Society of Civil Engineers, 1980.

U.S. Department of Agriculture. Standard Modular Foundations Panels for Houses of All Shapes. Technical Bulletin 1541. Washington DC: Government Printing Office, 1976.

Ursell, C.R.; Taylor, D.; and Calcote. Transportation Research, Volume 1, Permanent Perimeter Foundations for Manufactured Housing. Final Report. San Antonio, TX: Southwest Research Institute, 1983.

Waldrup, Travis. Mobile Home Anchoring Systems and Related Construction. Lubbock, TX: Institute for Disaster Research, 1976.

Western Wood Products Association. Treated Lumber Foundations: Conventional and Factory Built Modular Homes. Portland, OR: Western Wood Products Association.

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