DESIGN & ENGINEERING GUIDE

SFM SUN FRAME MICRORAIL

SUN FRAME MICRORAIL

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Introduction

SunFrame MicroRail (SFM) by Unirac, Inc. offers a fully integrated, solar racking solution for residential sloped roofs. SFM empowers system installers by providing pre-assembled components with integrated bonding and innovative installation features, while eliminating long rails and loose hardware. System designers are equipped with Unirac's proven user friendly online desing tool, prescriptive tables, and easy to follow design steps, to create code compliant designs and complete bill of material outputs.

SFM is developed specifically for use as a "flush to roof" photovoltaic solar racking system to pitched roofs for 60-cell modules only. Unirac, Inc. also has racking product solutions for ballasted, flat roof, rail based flush to roof, and rail based tilted racking solutions. To learn more about our racking options, go to www.unirac.com.

Installers Responsibility

Please review this guide thoroughly before installing your SunFrame MicroRail system. This guide provides supporting documentation for building permit applications, planning and assembly the SunFrame MicroRail System.

The installer is solely responsible for:

- Complying with all applicable local or national building codes, including code requirements that are more strenuous than the guidelines set forth in this manual;
- Maintaining and enforcing all aspects of a safe working environment;
- Ensuring that Unirac and other products are appropriate for the particular installation and the installation environment.
- Ensuring that the roof, its rafters, connections, and any other structural support members can support the array under all code level loading conditions (this total building assembly is referred to as the building structure);
- Using only Unirac parts and installer-supplied parts as specified by Unirac (substitution of parts may void the warranty and invalidate the letters of certification in all Unirac publications);
- Ensuring that lag screws have adequate pullout strength and shear capacities as installed;
- Verifying the strength of any alternate mounting if used in lieu of the lag screws;
- Maintaining the waterproof integrity of the roof, including selection and proper installation of appropriate flashing;
- Ensuring safe installation of all electrical aspects of the PV array, including proper grounding/bonding;
- Array shading and output analysis;
- Ensuring correct and appropriate design parameters are used in determining the design loading used for design of the specific installation. Parameters, such as snow loading, wind speed, exposure, and topographic factor should be confirmed with the local building official or a licensed professional engineer.

Unirac shall not be liable for any losses, damages, or injuries that directly or indirectly result from any non-conformance with the above.

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Design Methodology

SunFrame MicroRail was designed using the Minimum Design Loads for Buidings and Other Structures by the American Society of Civil Engineers and Structural Engineering Institute, 2005 and 2010 editions. These are referred to as ASCE/SEI 7-05 and ASCE/SEI 7-10, respectively. Analytical desing steps for both ASCE/SEI 7-05 and ASCE/SEI 7-10 are provided in this guide to demonstrate our interpretation of these codes and outline our design methodology as it applies specifically to the SunFrame MicroRail product. A sample calculation can be found in Appendix E. Three methods have been provided to aid in design of your project. When to use each method is discussed in the project requirements & Design Aids section on the following page.

Note: Please review Table 1 in the Project Requirements and Deisgn Aids section of this Guide to choose the appropriate design aid. Unirac's online desing tool is highly recommended for all projects. It will provide you with a Bill of Materials, Certification Letter, and Calculations for your project.

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Project Requirements and Design Aid

Table 1 - Project Requirements & Design Aid			
Project Requirements (Blank Cells for Project Specific Input Provided for your Convenience)	**Design Aid**		
		Online Design Tool[1a]	**Prescriptive Design Method[1b]**	**Do It Yourself[1c] (Analytical Method)**
Project Name:				
Project Address:				
AHJ (Authority Having Jurisdiction):				
Current Adopted Building Code:		ASCE 7-05/ASCE 7-10	ASCE 7-05/ASCE 7-10	ASCE 7-05/ASCE 7-10
Local Jurisdiction Code Amendments:				
Occupancy/Risk Category*:		II	II	As Permitted by Code
Basic Wind Speed*:		85-170 mph	***85-150mph/110-190mph	As Permitted by Code
Wind Exposure Category*:		B,C or D	B, C or D	As Permitted by Code
Ground Snow Load*:		0-60 psf	***	As Permitted by Code
Seismic Coefficient, Ss*:		<3.1g	<3.1g	As Permitted by Code
Roof Height (Eave & Ridge)*:		15, 30 or 60 feet	15, 30 or 60 feet	As Permitted by Code
Roof Slope*:		0-45 Degrees	0-45 Degrees	As Permitted by Code
Roof Zone(s)*:		1, 2, or 3	1, 2, and 3	As Permitted by Code
Framed Module Type & Module*:		Appendix	Appendix	User Input
Module Weight*:		2.094psf - 3.056psf	2.094psf - 3.056psf	User Input
Module Width*:		39in - 41in	39in - 41in	User Input
Total Module Quantity*:		Up to 500	No Size Limit	User Input
Design Method:		Allowable Stress Design		Unlimited**
Project Specific Calculations for Solar System Provided:		Yes	No	No
Stamped/Certified Engineering Letter for Solar System Provided:		Yes	Yes	No
Bill of Materials for Unirac Components of Solar System Provided:		Yes	No	No

* Requirements must fall within defined range to utilize specified design aide. ** The design professional could use the appropriate code method to perform the design in LRFD, LSD, or ASD. *** Prescriptive Pressure tables located in this guide on pgs. 22-25, in Appendix B and Online. 1a. This is an easy-to-use online design tool that is recommended for all preliminary and final designs, estimating, and layout validation. It is located on our website at www.unirac.com. The Online Design Tool allows for a customized project design that results in a final design, bill of materials, price quote and stamped/certified engineering approval letters. 1b. Prescriptive Design Method: This method is a simplified-analytical approach to the design of your SFM project. This method is recommended when computers or internet access is not available. Once project specific requirements are known, the project design load pressures can be looked up in the Prescriptive Tables ((4) located in this guide on pgs. 22-25 and (10)located in Appendix B). If additional tables are needed, they can be found online at www.unirac.com. Once the load pressures (by roof zone) have been identified, they are color coded to the appropriate application and layout rules. 1c. Do It Yourself (Analytical Method): This design approach follows the ASD calculations step by step through both the ASCE 7-05 and 7-10 design codes. Equations, figures, tables, and commentary are provided for your convenience to aid in generating the specific design load pressures for your loading conditions, such as wind and snow. This method has been provided for design or layout requirements that fall outside of the other two options or for design professionals that prefer to create their own calculation packages.

Prescriptive Design Method - Quick Design Steps

<u>Step 1:</u> Define Project Requirements
   a. Fill in the Table 1 - Project Requirements & Design Aid
   b. Once project specific information is determined, confirm that the prescriptive design method may be utilized.
   c. Review the Prescriptive Tables in the Appendix to see if they meet your needs. If a more precise design is needed (if the tables in the Appendix don't meet your project requirements, but per Table 1, you can still utilize the Perscriptive Design Method) please utilize the online tool for design.

<u>Step 2:</u> Create Initial Array Layout
   a. Identify the structural supporting members of your building. A sketch/drawing of the roof with location of supporting members, vents, skylights, cable/wires, areas to avoid, etc., is highly recommended.
   b. Create a "rough draft" layout of solar modules on the actual project roof. (Refer to System Application & Layout Rules pgs. 26-28)

<u>Step 3:</u> Determine Array Design Pressure by Roof Zone
   a. Use information in steps 1 & 2 and go to the prescriptive pressure tables, in the Appendix B.
   b. Use fill-in boxes below to document your project specific pressures and tables utilized.
       Note: Not all prescriptive pressure tables have been included in the appendix. If your project specific pressures are unavailable, the following steps should be followed; a) Go to www.unirac.com and access the SFM design tool. b) input your project specific requirements. c) design pressures will be generated for you based on your project specific inputs. d) these pressures (by roof zone) will be used to follow through the remaining steps below.

Prescriptive Design Method - Quick Design Steps (Continued)

Project Criteria:

Pressure Table Title -
Building Height -
Exposure Category -
Seismic Factor (Ss) -
Roof Pitch -

Controlling Pressure:

	Up (psf)	Down (psf)	Down Slope (psf)	Lateral (psf)	Rule*
Roof zone 1:					
Roof zone 2:					
Roof zone 3:					

Record the rule with the highest number in this column of cells. For example, if the rule for Up is 1, Down is 2, Side is 1, and Lateral is 3 across a row (roof zone), input and utilize Rule 3 as stated in the Appendix.

c. Record the SunFrame Micro Rail Rules:

Interior Rows:	Overhang	Span

North Row:	Overhang	Span

Can Consecutive Spans be Utilized per the Rules?

Step 4: Look-up Layout and Attachment Guidelines for Array

    a. Review your layout in Step 2 above, the rules as recorded in Step 3c above, and the System Application & Layout Rules to determine potential attachment points to your structure and if additional support will be required to support your system.

Step 5: Define Grounding & Bonding Path

    a. Refer to the Installation Guide for how to determine the Grounding and Bonding Path.

Analytical Method - ASCE 7-05

Step 1: User Inputs (ASCE 7-05)

Notes / Clarifications:

Input	Notes / Clarifications
Roof Height (ft):	Mean roof height (15 ft, 30 ft, or 60 ft)
Roof Angle (degrees):	Convert roof pitch to angle in degrees **[See Appendix C]**
Basic Wind Speed (MPH):	Per Basic Wind Speed-US Map (ASCE 7-05, Figure 6-1)
Wind Exposure Category:	Determine the Exposure Category (B, C or D) by using the definitions for Surface Roughness Categories (ASCE 7-05, Sections 6.5.6.2 and 6.5.6.3)
Roof Zone:	Determine the Roof Zone (1, 2 or 3) (ASCE 7-05, Figure 6-3)
Ground Snow Load (psf):	P_g = Ground Snow Load in PSF. Ground Snow Loads (ASCE 7-05, Figure 7-1)
Seismic Factor S_s (g):	ASCE 7-05 (Figures 22-1 through Figure 22-14)
Roof Live Load[1] (psf):	0 PSF, 20 PSF, etc.
Module Manufacturer/Type:	
Solar Module Length (in):	
Solar Module Width (in):	
Solar Module Weight (lb):	
Module Dead Load (psf):	

Commentary:

1) Most Building Officials allow for all or a portion of the roofs original live load design load to be removed/reduced at the time that solar panels are being added to the roof. The rationale behind this is that live load or roof foot traffic is eliminated or reduced to designated paths. in other words, the roof top solar array and live load foot traffic cannot occupy the same space. If all of the roof live load can be utilized by the proposed solar array, 0 PSF should be entered.

Step 2: Wind Pressure (ASCE 7-05, Chapter 6)

Calculate the wind pressure for uplift and downforce, using GC_{pn} & GC_{pp} respectively, in the provided boxes.

Wind Pressure Equation - Method 2 - Analytical Method (ASCE 7-05, Section 6.5):

$P_p=q_h (GC_{pp}-GC_{pi})$ (ASCE 7-05, Section 6.5.12.4.1) (GC_{pp} - Positive Downforce Factor)

$P_n=q_h (GC_{pn}-GC_{pi})$ (ASCE 7-05, Section 6.5.12.4.1) (GC_{pn} - Negative Uplift Factor)

GC_{pi} equals zero (per AC428, November 2012) (internal pressure coefficient)

GC_p is defined below (ASCE 7-05 Figure 6-11) and is a function of the roof zone, effective wind area (feet squared), and roof angle (degrees) (external pressure coefficient)

GC_{pp} (Positive downforce factor)

GC_{pn} (Negative uplift factor)

(ASCE 7-05, Figure 6-11B) for roof angles ≤ 7°

(ASCE 7-05, Figure 6-11C) for roof angles > 7° and ≤ 27°

(ASCE 7-05, Figure 6-11D) for roof angles > 27° and ≤ 45°

$q_h = q_z$

$q_z=0.00256K_z*K_{zt}*K_d*V^2*I$ (ASCE 7-05, Section 6.5.10)

K_z	Velocity Pressure Coefficient (ASCE 7-05, Table 6-3)
K_{zt}	Topographic Factor (ASCE 7-05, Section 6.5.7.2 & Figure 6-4)
K_d	Directionality Factor (ASCE 7-05, Table 6-4)
V	Basic Wind Speed in MPH from User Inputs in Step 1
I	Importance Factor[2] (ASCE 7-05, Table 6-1)

Commentary:

2) Typical values for the Importance Factor are 0.87 based on Occupancy Category I and 1.0 based on Occupancy Category II. Occupancy I is defined by ASCE 7-05 to mean "Buildings and other structures that present a low hazard to human life in the event of failure...".

Step 3: Dead Load

Calculated Ps (Sloped roof snow load) in the provided boxes.

Module Dead Load (psf):	Module Dead Load (psf) should be determined from User Inputs in Step 1
Racking System Dead Load[3] (psf):	**[See Appendix D]** (The racking system dead load should be taken as the total weight of the racking system (hardware, rails, nuts, bolts, attachments, etc.) divided by the total module area of the system.) Component weights can be found in the technical data sheets.
Total Dead Load (psf):	Sum of module dead load and racking system dead load

Calculated Dead Load in the provided boxes.

Step 4: Snow Load (ASCE 7-05, Chapter 7)

Sloped Roof Snow Load Pressure Equation:

$P_s=0.7*C_s*C_e*C_t*I*P_g$ (ASCE 7-05, Section 7.3)

	P_g	Ground Snow Load[4] (psf) from User inputs in Step 1.
	C_s	Slope Factor (ASCE 7-05, Figure 7-2)
	C_t	Thermal Factor[5] (ASCE 7-05, Table 7-3)
	I	Importance Factor[6] (snow) (ASCE 7-05, Table 7-4)
	C_e	Exposure Factor (ASCE 7-05, Table 7-2)

Commentary:

3) To be combined with the module dead load and used in wind load combinations.

4) The ground snow load is utlilized to calculate the roof snow load, which is the load applied to the structure.

5) From Section C7.8 of ASCE 7-05, "the collectors should be designed to sustain a load calculated by using the "unobstructed slippery surfaces" curve in Fig. 7-2a". This graph recommends the use of a C_t value of less than or equal to 1.0.

6) The Snow Importance Factor for Occupancy Category I = 0.8 and for Occupancy Category II = 1.0.

Step 5: Seismic Load (ASCE 7-05)

Calculate seismic loads for both horizontal and vertical in the provided boxes.

Seismic Load Equation (Horizontal):

$F_{p(horizontal)}=[(0.4*a_p*S_{DS}*W_p)/(R_p/I_p)]*(1+2*z/h)$ (ASCE 7-05, 13.3.1)

F_p need not exceed $1.6*S_{DS}*I_p*W_p$ and F_p shall not be less than $F_p=0.3*S_{DS}*I_p*W_p$

psf (seismic load (horiz.) on the module, divide by Fp the effected area)

a_p Component Amplification Factor[7] (ASCE 7-05, Table 13.6-1)

R_p Component Response Modification Factor[8] (ASCE 7-05, Table 13.6-1)

S_{DS} Spectral Acceleration (ASCE 7-05, Section 11.4.4) $S_{DS}=2/3*S_{MS}$

$S_{MS}=F_a*S_s$ (ASCE 7-05, Section 11.4.3)

F_a Site Coefficient (ASCE 7-05, Table 11.4-1)

S_s from User Inputs in Step 1

W_p Component operating weight (lbs) (determine by using total dead load (PSF) multiplied by the effected area (SF) of the component or attachment

I_p Seismic Importance Factor[9] (ASCE 7-05, section 13.1.3)

z Height in structure of point of attachment of component with respect to the base (ASCE 7-05, Section 13.3.1)

h average roof height of structure with respect to the base (ASCE 7-05, Section 13.3.1)

Seismic Load Equation (Vertical):

$F_{p(vertical)}=\pm0.2*S_{DS}*W_p$ (ASCE 7-05, Section 12.4.2.2)

psf (seismic load (vert.) on the module, divide Fp by the effected area)

Commentary:

7) The Component Amplification Factor (ap) for flush-mount systems should be taken as 1.0 (AC428, Section 3.1.3.3).

8) The Component Response Modification Factor (Rp) for flush-mounted systems should be taken as 1.5 (AC428, Section 3.1.3.3).

9) The Seismic Importance Factor for Occupancy Categories I and II = 1.0.

Step 6: Rewrite Your Loads

*Depending on your coordinate system, certain loads will need to be split into their horizontal and vertical components.

Total Dead Load:	psf
Wind Pressure Up:	psf
Wind Pressure Down:	psf
Snow Load:	psf
Seismic Load Horizontal:	lbs
Seismic Load Vertical:	psf

Step 7: Load Combinations (ASCE 7-05, Chapter 2, Section 2.4.1)

*The load combinations below have been identified as the likely controling cases for the roof structure.

1) D
2) D + L_r
3) D + S
4) D + W_{up}
5) D + W_{down}
6) D + 0.75W_{down} + 0.75S
7) D + 0.75W_{down} + 0.75Lr

8) D + 0.75(0.7E) + 0.75L_r
9) D + 0.75(0.7E) + 0.75S
10) D + 0.7E
11) 0.6D + W_{up}
12) 0.6 D + W_{down}
13) 0.6 D + 0.7E

D = Dead Load
L_r = Live Load to Roof
S = Snow Load
W_{up} = Wind Load Up
W_{down} = Wind Load Down
E = Earthquake/Seismic Load

Step 8: Create Initial Array Layout

a. Identify the structural supporting members of your building. A sketch/drawing of the roof/building with location of supporting members, vents, skylights, cable/wires, areas to avoid, etc., is highly recommended.

b. Create a "rough draft" layout of solar modules on the actual project roof. (Refer to System Application & Layout Rules)

Step 9: Determine Array Design Pressure by Roof Zone

a. Using information in steps 1 & 2 and go to the prescriptive pressure tables, in the Appendix B.
b. Use fill-in boxes below to document your project specific pressures and tables utilized.

> Note: Not all prescriptive pressure tables have been included in the appendix. If your project specific pressures are unavailable, the following steps should be followed; a) Go to www.unirac.com and access the SFM design tool. b) input your project specific requirements. c) Design pressure will be generated for you based on your project specific inputs. d) these pressures (by roof zone) will be used to follow through the remaining steps below.

Project Criteria:

Pressure Table Title -
Building Height -
Exposure Category -
Lateral (Ss) -
Roof Pitch -

Controlling Pressure:

	Up (psf)	Down (psf)	Down Slope (psf)	Lateral (psf)	Rule*
Roof zone 1:					
Roof zone 2:					
Roof zone 3:					

Record the rule with the highest number in this column of cells. For example, if the rule for Up is 1, Down is 2, Side is 1, and Lateral is 3 across a row (roof zone), input and utilize Rule 3 as stated in the Appendix.

c. Record the SunFrame Micro Rail Rules:

Interior Rows:	Overhang	Span	North Row:	Overhang	Span

Can Consecutive Spans be Utilized per the Rules?

Step 10: Look-up Layout and Attachment Guidelines for Array

a. Review your layout in Step 8 above, the rules as recorded in Step 9c above, and the System Application & Layout Rules to determine potential attachment points to your structure and if additional support will be required to support your system.

Step 11: Determine Load to the Roof

a. To determine the load on the roof through the attachment:
   - i. Determine the tributary area to each attachment.
   - ii. Review the controlling pressure in Steps 6 and 7.
   - iii. Determine pressure zones on the roof per the layout and attachment guidelines in the Installation Guide.
   - iv. Multiply the tributary area by the roof pressure to obtain loads to the roof attachment.
   - v. Determine the point load to the roof at each attachment.
   - vi. Appendix E contains a sample calculation for reference.

Step 12: Check Roof Load

a. Ensure that the supporting structure is capable of withstanding the additional loads imposed by the proposed solar system.

Step 13: Define Grounding & Bonding Path

a. Refer to the Installation Guide for how to determine the Grounding and Bonding Path.

Analytical Method - ASCE 7-10

Step 1: User Inputs (ASCE 7-10)

Notes / Clarifications:

Input	Notes / Clarifications
Roof Height (ft):	Mean roof height (15 ft, 30 ft, or 60 ft)
Roof Angle (degrees):	Convert roof pitch to angle in degrees [See Appendix C]
Basic Wind Speed (MPH):	Per Basic Wind Speeds for Risk Category I (ASCE 7-10, Figure 26.5-1A)
Wind Exposure Category:	Determine the Exposure Category (B, C or D) by using the definitions for Surface Roughness Categories (ASCE 7-10, Sections 26.7.2 and 26.7.3)
Roof Zone:	Determine the Roof Zone (1, 2 or 3)(ASCE 7-10, Figure 30.5-1)
Ground Snow Load (psf):	Pg = Ground Snow Load in PSF. Ground Snow Loads (ASCE 7-10, Figure 7-1)
Seismic Factor S_s (g):	ASCE 7-10 (Figures 22-1, 22-3, 22-25 and 22-6)
Roof Live Load[1] (psf):	0 PSF, 20 PSF, etc.
Module Manufacturer/Type:	
Solar Module Length (in):	
Solar Module Width (in):	
Solar Module Weight (lb):	
Module Dead Load (psf):	

Commentary:

1) Most Building Officials allow for all or a portion of the roofs original live load design load to be removed/reduced at the time that solar panels are being added to the roof. The rationale behind this is that live load or roof foot traffic is eliminated or reduced to designated paths. in other words, the roof top solar array and live load foot traffic cannot occupy the same space. If all of the roof live load can be utilized by the proposed solar array, 0 PSF should be entered.

Step 2: Wind Pressure (ASCE 7-10, Chapter 30)

Calculate the wind pressure for uplift and downforce, using GC_{pn} & GC_{pp} respectively, in the provided boxes.

Wind Pressure Equation - Components & Cladding (ASCE 7-10, Section 30.4.2):

$P_p=q_h (GC_{pp}-GC_{pi})$ (ASCE 7-10, Section 30.4.2) (GC_{pp} - Positive Downforce Factor)

$P_n=q_h (GC_{pn}-GC_{pi})$ (ASCE 7-10, Section 30.4.2) (GC_{pn} - Negative Uplift Factor)

GC_{pi} equals zero (per AC428, November 2012) (internal pressure coefficient)

GC_p is defined below (ASCE 7-05 Figure 6-11) and is a function of the roof zone, effective wind area (feet squared), and roof angle (degrees) (external pressure coefficient)

GC_{pp} (Positive downforce factor)

GC_{pn} (Negative uplift factor)

(ASCE 7-10, Figure 30.4-2A) for roof angles ≤ 7°

(ASCE 7-10, Figure 30.4-2B) for roof angles > 7° and ≤ 27°

(ASCE 7-10, Figure 30.4-2C) for roof angles > 27° and ≤ 45°

$q_h = qz$

$q_z=0.00256*K_z*K_{zt}*K_d*V^2$ (ASCE 7-10, Section 30.3.2)

	K_z	Velocity Pressure Coefficient (ASCE 7-10, Table 30.3-1)
	K_{zt}	Topographic Factor (ASCE 7-10, Section 26.8 & Figure 26.8-1)
	K_d	Directionality Factor (ASCE 7-10, Table 26.6-1)
	V	Basic Wind Speed in MPH from User Inputs in Step 1

Step 3: Dead Load

Calculated Ps (Sloped roof snow load) in the provided boxes.

Module Dead Load (psf):	Module Dead Load (psf) should be determined from User Inputs in Step 1
Racking System Dead Load[3] (psf):	**[See Appendix D]** (The racking system dead load should be taken as the total weight of the racking system (hardware, rails, nuts, bolts, attachments, etc.) divided by the total module area of the system.) Component weights can be found in the technical data sheets.
Total Dead Load (psf):	Sum of module dead load and racking system dead load

Calculated Dead Load in the provided boxes.

Step 4: Snow Load (ASCE 7-10, Chapter 7)

Sloped Roof Snow Load Pressure Equation:

	$Ps=0.7*Cs*Ce*Ct*I*Pg$ (ASCE 7-10, Sections 7.3 & 7.4 Flat and Sloped Roof Snow Loa
Pg	Ground Snow Load (psf) from User inputs in Step 1.
Cs	Slope Factor (ASCE 7-10, Figure 7-2)
C_t	Thermal Factor (ASCE 7-10, Table 7-3)
I	Importance Factor (snow) (ASCE 7-10, Table 1.5-2)
Ce	Exposure Factor (ASCE 7-10, Table 7-2)

Commentary:

2) To be combined with the module dead load and used in wind load combinations.

3) The ground snow load is utlilized to calculate the roof snow load, which is the load applied to the structure.

4) The Snow Importance Factor for Occupancy Category I = 0.8 and for Occupancy Category II = 1.0.

Step 5: Seismic Load (ASCE 7-10)

Calculate seismic loads for both horizontal and vertical in the provided boxes.

Seismic Load Equation (Horizontal):

$F_p(horizontal) = [(0.4*a_p*S_{DS}*W_p)/(R_p/I_p)]*(1+2*z/h)$ (ASCE 7-10, 13.3.1)

F_p need not exceed $1.6*S_{DS}*I_p*W_p$ and F_p shall not be less than $F_p = 0.3*S_{DS}*I_p*W_p$

psf (seismic load (horiz.) on the module, divide by Fp the effected area)

a_p Component Amplification Factor (ASCE 7-10, Table 13.5-1)

R_p Component Response Modification Factor6 (ASCE 7-10, Table 13.5-1)

S_{DS} Spectral Acceleration (ASCE 7-10, Section 11.4.4) $S_{DS}=2/3*S_{MS}$

$S_{MS}=F_a*S_s$ (ASCE 7-10, Section 11.4.3)

F_a Site Coefficient (ASCE 7-10, Table 11.4-1)

S_s from User Inputs in Step 1

W_p Component operating weight (lbs) (determine by using total dead load (PSF) multiplied by the effected area (SF) of the component or attachment

I_e Seismic Importance Factor7 (ASCE 7-10, section 1.5-2)

z Height in structure of point of attachment of component with respect to the base (ASCE 7-10, Section 13.3.1)

h average roof height of structure with respect to the base (ASCE 7-10, Section 13.3.1)

Seismic Load Equation (Vertical):

$F_{p(vertical)}=\pm0.2*S_{DS}*W_p$ (ASCE 7-10, Section 12.4.2.2)

psf (seismic load (vert.) on the module, divide F_p by the effected area)

Commentary:

5) The Component Amplification Factor (a_p) for flush-mount systems should be taken as 1.0 (AC428, Section 3.1.3.3).

6) The Component Response Modification Factor (R_p) for flush-mount systems should be taken as 1.5 (AC428, Section 3.1.3.3).

7) The Seismic Importance Factor for Occupancy Categories I and II = 1.0.

Step 6: Rewrite Your Loads

*Depending on your coordinate system, certain loads will need to be split into their horizontal and vertical components.

Total Dead Load:		psf
Wind Pressure Up:		psf
Wind Pressure Down:		psf
Snow Load:		psf
Seismic Load Horizontal:		lbs
Seismic Load Vertical:		psf

Step 7: Load Combinations (ASCE 7-10, Chapter 2, Section 2.4.1)

*The load combinations below have been identified as the likely controling cases for the roof structure.

1) D
2) D + L_r
3) D + S
4) D + $0.6W_{up}$
5) D + $0.6W_{down}$
6) D + $0.75(0.6W_{down})$ + 0.75S
7) D + $0.75(0.6W_{down})$ + $0.75L_r$

8) D + 0.75(0.7E) + $0.75L_r$
9) D + 0.75(0.7E) + 0.75S
10) D + 0.7E
11) 0.6D + $0.6W_{up}$
12) 0.6 D + $0.6W_{down}$
13) 0.6 D + 0.7E

D = Dead Load
L_r = Live Load to Roof
S = Snow Load
W_{up} = Wind Load Up
W_{down} = Wind Load Down
E = Earthquake/Seismic Load

Step 8: Create Initial Array Layout

a. Identify the structural supporting members of your building. A sketch/drawing of the roof/building with location of supporting members, vents, skylights, cable/wires, areas to avoid, etc., is highly recommended.

b. Create a "rough draft" layout of solar modules on the actual project roof. (Refer to System Application & Layout Rules)

<u>Step 9:</u> Determine Array Design Pressure by Roof Zone

a. Using information in steps 1 & 2 and go to the prescriptive pressure tables, in the Appendix B.

b. Use fill-in boxes below to document your project specific pressures and tables utilized.

> Note: Not all prescriptive pressure tables have been included in the appendix. If your project specific pressures are unavailable, the following steps should be followed; a) Go to www.unirac.com and access the SFM design tool. b) input your project specific requirements. c) Design pressure will be generated for you based on your project specific inputs. d) these pressures (by roof zone) will be used to follow through the remaining steps below.

Project Criteria:

Pressure Table Title -	
Building Height -	
Exposure Category -	
Lateral (Ss) -	
Roof Pitch -	

Controlling Pressure:

	Up (psf)	Down (psf)	Down Slope (psf)	Lateral (psf)	Rule*
Roof zone 1:					
Roof zone 2:					
Roof zone 3:					

Record the rule with the highest number in this column of cells. For example, if the rule for Up is 1, Down is 2, Side is 1, and Lateral is 3 across a row (roof zone), input and utilize Rule 3 as stated in the Appendix.

c. Record the SunFrame Micro Rail Rules:

Interior Rows:	Overhang	Span		North Row:	Overhang	Span

Can Consecutive Spans be Utilized per the Rules? [ ]

Step 10: Look-up Layout and Attachment Guidelines for Array

    a. Review your layout in Step 8 above, the rules as recorded in Step 9c above, and the System Application & Layout Rules to determine potential attachment points to your structure and if additional support will be required to support your system.

Step 11: Determine Load to the Roof

    a. To determine the load on the roof through the attachment:
        i. Determine the tributary area to each attachment.
        ii. Review the controlling pressure in Steps 6 and 7.
        iii. Determine pressure zones on the roof per the layout and attachment guidelines in the Installation Guide.
        iv. Multiply the tributary area by the roof pressure to obtain loads to the roof attachment.
        v. Determine the point load to the roof at each attachment.
        vi. Appendix E contains a sample calculation for reference.

Step 12: Check Roof Load

    a. Ensure that the supporting structure is capable of withstanding the additional loads imposed by the proposed solar system.

Step 13: Define Grounding & Bonding Path

    a. Refer to the Installation Guide for how to determine the Grounding and Bonding Path.

Up and Down (psf)

Exposure Category B

Roof Pitch	Bldg. Height = 60 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 30 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 15 ft. Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-12.1	-22.9	-36.3	14.8	-9.8	-18.6	-29.7	14.8	-9.8	-18.6	-29.7	14.8
2:12	-10.8	-21.6	-33.6	14.4	-8.7	-17.5	-27.5	14.4	-8.7	-17.5	-27.5	14.4
3:12	-10.8	-21.6	-33.7	14.0	-8.7	-17.6	-27.5	14.0	-8.7	-17.6	-27.5	14.0
4:12	-10.9	-21.6	-33.7	13.2	-8.7	-17.6	-27.5	13.2	-8.7	-17.6	-27.5	13.2
5:12	-10.9	-21.6	-33.7	13.2	-8.8	-17.6	-27.6	13.2	-8.8	-17.6	-27.6	13.2
6:12	-10.9	-21.7	-33.8	13.0	-8.8	-17.7	-27.6	13.0	-8.8	-17.7	-27.6	13.0
7:12	-12.3	-15.0	-15.0	15.4	-9.9	-12.2	-12.2	13.3	-9.9	-12.2	-12.2	13.3
8:12	-12.4	-15.0	-15.0	15.3	-10.0	-12.2	-12.2	13.2	-10.0	-12.2	-12.2	13.2
9:12	-12.4	-15.1	-15.1	15.2	-10.0	-12.2	-12.2	13.0	-10.0	-12.2	-12.2	13.0
10:12	-12.4	-15.1	-15.1	15.0	-10.1	-12.3	-12.3	12.9	-10.1	-12.3	-12.3	12.9
11:12	-12.5	-15.2	-15.2	14.9	-10.1	-12.3	-12.3	12.8	-10.1	-12.3	-12.3	12.8
12:12	-12.5	-15.2	-15.2	14.8	-10.2	-12.4	-12.4	12.7	-10.2	-12.4	-12.4	12.7

Exposure Category C

Roof Pitch	Bldg. Height = 60 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 30 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 15 ft. Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-16.6	-30.9	-48.7	14.8	-14.2	-26.6	-42.1	14.8	-12.1	-22.9	-36.3	14.8
2:12	-14.8	-29.1	-45.1	14.4	-12.7	-25.1	-39.0	14.4	-10.8	-21.6	-33.6	14.4
3:12	-14.8	-29.1	-45.2	14.0	-12.7	-25.1	-39.0	14.0	-10.8	-21.6	-33.7	14.0
4:12	-14.8	-29.1	-45.2	13.2	-12.7	-25.1	-39.0	13.2	-10.9	-21.6	-33.7	13.2
5:12	-14.9	-29.2	-45.2	13.2	-12.7	-25.2	-39.1	13.2	-10.9	-21.7	-33.7	13.2
6:12	-14.9	-29.2	-45.3	13.0	-12.8	-25.2	-39.1	13.0	-10.9	-21.7	-33.8	13.0
7:12	-16.7	-20.3	-20.3	19.4	-14.4	-17.5	-17.5	17.3	-12.3	-15.0	-15.0	15.4
8:12	-16.8	-20.4	-20.4	19.3	-14.4	-17.5	-17.5	17.1	-12.4	-15.0	-15.0	15.3
9:12	-16.8	-20.4	-20.4	19.1	-14.5	-17.6	-17.6	17.0	-12.4	-15.1	-15.1	15.2
10:12	-16.9	-20.4	-20.4	19.0	-14.5	-17.6	-17.6	16.9	-12.4	-15.1	-15.1	15.0
11:12	-16.9	-20.5	-20.5	18.9	-14.5	-17.6	-17.6	16.8	-12.5	-15.2	-15.2	14.9
12:12	-16.9	-20.5	-20.5	18.8	-14.6	-17.7	-17.7	16.7	-12.5	-15.2	-15.2	14.8

Exposure Category D

Roof Pitch	Bldg. Height = 60 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 30 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 15 ft. Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-19.4	-36.0	-56.7	14.8	-17.0	-31.7	-50.0	14.8	-15.0	-28.0	-44.3	14.8
2:12	-17.4	-33.9	-52.5	15.0	-15.2	-29.9	-46.4	14.4	-13.4	-26.4	-41.0	14.4
3:12	-17.4	-33.9	-52.6	14.5	-15.2	-29.9	-46.4	14.0	-13.4	-26.4	-41.1	14.0
4:12	-17.4	-34.0	-52.6	14.0	-15.3	-29.9	-46.4	13.2	-13.4	-26.4	-41.1	13.2
5:12	-17.4	-34.0	-52.6	13.9	-15.3	-30.0	-46.5	13.2	-13.5	-26.5	-41.1	13.2
6:12	-17.5	-34.0	-52.7	13.8	-15.3	-30.0	-46.5	13.0	-13.5	-26.5	-41.2	13.0
7:12	-19.6	-23.7	-23.7	21.9	-17.2	-20.9	-20.9	18.0	-15.2	-18.4	-18.4	18.0
8:12	-19.6	-23.8	-23.8	21.8	-17.3	-20.9	-20.9	17.8	-15.2	-18.5	-18.5	17.8
9:12	-19.7	-23.8	-23.8	21.7	-17.3	-21.0	-21.0	17.7	-15.2	-18.5	-18.5	17.7
10:12	-19.7	-23.8	-23.8	21.6	-17.3	-21.0	-21.0	17.6	-15.3	-18.5	-18.5	17.6
11:12	-19.7	-23.9	-23.9	21.5	-17.4	-21.0	-21.0	17.5	-15.3	-18.6	-18.6	17.5
12:12	-19.8	-23.9	-23.9	21.3	-17.4	-21.1	-21.1	17.4	-15.4	-18.6	-18.6	17.4

Side Load (psf) — Lateral — Down Slope

Roof Pitch	Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
1:12	0.7	0.8	1.0	1.1	1.3	1.4	1.9	2.1	2.5	3.2	4.0	4.8
2:12	1.4	1.4	1.6	1.7	1.9	2.0	2.4	2.6	2.9	3.6	4.3	5.2
3:12	1.9	1.9	2.0	2.2	2.4	2.5	2.9	3.1	3.4	3.9	4.6	5.5
4:12	2.0	2.0	2.2	2.4	2.5	2.6	3.1	3.2	3.5	4.2	4.9	5.8
5:12	2.4	2.4	2.5	2.7	2.8	2.9	3.4	3.5	3.8	4.4	5.1	6.0
6:12	2.7	2.7	2.8	2.9	3.1	3.2	3.6	3.8	4.0	4.6	5.3	6.2
7:12	2.9	2.9	3.0	3.1	3.3	3.4	3.8	4.0	4.2	4.8	5.5	6.3
8:12	3.0	3.0	3.1	3.3	3.4	3.5	4.0	4.1	4.4	4.9	5.6	6.5
9:12	3.2	3.2	3.3	3.4	3.6	3.7	4.1	4.2	4.5	5.0	5.7	6.5
10:12	3.3	3.3	3.4	3.5	3.7	3.8	4.2	4.3	4.6	5.1	5.8	6.6
11:12	3.3	3.3	3.5	3.6	3.7	3.8	4.2	4.4	4.6	5.2	5.9	6.6
12:12	3.4	3.4	3.5	3.7	3.8	3.9	4.3	4.4	4.7	5.3	5.9	6.7
	0.0	0.2	0.5	0.7	0.9	1.0	1.6	1.8	2.2	2.9	3.6	4.5

California*

ASCE 7-10

110 mph Basic Wind Speed

5 psf Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

Up and Down (psf)

Exposure Category B

Bldg. Height = 15 ft — Up Pressures (psf)

Roof Pitch	Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-10.8	-20.5	-32.6	31.9
2:12	-9.6	-19.3	-30.2	30.0
3:12	-9.6	-19.3	-30.2	27.9
4:12	-9.7	-19.3	-30.2	25.8
5:12	-9.7	-19.4	-30.2	23.8
6:12	-9.7	-19.4	-30.3	21.9
7:12	-11.0	-13.4	-13.4	21.1
8:12	-11.0	-13.4	-13.4	19.5
9:12	-11.1	-13.5	-13.5	18.1
10:12	-11.1	-13.6	-13.6	16.9
11:12	-11.1	-13.6	-13.6	15.8
12:12	-11.2	-13.6	-13.6	14.9

Bldg. Height = 30 ft — Up Pressures (psf)

Roof Pitch	Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-13.4	-25.1	-39.8	31.9
2:12	-11.9	-23.7	-36.9	30.0
3:12	-12.0	-23.7	-36.9	27.9
4:12	-12.0	-23.7	-36.9	25.8
5:12	-12.0	-23.8	-37.0	23.8
6:12	-12.1	-23.8	-37.0	21.9
7:12	-13.6	-16.5	-16.5	21.1
8:12	-13.6	-16.5	-16.5	19.5
9:12	-13.6	-16.6	-16.6	18.1
10:12	-13.7	-16.6	-16.6	16.9
11:12	-13.7	-16.7	-16.7	15.8
12:12	-13.8	-16.7	-16.7	14.9

Bldg. Height = 60 ft — Up Pressures (psf)

Roof Pitch	Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-13.4	-25.1	-39.8	31.9
2:12	-11.9	-23.7	-36.9	30.0
3:12	-12.0	-23.7	-36.9	27.9
4:12	-12.0	-23.7	-36.9	25.8
5:12	-12.0	-23.8	-37.0	23.8
6:12	-12.1	-23.8	-37.0	21.9
7:12	-13.6	-16.5	-16.5	22.8
8:12	-13.6	-16.5	-16.5	21.2
9:12	-13.6	-16.6	-16.6	19.8
10:12	-13.7	-16.6	-16.6	18.6
11:12	-13.7	-16.7	-16.7	17.6
12:12	-13.8	-16.7	-16.7	16.7

Exposure Category C

Bldg. Height = 15 ft — Up Pressures (psf)

Roof Pitch	Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-18.7	-30.7	-48.5	29.8
2:12	-16.8	-29.0	-45.0	28.1
3:12	-16.8	-29.0	-45.0	26.2
4:12	-16.8	-29.0	-45.0	24.3
5:12	-16.8	-29.0	-45.1	22.5
6:12	-16.9	-29.1	-45.1	20.7
7:12	-18.9	-20.2	-20.2	24.0
8:12	-19.0	-20.3	-20.3	22.5
9:12	-19.0	-20.3	-20.3	21.2
10:12	-19.0	-20.4	-20.4	20.1
11:12	-19.1	-20.4	-20.4	19.2
12:12	-19.1	-20.4	-20.4	18.7

Bldg. Height = 30 ft — Up Pressures (psf)

Roof Pitch	Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-15.6	-29.2	-46.1	31.9
2:12	-14.0	-27.5	-42.7	30.0
3:12	-14.0	-27.5	-42.7	27.9
4:12	-14.0	-27.5	-42.8	25.8
5:12	-14.0	-27.6	-42.8	23.8
6:12	-14.1	-27.6	-42.8	21.9
7:12	-15.8	-19.2	-19.2	24.3
8:12	-15.9	-19.2	-19.2	22.7
9:12	-15.9	-19.3	-19.3	21.4
10:12	-15.9	-19.3	-19.3	20.1
11:12	-16.0	-19.4	-19.4	19.1
12:12	-16.0	-19.4	-19.4	18.2

Bldg. Height = 60 ft — Up Pressures (psf)

Roof Pitch	Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-18.2	-33.8	-53.4	31.9
2:12	-16.3	-31.9	-49.5	30.1
3:12	-16.3	-31.9	-49.5	28.1
4:12	-16.3	-32.0	-49.5	26.0
5:12	-16.4	-32.0	-49.5	23.9
6:12	-16.4	-32.0	-49.6	22.0
7:12	-18.4	-22.3	-22.3	26.1
8:12	-18.4	-22.3	-22.3	24.5
9:12	-18.5	-22.4	-22.4	23.1
10:12	-18.5	-22.4	-22.4	21.9
11:12	-18.6	-22.5	-22.5	20.8
12:12	-18.6	-22.5	-22.5	20.3

Exposure Category D

Bldg. Height = 15 ft — Up Pressures (psf)

Roof Pitch	Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-16.5	-30.7	-48.5	29.8
2:12	-14.7	-29.0	-45.0	28.1
3:12	-14.8	-29.0	-45.0	26.2
4:12	-14.8	-29.0	-45.0	24.3
5:12	-14.8	-29.0	-45.1	22.5
6:12	-14.9	-29.1	-45.1	20.7
7:12	-16.7	-20.2	-20.2	24.0
8:12	-16.7	-20.3	-20.3	22.5
9:12	-16.8	-20.3	-20.3	21.2
10:12	-16.8	-20.4	-20.4	20.1
11:12	-16.8	-20.4	-20.4	19.2
12:12	-16.9	-20.4	-20.4	18.7

Bldg. Height = 30 ft — Up Pressures (psf)

Roof Pitch	Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-18.7	-34.8	-54.8	29.8
2:12	-16.8	-32.8	-50.8	28.4
3:12	-16.8	-32.8	-50.8	26.6
4:12	-16.8	-32.8	-50.9	24.7
5:12	-16.8	-32.9	-50.9	22.8
6:12	-16.9	-32.9	-50.9	21.1
7:12	-18.9	-22.9	-22.9	25.5
8:12	-19.0	-23.0	-23.0	24.0
9:12	-19.0	-23.0	-23.0	22.8
10:12	-19.0	-23.0	-23.0	21.7
11:12	-19.1	-23.1	-23.1	20.9
12:12	-19.1	-23.1	-23.1	20.7

Bldg. Height = 60 ft — Up Pressures (psf)

Roof Pitch	Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-21.3	-39.4	-62.1	29.8
2:12	-19.1	-37.2	-57.5	29.4
3:12	-19.1	-37.2	-57.6	27.5
4:12	-19.1	-37.2	-57.6	25.6
5:12	-19.2	-37.3	-57.6	23.8
6:12	-19.2	-37.3	-57.7	22.0
7:12	-21.5	-26.0	-26.0	27.2
8:12	-21.6	-26.1	-26.1	25.8
9:12	-21.6	-26.1	-26.1	24.5
10:12	-21.6	-26.2	-26.2	23.4
11:12	-21.7	-26.2	-26.2	23.2
12:12	-21.7	-26.2	-26.2	23.1

Side Load (psf) — Lateral

Down Slope

Roof Pitch	Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.3	Ss=3.1
1:12	2.6	2.6	2.6	2.6	2.7	2.8	3.3	3.4	3.7	4.2	4.8	5.5
2:12	4.9	4.9	4.9	4.9	4.9	4.9	5.0	5.2	5.5	6.0	6.6	7.2
3:12	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.9	7.4	8.0	8.6
4:12	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	8.4	9.0	9.6
5:12	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	9.1	9.7	10.3
6:12	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.5	10.0	10.7
7:12	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.7	10.2	10.8
8:12	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.6	10.2	10.8
9:12	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.5	10.0	10.6
10:12	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	9.3	9.8	10.4
11:12	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9.0	9.5	10.0
12:12	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.7	9.1	9.7
	0.0	0.2	0.5	0.7	0.9	1.0	1.6	1.8	2.2	2.9	3.6	4.5

Massachusetts*

ASCE **7-10**

115 mph — Basic Wind Speed

40 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independently verified for the specific install location.

Up and Down (psf)

Exposure Category B

Roof Pitch	Bldg. Height = 60 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 30 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 15 ft. Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-17.5	-32.5	-51.2	25.9	-15.6	-26.5	-42.0	25.9	-14.2	-26.5	-42.0	25.9
2:12	-15.6	-30.6	-47.5	24.6	-12.6	-25.0	-38.9	24.6	-12.6	-25.0	-38.9	24.6
3:12	-15.6	-30.6	-47.5	23.1	-12.7	-25.0	-38.9	23.1	-12.7	-25.0	-38.9	23.1
4:12	-15.7	-30.7	-47.5	20.2	-12.7	-25.0	-38.9	20.2	-12.7	-25.0	-38.9	20.2
5:12	-15.7	-30.7	-47.6	18.9	-12.7	-25.1	-39.0	18.9	-12.7	-25.1	-39.0	18.9
6:12	-15.7	-30.7	-47.6	17.7	-12.8	-25.1	-39.0	17.7	-12.8	-25.1	-39.0	17.7
7:12	-17.6	-21.4	-21.4	22.0	-14.3	-17.4	-17.4	19.7	-14.3	-17.4	-17.4	22.0
8:12	-17.7	-21.4	-21.4	20.9	-14.4	-17.5	-17.5	18.7	-14.4	-17.5	-17.5	20.9
9:12	-17.7	-21.5	-21.5	20.0	-14.4	-17.5	-17.5	17.8	-14.4	-17.5	-17.5	20.0
10:12	-17.8	-21.5	-21.5	19.8	-14.5	-17.5	-17.5	17.0	-14.5	-17.5	-17.5	19.8
11:12	-17.8	-21.6	-21.6	19.7	-14.5	-17.6	-17.6	16.7	-14.5	-17.6	-17.6	19.7
12:12	-17.8	-21.6	-21.6	19.6	-14.5	-17.6	-17.6	16.6	-14.5	-17.6	-17.6	19.6

Exposure Category C

Roof Pitch	Bldg. Height = 60 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 30 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 15 ft. Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-23.7	-43.6	-68.5	25.9	-20.3	-37.6	-59.3	25.9	-21.4	-39.6	-62.4	25.9
2:12	-21.2	-41.1	-63.6	26.7	-18.2	-35.5	-55.0	25.5	-19.2	-37.4	-57.8	25.9
3:12	-21.2	-41.1	-63.6	25.2	-18.2	-35.5	-55.0	24.0	-19.2	-37.4	-57.8	24.4
4:12	-21.2	-41.2	-63.6	22.4	-18.2	-35.5	-55.0	21.1	-19.2	-37.4	-57.9	20.6
5:12	-21.3	-41.2	-63.6	21.1	-18.3	-35.6	-55.0	19.8	-19.3	-37.4	-57.9	19.4
6:12	-21.3	-41.2	-63.7	19.8	-18.3	-35.6	-55.1	18.6	-19.3	-37.5	-57.9	18.3
7:12	-23.8	-28.8	-28.8	26.1	-20.5	-24.8	-24.8	23.9	-21.6	-26.2	-26.2	24.1
8:12	-23.9	-28.9	-28.9	25.6	-20.6	-24.9	-24.9	22.9	-21.7	-26.2	-26.2	23.7
9:12	-23.9	-28.9	-28.9	25.5	-20.6	-24.9	-24.9	22.5	-21.7	-26.2	-26.2	23.5
10:12	-23.9	-28.9	-28.9	25.4	-20.6	-25.0	-25.0	22.4	-21.7	-26.3	-26.3	23.4
11:12	-24.0	-29.0	-29.0	25.3	-20.7	-25.0	-25.0	22.3	-21.8	-26.3	-26.3	23.3
12:12	-24.0	-29.0	-29.0	25.2	-20.7	-25.0	-25.0	22.2	-21.8	-26.4	-26.4	23.2

Exposure Category D

Roof Pitch	Bldg. Height = 60 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 30 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 15 ft. Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-27.6	-50.7	-79.7	25.9	-24.3	-44.8	-70.4	25.9	-24.3	-44.8	-70.4	25.9
2:12	-24.7	-47.9	-73.9	28.2	-21.8	-42.2	-65.3	27.0	-21.8	-42.2	-65.3	25.9
3:12	-24.8	-47.9	-73.9	26.7	-21.8	-42.3	-65.3	25.5	-21.8	-42.3	-65.3	24.4
4:12	-24.8	-47.9	-73.9	22.9	-21.8	-42.3	-65.3	21.7	-21.8	-42.3	-65.3	20.6
5:12	-24.8	-48.0	-74.0	21.7	-21.9	-42.3	-65.4	20.5	-21.9	-42.3	-65.4	19.4
6:12	-24.9	-48.0	-74.0	20.6	-21.9	-42.4	-65.4	19.4	-21.9	-42.4	-65.4	18.3
7:12	-27.8	-33.6	-33.6	29.3	-24.5	-29.6	-29.6	26.4	-24.5	-29.6	-29.6	24.1
8:12	-27.8	-33.6	-33.6	29.2	-24.5	-29.6	-29.6	26.2	-24.5	-29.6	-29.6	23.7
9:12	-27.9	-33.7	-33.7	29.1	-24.6	-29.7	-29.7	26.1	-24.6	-29.7	-29.7	23.5
10:12	-27.9	-33.7	-33.7	29.0	-24.6	-29.7	-29.7	26.0	-24.6	-29.7	-29.7	23.4
11:12	-28.0	-33.7	-33.7	28.9	-24.6	-29.8	-29.8	25.9	-24.6	-29.8	-29.8	23.3
12:12	-28.0	-33.8	-33.8	28.7	-24.7	-29.8	-29.8	25.8	-24.7	-29.8	-29.8	23.2

Side Load (psf)

Down Slope

Roof Pitch	Ss=3.1	Ss=2.5	Ss=2.0	Ss=1.5	Ss=1.25	Ss=1.0	Ss=0.5	Ss=0.4	Ss=0.3	Ss=0.2	Ss=0.1	Ss=0.0
1:12	5.0	4.3	3.8	3.2	2.9	2.8	2.3	2.2	2.1	2.0	2.0	2.0
2:12	6.3	5.7	5.1	4.6	4.3	4.1	3.7	3.7	3.7	3.7	3.7	3.7
3:12	7.4	6.7	6.2	5.6	5.4	5.2	5.0	5.0	5.0	5.0	5.0	5.0
4:12	7.8	7.1	6.6	6.0	5.7	5.6	5.4	5.4	5.4	5.4	5.4	5.4
5:12	8.3	7.6	7.1	6.5	6.2	6.1	6.0	6.0	6.0	6.0	6.0	6.0
6:12	8.6	7.9	7.4	6.9	6.6	6.4	6.4	6.4	6.4	6.4	6.4	6.4
7:12	8.7	8.1	7.6	7.0	6.8	6.6	6.6	6.6	6.6	6.6	6.6	6.6
8:12	8.8	8.1	7.6	7.1	6.8	6.7	6.6	6.6	6.6	6.6	6.6	6.6
9:12	8.7	8.1	7.6	7.1	6.8	6.6	6.6	6.6	6.6	6.6	6.6	6.6
10:12	8.6	8.0	7.5	7.0	6.7	6.6	6.5	6.5	6.5	6.5	6.5	6.5
11:12	8.4	7.8	7.3	6.8	6.6	6.4	6.3	6.3	6.3	6.3	6.3	6.3
12:12	8.2	7.6	7.1	6.7	6.4	6.3	6.1	6.1	6.1	6.1	6.1	6.1

Lateral

	Ss=3.1	Ss=2.5	Ss=2.0	Ss=1.5	Ss=1.25	Ss=1.0	Ss=0.5	Ss=0.4	Ss=0.3	Ss=0.2	Ss=0.1	Ss=0.0
	4.5	3.6	2.9	2.2	1.8	1.6	1.0	0.9	0.7	0.5	0.2	0.0

New Jersey*

ASCE **7-10**

130 mph Basic Wind Speed

25 psf Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independently verified for the specific install location.

Up and Down (psf)

Note: Values below are organized by Exposure Category and Building Height. Each height block lists Up Pressures (Zone 1, Zone 2, Zone 3) and Down (psf). Roof pitch rows run 1:12 through 12:12.

Exposure Category B

Roof Pitch	15 ft Zone 1	15 ft Zone 2	15 ft Zone 3	15 ft Down	30 ft Zone 1	30 ft Zone 2	30 ft Zone 3	30 ft Down	60 ft Zone 1	60 ft Zone 2	60 ft Zone 3	60 ft Down
1:12	-25.1	-46.3	-72.7	13.4	-30.8	-56.4	-88.5	13.5	-41.4	-65.3	-102.3	14.9
2:12	-22.5	-43.6	-67.4	17.0	-27.6	-53.3	-82.1	19.8	-37.1	-61.6	-94.9	22.3
3:12	-22.5	-43.7	-67.4	16.9	-27.6	-53.3	-82.1	19.8	-37.1	-61.6	-94.9	22.2
4:12	-22.6	-43.7	-67.5	16.9	-27.6	-53.3	-82.2	19.7	-37.2	-61.6	-94.9	22.1
5:12	-22.6	-43.7	-67.5	16.8	-27.7	-53.3	-82.2	19.6	-37.2	-61.7	-95.0	22.0
6:12	-22.6	-43.8	-67.5	16.6	-27.7	-53.4	-82.2	19.5	-37.2	-61.7	-95.0	21.9
7:12	-25.3	-30.6	-30.6	27.1	-31.0	-37.4	-37.4	32.2	-41.5	-43.3	-43.3	36.6
8:12	-25.3	-30.6	-30.6	27.0	-31.0	-37.4	-37.4	32.1	-41.6	-43.3	-43.3	36.5
9:12	-25.4	-30.7	-30.7	26.8	-31.0	-37.5	-37.5	31.9	-41.6	-43.3	-43.3	36.4
10:12	-25.4	-30.7	-30.7	26.7	-31.1	-37.5	-37.5	31.8	-41.7	-43.4	-43.4	36.2
11:12	-25.5	-30.7	-30.7	26.6	-31.1	-37.5	-37.5	31.7	-41.7	-43.4	-43.4	36.1
12:12	-25.5	-30.8	-30.8	26.5	-31.2	-37.6	-37.6	31.6	-41.7	-43.5	-43.5	36.0

Exposure Category C

Roof Pitch	15 ft Zone 1	15 ft Zone 2	15 ft Zone 3	15 ft Down	30 ft Zone 1	30 ft Zone 2	30 ft Zone 3	30 ft Down	60 ft Zone 1	60 ft Zone 2	60 ft Zone 3	60 ft Down
1:12	-37.6	-68.7	-107.5	15.5	-41.4	-75.5	-118.1	16.6	-42.7	-77.5	-121.3	17.0
2:12	-33.7	-64.8	-99.8	23.2	-37.1	-71.2	-109.6	25.1	-38.1	-73.1	-112.5	25.7
3:12	-33.7	-64.8	-99.8	23.2	-37.1	-71.2	-109.6	25.1	-38.1	-73.2	-112.6	25.6
4:12	-33.8	-64.9	-99.8	23.1	-37.2	-71.3	-109.6	25.0	-38.2	-73.2	-112.6	25.5
5:12	-33.8	-64.9	-99.9	23.0	-37.2	-71.3	-109.7	24.9	-38.2	-73.2	-112.6	25.4
6:12	-33.8	-64.9	-99.9	22.9	-37.2	-71.3	-109.7	24.8	-38.2	-73.3	-112.7	25.3
7:12	-37.8	-45.5	-45.5	38.3	-41.5	-50.1	-50.1	41.7	-42.7	-51.4	-51.4	42.7
8:12	-37.8	-45.6	-45.6	38.2	-41.6	-50.1	-50.1	41.6	-42.7	-51.5	-51.5	42.6
9:12	-37.8	-45.6	-45.6	38.1	-41.6	-50.1	-50.1	41.5	-42.7	-51.5	-51.5	42.5
10:12	-37.9	-45.6	-45.6	37.9	-41.7	-50.2	-50.2	41.3	-42.8	-51.5	-51.5	42.3
11:12	-37.9	-45.7	-45.7	37.8	-41.7	-50.2	-50.2	41.2	-42.8	-51.6	-51.6	42.2
12:12	-38.0	-45.7	-45.7	37.7	-41.7	-50.3	-50.3	41.1	-42.9	-51.6	-51.6	42.1

Exposure Category D

Roof Pitch	60 ft Zone 1	60 ft Zone 2	60 ft Zone 3	60 ft Down
1:12	-48.1	-87.7	-137.1	18.7
2:12	-43.2	-82.8	-127.2	28.5
3:12	-43.2	-82.8	-127.3	28.4
4:12	-43.3	-82.8	-127.3	28.4
5:12	-43.3	-82.8	-127.3	28.3
6:12	-43.3	-82.9	-127.4	28.2
7:12	-48.3	-58.2	-58.2	47.8
8:12	-48.4	-58.2	-58.2	47.7
9:12	-48.4	-58.3	-58.3	47.6
10:12	-48.4	-58.3	-58.3	47.4
11:12	-48.5	-58.4	-58.4	47.3
12:12	-48.5	-58.4	-58.4	47.2

Side Load (psf)

Down Slope

Roof Pitch	Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
1:12	0.3	0.6	0.8	1.0	1.2	1.3	1.9	2.1	2.5	3.2	4.0	4.8
2:12	0.6	0.9	1.1	1.3	1.5	1.7	2.3	2.5	2.8	3.6	4.3	5.2
3:12	0.9	1.2	1.4	1.6	1.8	2.0	2.6	2.8	3.2	3.9	4.6	5.5
4:12	1.2	1.5	1.7	1.9	2.1	2.3	2.8	3.1	3.4	4.2	4.9	5.8
5:12	1.5	1.7	1.9	2.2	2.3	2.5	3.1	3.3	3.7	4.4	5.1	6.0
6:12	1.7	2.0	2.2	2.4	2.6	2.7	3.3	3.5	3.9	4.6	5.3	6.2
7:12	1.9	2.2	2.4	2.6	2.8	2.9	3.5	3.7	4.1	4.8	5.5	6.3
8:12	2.1	2.4	2.6	2.8	3.0	3.1	3.7	3.9	4.2	4.9	5.6	6.5
9:12	2.3	2.5	2.7	2.9	3.1	3.3	3.8	4.0	4.4	5.0	5.7	6.5
10:12	2.5	2.7	2.9	3.1	3.3	3.4	3.9	4.1	4.5	5.1	5.8	6.6
11:12	2.6	2.8	3.0	3.2	3.4	3.5	4.0	4.2	4.6	5.2	5.9	6.6
12:12	2.7	2.9	3.1	3.3	3.5	3.6	4.1	4.3	4.6	5.3	5.9	6.7

Lateral

Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
0.0	0.2	0.5	0.7	0.9	1.0	1.6	1.8	2.2	2.9	3.6	4.5

Legend

Louisiana*

ASCE 7-10

170 mph — Basic Wind Speed

0 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

MicroRail Dimensions			Landscape Orientation				Portrait Orientation			
			Flashkit SFM				Flashkit SFM			
	(A) Overhang (in)	(B) Span (in)	Pressure Limits (psf)				Pressure Limits (psf)			
Rule	Interior & North Rows		up	down	down slope	lateral	up	down	down slope	lateral
1	24	72	21.3	33.0	9.7	3.1	12.8	19.8	5.8	1.8
2	21	64	23.9	43.5	12.3	3.5	14.3	26.1	7.4	2.1
3	18	48	31.9	59.8	16.7	4.7	19.1	35.9	10.0	2.8
	10*	32*	42.6*	89.7*	22.3*	6.3*	25.6	53.9	13.4	3.7
	8*	24*	63.9*	119.6*	33.4*	9.4*	38.4	71.96	20.1	5.6

Trim Rail Dimensions			Pressure Limits (psf)				Pressure Limits (psf)			
	(C) Overhang (in)	(D) Span (in)	up	down	down slope	lateral	up	down	down slope	lateral
Rule										
1	24	72	31.9	46.9	9.7	n/a	19.1	28.2	5.8	n/a
2	21	64	31.9	59.7	12.3	n/a	19.1	35.9	7.4	n/a
3	18	48	31.9	59.8	16.7	n/a	19.1	35.9	10.0	n/a
	10*	32*	42.6*	89.7*	22.3*	n/a	25.6	53.9	13.4	n/a
	8*	24*	63.9*	119.6*	33.4*	n/a	38.4	71.9	20.1	n/a

* Indicates values specifically provided for portions of arrays that may fall within roof
  zones 2 and 3 that yield pressures larger than those provided in Rule 3

Minimum of 2 clips per module

Examples (approx.):
Module   17%   14%
60 cell: 11.5"   9.5"
72 cell: 13.5"   11.5"

3rd clip required at center for high snow loads only

L X 17% *   L X 17%*

*Reduce to L X 14% if 3rd clip is used

Requirements for 3rd Module Clip at TrimRail (Landscape Orientation Only)			
Module Size	Approx. Dim. (WxL)	Module Frame Ht.	Ground Snow Load Exceeds
60 Cell	39" x 66"	32mm-33mm	30 psf
		35mm-40mm	50 psf
72 Cell	39" x 80"	32mm-33mm	20 psf
		35mm-40mm	30 psf

Design Rule Definitions (*refer to 3x4 landscape array on the following page*):

A   Max. Module Overhang - Length of module extending past the first or last roof attachment of the row.
B   Max. Span - The span between MicroRail roof attachments.
C   Max. Trim Rail Overhang - Length of Trim Rail extending past the first or last roof attachment of the row.
D   Max. Span for Trim Rail. (Measured between Trim Rail Roof Attachment)
E   Trim Rail is not required to be flush with the edge of the module. (+/-2" is acceptable.)
F   Trim Rail overhang from edge of Trim Rail to edge of Trim Rail Roof Attachment. (3" min)
G   Module width is limited to 39.37 in (1 meter.) Reduce spans linearly for modules wider than this.
H   Each section of Trim Rail and each module must be supported by at least 1 attachment.
I   Modules shall be attached to trimrail with module clips per image and table at right

Pressure limit Modification Guidelines

· Pressure limits provided above were calculated utilizing a
  module size of 39.37in wide x 65in long (17.88sf module area)
·These pressure limits may be increased or decreased linearly.
·To modify pressure limits provided, follow these simple steps:
   1. *Divide the provided module area of 17.88sf by the area (sf) of your project specific module*
   2. *Multiply the resultant by the above pressure limits that exceeds your project specific pressures*

See Installation Guide for detailed system layout procedure.

● indicates - SUNFRAME Microrail™ 2"
● indicates - SUNFRAME Microrail™ 6.5" Splice
● indicates - SUNFRAME Microrail™ 8" Attached Splice
● indicates - Trim Rail Roof Attachment
● indicates - **Trim Rail Module Clip**

3x4 Landscape Array

SFM SUN FRAME MICRORAIL
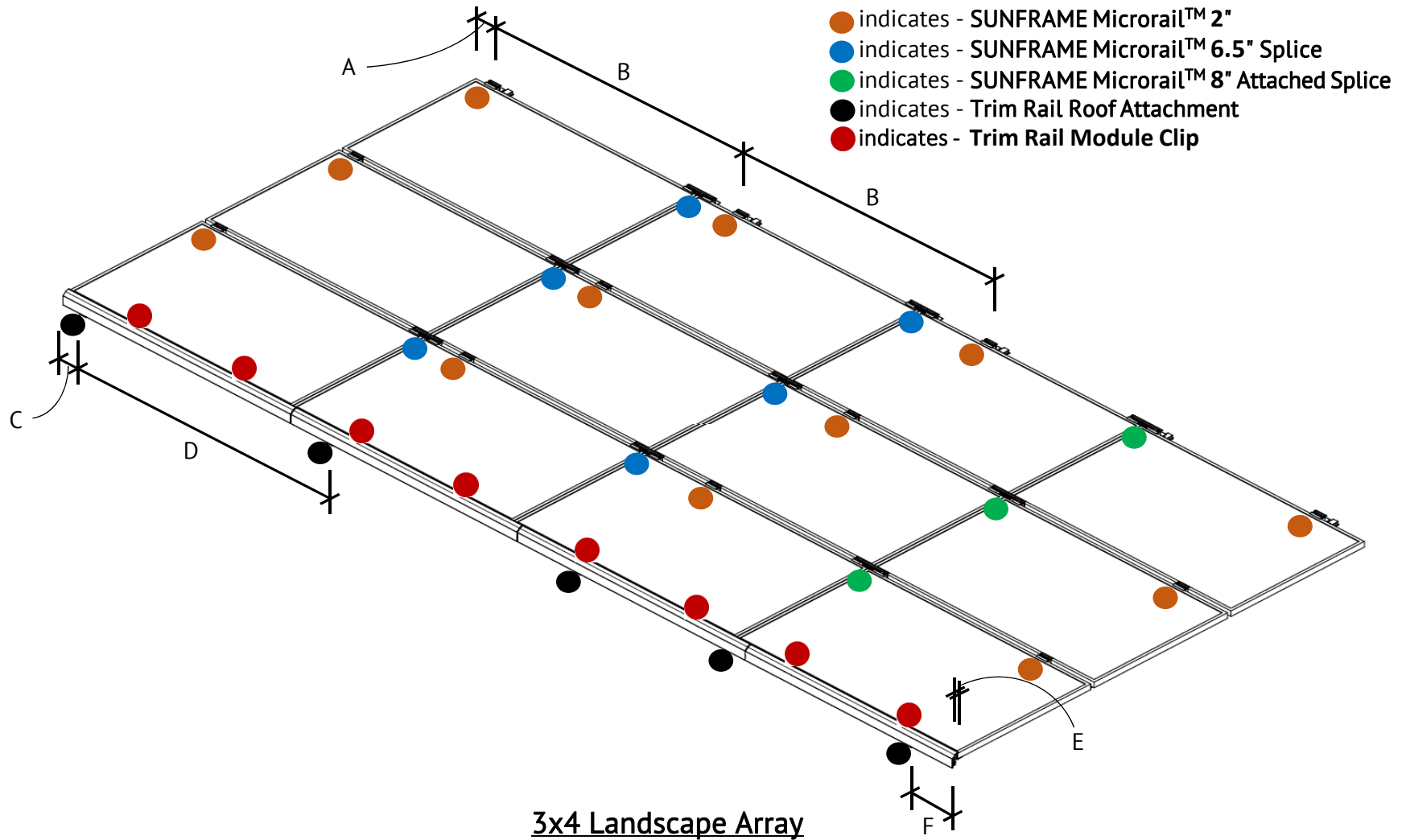
Basic Layouts
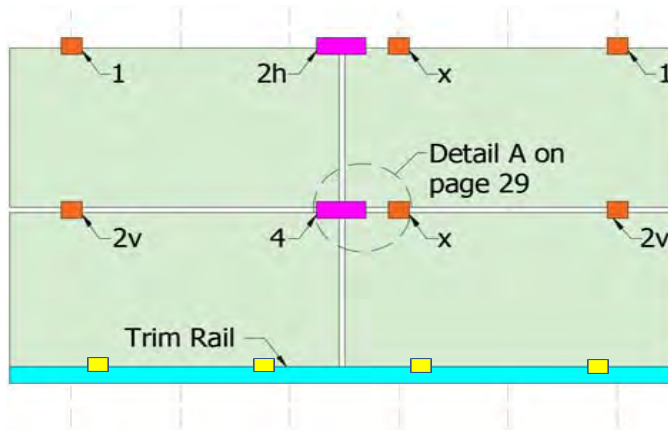
Sample Layout A-1: 2x2 landscape array with 6.5" splice
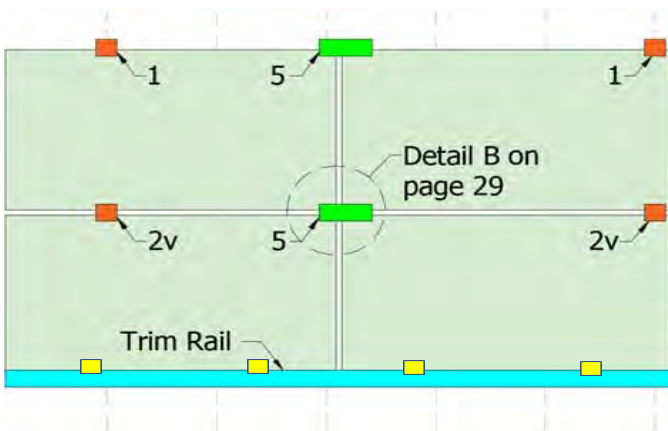
Sample Layout A-2: 2x2 landscape array with 8" Attached Splice

The basic application rules for the SFM system are extremely simple.

Base Rules:

- All modules must be supported at four corners on the North and South edges. Except at row 1, where the south edge of each first row module will be supported by Trim Rail and at least two module clips

- Any intersection of module corners must be supported according to the following Connection/Attachment Rules.

- All MicroRails are oriented in an east-west direction (perpendicular to roof slope).

Connection/Attachment Rules:

x 2" MicroRails: Supporting attachments installed at applicable spans per design rules. (See table on page 26.)

1 Any outer edge module corner must be supported at the first rafter interior to the array.

2v 2 Modules Vertical: 2" MicroRail - Interface between two modules oriented in the north-south direction in relation to each other whose nearest east or west edges are exposed.

2h 2 Modules Horizontal: 6.5" Splice - Interface between any two modules oriented in the east-west direction in relation to each other along the exposed north edge. (Roof attachment not required. See detail A on page 29.)

3 3 Module Intersection with two Horizontal: 6.5" Splice - Interface between any three modules where two are oriented in the east-west direction in relation to each other. (Roof attachment not required. See detail A on page 29.)

4 4 Modules Intersecting at their Corners: 6.5" Splice - Interface between four modules in a grid pattern. (Roof attachment not required. See detail A on page 29.)

5 8" Attached Splice: Similar to **2h**, **2v**, & **4**, roof attachment is required. (See detail B on page 29.)

Trim Rail: Must be installed at the southern-most edge (first row) of modules. (A minimum of (1) Trim Rail roof attachment required per length of Trim. See table on page 26.)

Trim Rail module clip: A minimum of two module clips per module (See rule I on page 26)
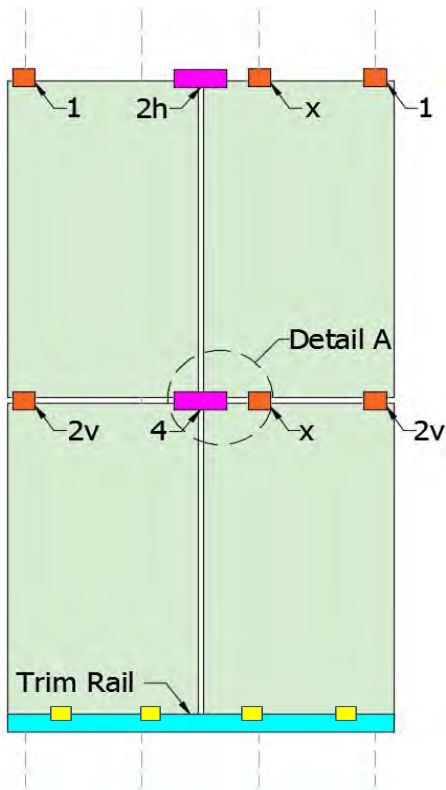
Sample Layout B-1: 2x2 portrait array with 6.5" Splice
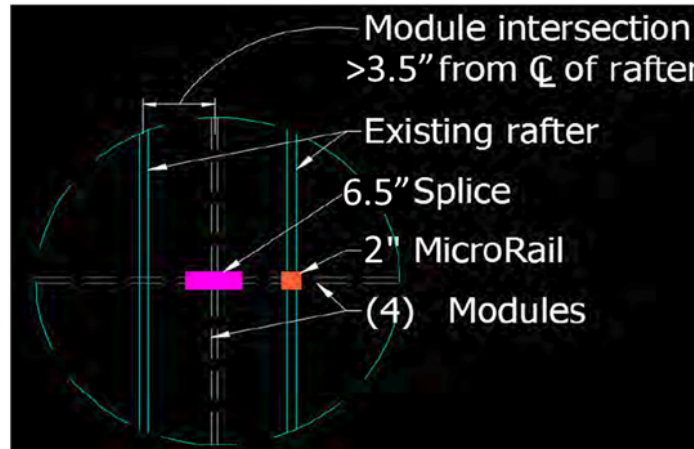
Detail A: 6.5" Splice at module intersection
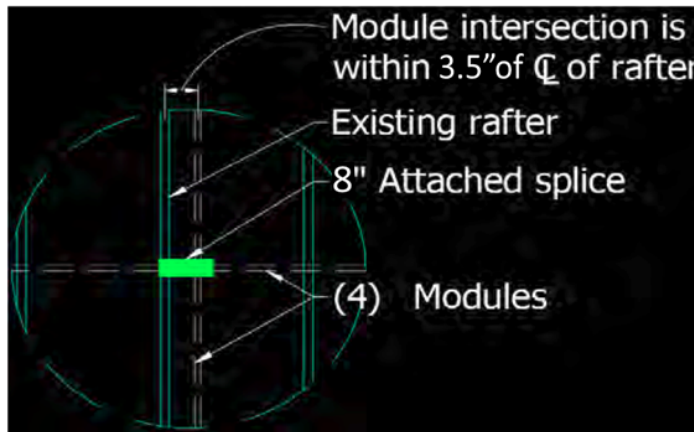
Detail B: 8" Attached Splice at module intersection
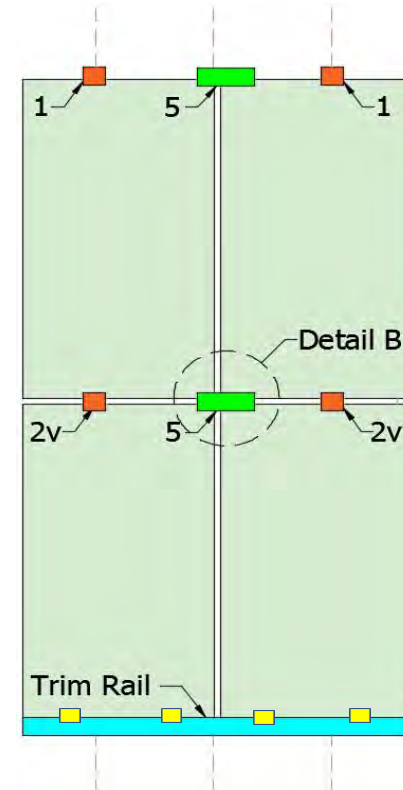
Sample Layout B-2: 2x2 portrait array with 8" Attached Splice
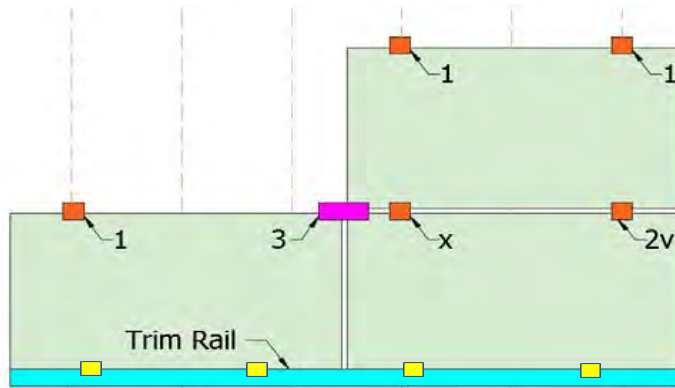
Sample Layout C: Landscape array with 6.5" Splice
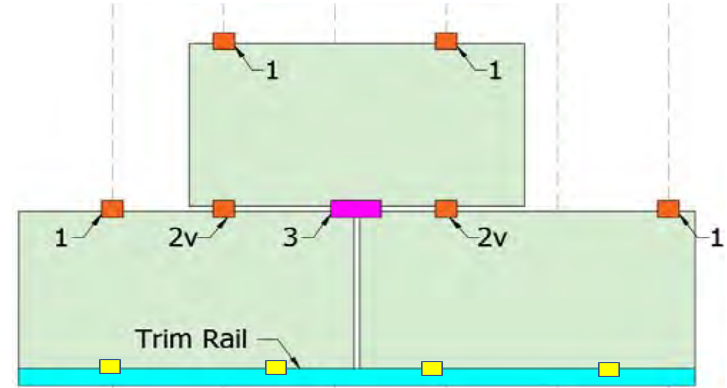
Sample Layout D: Landscape with 2" MicroRail attachments only
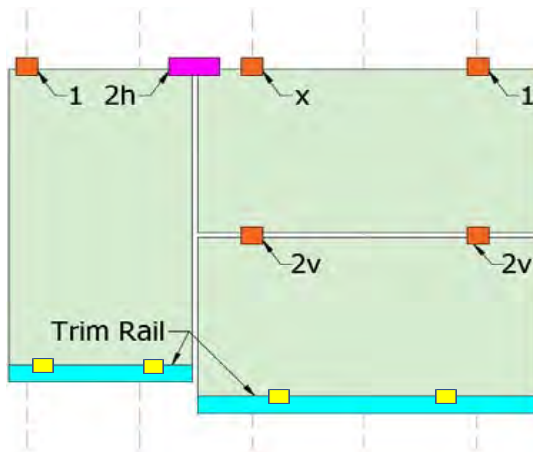
Sample Layout E: Mixed array
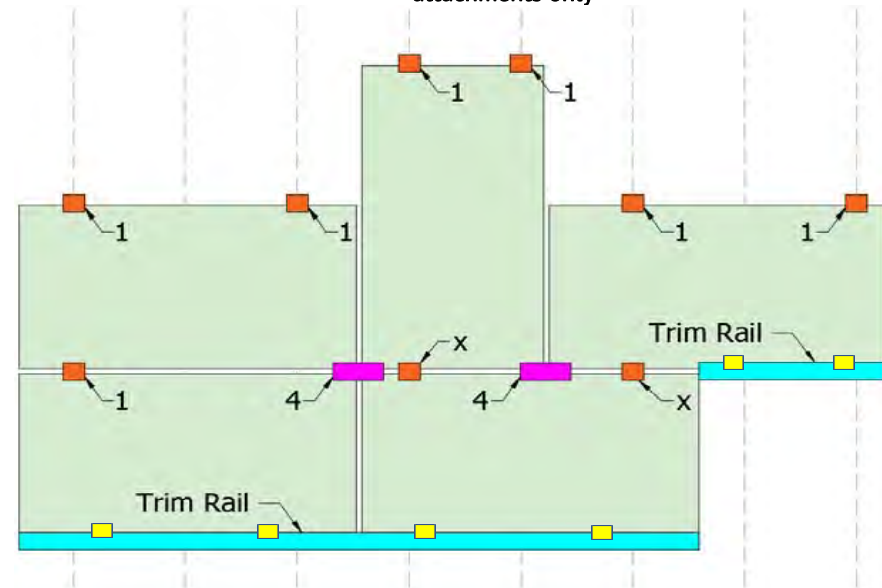
Sample Layout F: Mixed array

Technical Support

If you have further questions regarding the SunFrame MicroRail product, please contact Unirac at info@unirac.com or 505-242-6411. The Unirac website has an online calculator (U-Builder) which when used, will direct you to a page with additional information regarding the SFM product.

Table of Contents

Product Catalog Parts List			
Catalog Number	Part Type	Description	Box Quantities
004200D	KIT	FLASHKIT SFM TRIM COMP DARK	10
008000U	ASSEMBLY	SFM N/S BONDING CLAMP	20
250010U	ASSEMBLY	SFM SPLICE 6.5"	10
250030U	ASSEMBLY	SFM ATTATCHED SPLICE 8"	10
250100U	PART	SFM TRIMRAIL 66 UNIV DRK	4
250110U	KIT	SFM TRIMRAIL UNIV CLIP W/HDW	10
250120U	ASSEMBLY	SFM TRIM SPLICE DRK	10
250020U	ASSEMBLY	SFM MICRORAIL 2"	10
008100U	ASSEMBLY	SFM TRIM BONDING CLAMP	10
250130U	PART	SFM TRIM END CAPS	10
004070D	KIT	FLASHKIT SFM SLIDER COMP DARK	10

SFM — SUN FRAME MICRORAIL

Up and Down (psf)

Exposure Category B

Roof Pitch	\ Bldg. Height = 15 ft. \ Zone 1	Zone 2	Zone 3	Down (psf)	\ Bldg. Height = 30 ft. \ Zone 1	Zone 2	Zone 3	Down (psf)	\ Bldg. Height = 60 ft. \ Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-9.7	-18.5	-29.5	15.1	-9.7	-18.5	-29.5	15.1	-12.1	-22.8	-36.1	15.1
2:12	-8.7	-17.4	-27.3	14.7	-8.7	-17.4	-27.3	14.7	-10.8	-21.5	-33.5	14.7
3:12	-8.8	-17.5	-27.4	14.3	-8.8	-17.5	-27.4	14.3	-10.8	-21.5	-33.5	14.3
4:12	-8.8	-17.5	-27.4	13.6	-8.8	-17.5	-27.4	13.6	-10.8	-21.5	-33.5	13.6
5:12	-8.8	-17.5	-27.4	13.6	-8.8	-17.5	-27.4	13.6	-10.8	-21.5	-33.6	13.6
6:12	-8.9	-17.6	-27.5	13.4	-8.9	-17.6	-27.5	13.4	-10.9	-21.8	-33.6	13.4
7:12	-9.9	-12.1	-12.1	13.3	-9.9	-12.1	-12.1	13.3	-12.3	-14.9	-14.9	15.4
8:12	-9.9	-12.1	-12.1	13.2	-9.9	-12.1	-12.1	13.2	-12.3	-15.0	-15.0	15.2
9:12	-10.0	-12.2	-12.2	13.1	-10.0	-12.2	-12.2	13.1	-12.3	-15.0	-15.0	15.1
10:12	-10.0	-12.2	-12.2	13.0	-10.0	-12.2	-12.2	13.0	-12.4	-15.0	-15.0	15.0
11:12	-10.1	-12.3	-12.3	12.8	-10.1	-12.3	-12.3	12.8	-12.4	-15.1	-15.1	14.9
12:12	-10.1	-12.3	-12.3	12.7	-10.1	-12.3	-12.3	12.7	-12.5	-15.1	-15.1	14.7

Exposure Category C

Roof Pitch	\ Bldg. Height = 15 ft. \ Zone 1	Zone 2	Zone 3	Down (psf)	\ Bldg. Height = 30 ft. \ Zone 1	Zone 2	Zone 3	Down (psf)	\ Bldg. Height = 60 ft. \ Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-14.9	-27.9	-44.1	15.1	-14.1	-26.5	-41.9	15.1	-16.5	-30.7	-48.5	15.1
2:12	-13.3	-26.3	-40.8	14.7	-12.6	-24.9	-38.8	14.7	-14.7	-28.9	-44.9	14.7
3:12	-13.3	-26.3	-40.9	14.3	-12.6	-24.9	-38.8	14.3	-14.7	-29.0	-44.9	14.3
4:12	-13.4	-26.3	-40.9	13.6	-12.6	-25.0	-38.8	13.6	-14.8	-29.0	-45.0	13.6
5:12	-13.4	-26.3	-40.9	13.6	-12.7	-25.0	-38.9	13.6	-14.8	-29.0	-45.0	13.6
6:12	-13.4	-26.4	-41.0	13.4	-12.7	-25.0	-38.9	13.4	-14.8	-29.1	-45.0	13.4
7:12	-15.1	-18.3	-18.3	17.9	-14.3	-17.4	-17.4	17.2	-16.7	-20.2	-20.2	19.3
8:12	-15.1	-18.4	-18.4	17.8	-14.3	-17.4	-17.4	17.1	-16.7	-20.2	-20.2	19.2
9:12	-15.2	-18.4	-18.4	17.7	-14.4	-17.5	-17.5	16.9	-16.7	-20.3	-20.3	19.1
10:12	-15.2	-18.4	-18.4	17.5	-14.4	-17.5	-17.5	16.8	-16.8	-20.3	-20.3	18.9
11:12	-15.2	-18.5	-18.5	17.4	-14.5	-17.5	-17.5	16.7	-16.8	-20.4	-20.4	18.8
12:12	-15.3	-18.5	-18.5	17.3	-14.5	-17.6	-17.6	16.6	-16.9	-20.4	-20.4	18.7

Exposure Category D

Roof Pitch	\ Bldg. Height = 15 ft. \ Zone 1	Zone 2	Zone 3	Down (psf)	\ Bldg. Height = 30 ft. \ Zone 1	Zone 2	Zone 3	Down (psf)	\ Bldg. Height = 60 ft. \ Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-14.9	-27.9	-44.1	15.1	-17.0	-31.5	-49.8	15.1	-19.3	-35.8	-56.4	15.1
2:12	-13.3	-26.3	-40.8	14.7	-15.1	-29.7	-46.1	14.7	-17.3	-33.7	-52.3	14.9
3:12	-13.3	-26.3	-40.9	14.3	-15.2	-29.8	-46.2	14.3	-17.3	-33.8	-52.3	14.5
4:12	-13.4	-26.3	-40.9	13.6	-15.2	-29.8	-46.2	13.6	-17.3	-33.8	-52.3	13.9
5:12	-13.4	-26.3	-40.9	13.6	-15.2	-29.8	-46.2	13.6	-17.4	-33.8	-52.4	13.8
6:12	-13.4	-26.4	-41.0	13.4	-15.3	-29.9	-46.3	13.4	-17.4	-33.9	-52.4	13.7
7:12	-15.1	-18.3	-18.3	17.9	-17.1	-20.8	-20.8	19.7	-19.5	-23.6	-23.6	21.9
8:12	-15.1	-18.4	-18.4	17.8	-17.2	-20.8	-20.8	19.6	-19.5	-23.6	-23.6	21.7
9:12	-15.2	-18.4	-18.4	17.7	-17.2	-20.9	-20.9	19.5	-19.6	-23.7	-23.7	21.6
10:12	-15.2	-18.4	-18.4	17.5	-17.3	-20.9	-20.9	19.4	-19.6	-23.7	-23.7	21.5
11:12	-15.2	-18.5	-18.5	17.4	-17.3	-20.9	-20.9	19.2	-19.6	-23.8	-23.8	21.4
12:12	-15.3	-18.5	-18.5	17.3	-17.3	-21.0	-21.0	19.1	-19.7	-23.8	-23.8	21.3

Side Load (psf) — Down Slope

Roof Pitch	Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
1:12	0.7	0.8	1.0	1.1	1.3	1.4	1.9	2.1	2.5	3.2	4.0	4.8
2:12	1.4	1.4	1.6	1.7	1.9	2.0	2.4	2.6	2.9	3.6	4.3	5.2
3:12	1.9	1.9	2.0	2.2	2.4	2.5	2.9	3.1	3.4	3.9	4.6	5.5
4:12	2.0	2.0	2.2	2.4	2.5	2.6	3.1	3.2	3.5	4.2	4.9	5.8
5:12	2.4	2.4	2.5	2.7	2.8	2.9	3.4	3.5	3.8	4.4	5.1	6.0
6:12	2.7	2.7	2.8	2.9	3.1	3.2	3.6	3.8	4.0	4.6	5.3	6.2
7:12	2.9	2.9	3.0	3.1	3.3	3.4	3.8	4.0	4.2	4.8	5.5	6.3
8:12	3.0	3.0	3.1	3.3	3.4	3.5	4.0	4.1	4.4	4.9	5.6	6.5
9:12	3.2	3.2	3.3	3.4	3.6	3.7	4.1	4.2	4.5	5.0	5.7	6.5
10:12	3.3	3.3	3.4	3.5	3.7	3.8	4.2	4.3	4.6	5.1	5.8	6.6
11:12	3.3	3.3	3.5	3.6	3.7	3.8	4.2	4.4	4.6	5.2	5.9	6.6
12:12	3.4	3.4	3.5	3.7	3.8	3.9	4.3	4.4	4.7	5.3	5.9	6.7

Lateral

	Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
	0.0	0.2	0.5	0.7	0.9	1.0	1.6	1.8	2.2	2.9	3.6	4.5

California*

ASCE 7-05

85 mph
Basic Wind Speed

5 psf
Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

Southwest*

ASCE **7-05**

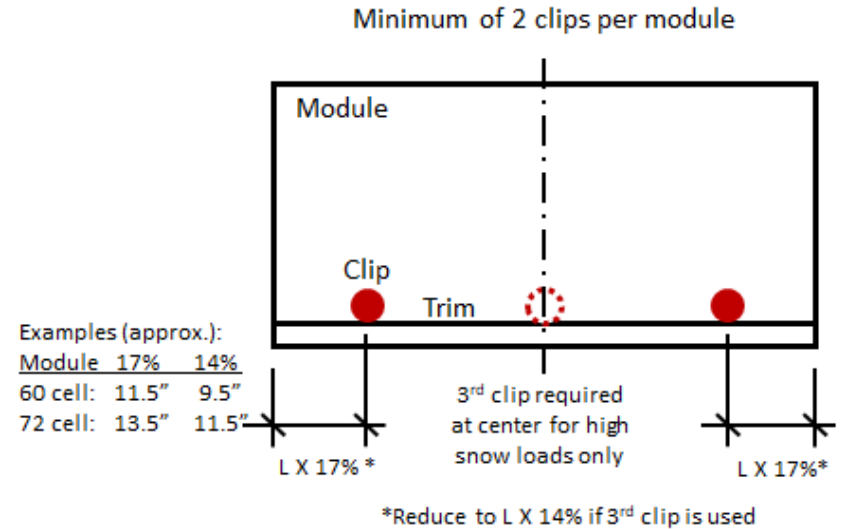**90 mph** — Basic Wind Speed

5 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

Up and Down (psf)

Bldg. Height = 15 ft.

Roof Pitch	B Zone 1	B Zone 2	B Zone 3	B Down	C Zone 1	C Zone 2	C Zone 3	C Down	D Zone 1	D Zone 2	D Zone 3	D Down
1:12	-11.1	-20.9	-33.3	13.9	-13.7	-25.7	-40.7	13.9	-16.9	-31.4	-49.6	13.8
2:12	-9.8	-19.7	-30.8	13.8	-12.2	-24.2	-37.7	13.8	-15.1	-29.6	-45.9	13.8
3:12	-9.9	-19.7	-30.8	13.7	-12.2	-24.2	-37.7	13.7	-15.1	-29.6	-46.0	13.7
4:12	-9.9	-19.8	-30.9	13.6	-12.3	-24.3	-37.7	13.6	-15.1	-29.6	-46.0	13.6
5:12	-9.9	-19.8	-30.9	13.6	-12.3	-24.3	-37.8	13.6	-15.2	-29.7	-46.0	13.6
6:12	-10.0	-19.8	-30.9	13.4	-12.3	-24.3	-37.8	13.4	-15.2	-29.7	-46.1	13.4
7:12	-11.2	-13.7	-13.7	14.4	-13.9	-16.9	-16.9	16.8	-17.0	-20.7	-20.7	19.7
8:12	-11.3	-13.7	-13.7	14.3	-13.9	-16.9	-16.9	16.7	-17.1	-20.7	-20.7	19.5
9:12	-11.3	-13.8	-13.8	14.2	-14.0	-17.0	-17.0	16.6	-17.1	-20.8	-20.8	19.4
10:12	-11.4	-13.8	-13.8	14.1	-14.0	-17.0	-17.0	16.4	-17.2	-20.8	-20.8	19.3
11:12	-11.4	-13.9	-13.9	13.9	-14.0	-17.0	-17.0	16.3	-17.2	-20.8	-20.8	19.2
12:12	-11.4	-13.9	-13.9	13.8	-14.1	-17.1	-17.1	16.2	-17.2	-20.9	-20.9	19.1

Bldg. Height = 30 ft.

Roof Pitch	B Zone 1	B Zone 2	B Zone 3	B Down	C Zone 1	C Zone 2	C Zone 3	C Down	D Zone 1	D Zone 2	D Zone 3	D Down
1:12	-11.1	-20.9	-33.3	13.9	-16.0	-29.8	-47.1	13.9	-19.2	-35.5	-56.0	13.8
2:12	-9.8	-19.7	-30.8	13.8	-14.3	-28.1	-43.6	13.8	-17.1	-33.5	-51.9	14.0
3:12	-9.9	-19.7	-30.8	13.7	-14.3	-28.1	-43.7	13.7	-17.2	-33.5	-51.9	14.0
4:12	-9.9	-19.8	-30.9	13.6	-14.3	-28.1	-43.7	13.6	-17.2	-33.5	-51.9	13.9
5:12	-9.9	-19.8	-30.9	13.6	-14.4	-28.2	-43.7	13.6	-17.2	-33.6	-52.0	13.8
6:12	-10.0	-19.8	-30.9	13.4	-14.4	-28.2	-43.8	13.4	-17.3	-33.6	-52.0	13.7
7:12	-11.2	-13.7	-13.7	14.4	-16.2	-19.6	-19.6	18.9	-19.3	-23.4	-23.4	21.7
8:12	-11.3	-13.7	-13.7	14.3	-16.2	-19.7	-19.7	18.7	-19.4	-23.5	-23.5	21.6
9:12	-11.3	-13.8	-13.8	14.2	-16.2	-19.7	-19.7	18.6	-19.4	-23.5	-23.5	21.5
10:12	-11.4	-13.8	-13.8	14.1	-16.3	-19.7	-19.7	18.5	-19.5	-23.5	-23.5	21.4
11:12	-11.4	-13.9	-13.9	13.9	-16.3	-19.8	-19.8	18.4	-19.5	-23.6	-23.6	21.2
12:12	-11.4	-13.9	-13.9	13.8	-16.4	-19.8	-19.8	18.3	-19.5	-23.6	-23.6	21.1

Bldg. Height = 60 ft.

Roof Pitch	B Zone 1	B Zone 2	B Zone 3	B Down	C Zone 1	C Zone 2	C Zone 3	C Down	D Zone 1	D Zone 2	D Zone 3	D Down
1:12	-13.7	-25.7	-40.7	13.9	-18.6	-34.6	-54.5	13.9	-21.8	-40.3	-63.4	13.8
2:12	-12.2	-24.2	-37.7	13.8	-16.7	-32.6	-50.5	13.8	-19.5	-38.0	-58.8	15.3
3:12	-12.2	-24.2	-37.7	13.7	-16.7	-32.6	-50.5	13.7	-19.5	-38.0	-58.8	15.3
4:12	-12.3	-24.3	-37.7	13.6	-16.7	-32.6	-50.6	13.6	-19.6	-38.0	-58.8	15.2
5:12	-12.3	-24.3	-37.8	13.6	-16.7	-32.7	-50.6	13.6	-19.6	-38.1	-58.8	15.1
6:12	-12.3	-24.3	-37.8	13.4	-16.8	-32.7	-50.6	13.4	-19.6	-38.1	-58.9	15.0
7:12	-13.9	-16.9	-16.9	16.8	-18.8	-22.8	-22.8	21.2	-22.0	-26.6	-26.6	24.1
8:12	-13.9	-16.9	-16.9	16.7	-18.8	-22.8	-22.8	21.1	-22.0	-26.6	-26.6	24.0
9:12	-14.0	-17.0	-17.0	16.6	-18.9	-22.9	-22.9	21.0	-22.1	-26.7	-26.7	23.9
10:12	-14.0	-17.0	-17.0	16.4	-18.9	-22.9	-22.9	20.9	-22.1	-26.7	-26.7	23.7
11:12	-14.0	-17.0	-17.0	16.3	-19.0	-23.0	-23.0	20.8	-22.1	-26.8	-26.8	23.6
12:12	-14.1	-17.1	-17.1	16.2	-19.0	-23.0	-23.0	20.6	-22.2	-26.8	-26.8	23.5

Side Load (psf) — Down Slope (Lateral)

Bldg. Height = 15 ft.

Roof Pitch	Ss = 0.0	Ss = 0.1	Ss = 0.2	Ss = 0.3
1:12	0.6	0.7	0.9	1.1
2:12	1.2	1.2	1.4	1.6
3:12	1.7	1.7	1.8	2.0
4:12	2.1	2.1	2.2	2.4
5:12	2.5	2.5	2.6	2.7
6:12	2.8	2.8	2.9	3.0
7:12	3.0	3.0	3.1	3.2
8:12	3.2	3.2	3.3	3.4
9:12	3.4	3.4	3.4	3.6
10:12	3.5	3.5	3.6	3.7
11:12	3.6	3.6	3.7	3.8
12:12	3.7	3.7	3.7	3.9
(base)	0.0	0.2	0.5	0.7

Bldg. Height = 30 ft.

Roof Pitch	Ss = 0.4	Ss = 0.5	Ss = 1.0	Ss = 1.25
1:12	1.2	1.3	1.9	2.1
2:12	1.7	1.8	2.3	2.5
3:12	2.1	2.3	2.7	2.9
4:12	2.5	2.7	3.1	3.3
5:12	2.9	3.0	3.4	3.6
6:12	3.1	3.3	3.7	3.9
7:12	3.4	3.5	3.9	4.1
8:12	3.6	3.7	4.1	4.3
9:12	3.7	3.8	4.2	4.4
10:12	3.8	3.9	4.3	4.5
11:12	3.9	4.0	4.4	4.6
12:12	4.0	4.1	4.5	4.6
(base)	0.9	1.0	1.6	1.8

Bldg. Height = 60 ft.

Roof Pitch	Ss = 1.5	Ss = 2.0	Ss = 2.5	Ss = 3.1
1:12	2.5	3.2	4.0	4.8
2:12	2.8	3.6	4.3	5.2
3:12	3.2	3.9	4.6	5.5
4:12	3.5	4.2	4.9	5.8
5:12	3.9	4.4	5.1	6.0
6:12	4.1	4.7	5.3	6.2
7:12	4.3	4.9	5.5	6.3
8:12	4.5	5.0	5.6	6.5
9:12	4.6	5.2	5.7	6.5
10:12	4.7	5.2	5.8	6.6
11:12	4.8	5.3	5.9	6.6
12:12	4.9	5.3	5.9	6.7
(base)	2.2	2.9	3.6	4.5

Up and Down (psf)

Exposure Category B

Roof Pitch	Bldg. Height = 60 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 30 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 15 ft. Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-13.7	-25.7	-40.7	24.4	-11.1	-20.9	-33.3	24.4	-11.1	-20.9	-33.3	24.4
2:12	-12.2	-24.2	-37.7	23.2	-9.8	-19.7	-30.8	23.2	-9.8	-19.7	-30.8	23.2
3:12	-12.2	-24.2	-37.7	21.9	-9.9	-19.7	-30.8	21.9	-9.9	-19.7	-30.8	21.9
4:12	-12.3	-24.3	-37.7	20.5	-9.9	-19.8	-30.9	20.5	-9.9	-19.8	-30.9	20.5
5:12	-12.3	-24.3	-37.8	19.2	-9.9	-19.8	-30.9	19.2	-9.9	-19.8	-30.9	19.2
6:12	-12.3	-24.3	-37.8	18.0	-10.0	-19.8	-30.9	18.0	-10.0	-19.8	-30.9	18.0
7:12	-13.9	-16.9	-13.7	19.4	-11.2	-13.7	-13.7	17.6	-11.2	-13.7	-13.7	17.6
8:12	-13.9	-16.9	-13.7	18.4	-11.3	-13.7	-13.7	16.6	-11.3	-13.7	-13.7	16.6
9:12	-14.0	-17.0	-13.8	17.5	-11.3	-13.8	-13.8	15.7	-11.3	-13.8	-13.8	15.7
10:12	-14.0	-17.0	-13.8	16.7	-11.4	-13.8	-13.8	14.9	-11.4	-13.8	-13.8	14.9
11:12	-14.0	-17.0	-13.9	16.3	-11.4	-13.9	-13.9	14.2	-11.4	-13.9	-13.9	14.2
12:12	-14.1	-17.1	-13.9	16.2	-11.4	-13.9	-13.9	13.8	-11.4	-13.9	-13.9	13.8

Exposure Category C

Roof Pitch	Bldg. Height = 60 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 30 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 15 ft. Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-18.6	-34.6	-54.5	24.4	-16.0	-29.8	-47.1	24.4	-16.9	-31.4	-49.6	23.1
2:12	-16.7	-32.6	-50.5	23.2	-14.3	-28.1	-43.6	23.2	-15.1	-29.6	-45.9	22.0
3:12	-16.7	-32.6	-50.5	21.9	-14.3	-28.1	-43.7	21.9	-15.1	-29.6	-46.0	20.8
4:12	-16.7	-32.6	-50.6	20.5	-14.3	-28.1	-43.7	20.5	-15.1	-29.6	-46.0	19.6
5:12	-16.7	-32.7	-50.6	19.2	-14.4	-28.2	-43.7	19.2	-15.2	-29.7	-46.0	18.4
6:12	-16.8	-32.7	-50.6	18.0	-14.4	-28.2	-43.8	18.0	-15.2	-29.7	-46.1	17.3
7:12	-18.8	-22.8	-19.6	22.8	-16.2	-19.6	-19.6	21.0	-17.0	-20.7	-20.7	21.0
8:12	-18.8	-22.8	-19.7	21.7	-16.2	-19.7	-19.7	19.9	-17.1	-20.7	-20.7	20.0
9:12	-18.9	-22.9	-19.7	21.0	-16.2	-19.7	-19.7	19.0	-17.1	-20.8	-20.8	19.4
10:12	-18.9	-22.9	-19.7	20.9	-16.3	-19.7	-19.7	18.5	-17.2	-20.8	-20.8	19.3
11:12	-19.0	-23.0	-19.8	20.8	-16.3	-19.8	-19.8	18.4	-17.2	-20.8	-20.8	19.2
12:12	-19.0	-23.0	-19.8	20.6	-16.4	-19.8	-19.8	18.3	-17.2	-20.9	-20.9	19.1

Exposure Category D

Roof Pitch	Bldg. Height = 60 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 30 ft. Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-21.8	-40.3	-63.4	23.1	-19.2	-35.5	-56.0	23.1
2:12	-19.5	-38.0	-58.8	23.2	-17.1	-33.5	-51.9	22.2
3:12	-19.5	-38.0	-58.8	22.0	-17.2	-33.5	-51.9	21.0
4:12	-19.6	-38.0	-58.8	20.7	-17.2	-33.5	-51.9	19.8
5:12	-19.6	-38.1	-58.8	19.5	-17.2	-33.6	-52.0	18.6
6:12	-19.6	-38.1	-58.9	18.4	-17.3	-33.6	-52.0	17.4
7:12	-22.0	-26.6	-26.6	24.3	-19.3	-23.4	-23.4	22.5
8:12	-22.0	-26.6	-26.6	24.0	-19.4	-23.5	-23.5	21.6
9:12	-22.1	-26.7	-26.7	23.9	-19.4	-23.5	-23.5	21.5
10:12	-22.1	-26.7	-26.7	23.7	-19.5	-23.5	-23.5	21.4
11:12	-22.1	-26.8	-26.8	23.6	-19.5	-23.6	-23.6	21.2
12:12	-22.2	-26.8	-26.8	23.5	-19.5	-23.6	-23.6	21.1

Side Load (psf) — Down Slope

Roof Pitch	Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
1:12	1.8	1.8	1.8	1.9	2.1	2.2	2.6	2.8	3.1	3.6	4.1	4.8
2:12	3.3	3.3	3.3	3.3	3.3	3.4	3.9	4.0	4.3	4.9	5.4	6.1
3:12	4.6	4.6	4.6	4.6	4.6	4.6	4.9	5.1	5.3	5.9	6.4	7.1
4:12	5.6	5.6	5.6	5.6	5.6	5.6	5.7	5.9	6.2	6.7	7.3	7.9
5:12	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.5	6.8	7.4	7.9	8.6
6:12	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.3	7.8	8.4	9.0
7:12	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.6	7.6	8.1	8.6	9.3
8:12	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.8	8.3	8.8	9.4
9:12	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.9	8.4	8.9	9.5
10:12	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.9	8.4	8.9	9.5
11:12	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.8	8.3	8.8	9.4
12:12	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.7	8.2	8.7	9.2

Lateral

Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
0.0	0.2	0.5	0.7	0.9	1.0	1.6	1.8	2.2	2.9	3.6	4.5

Mid US (Medium Snow)*

ASCE **7-05**

90 mph — Basic Wind Speed

25 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

Up and Down (psf)

Exposure Category B

Roof Pitch	60 ft Zone 1	60 ft Zone 2	60 ft Zone 3	60 ft Down	30 ft Zone 1	30 ft Zone 2	30 ft Zone 3	30 ft Down	15 ft Zone 1	15 ft Zone 2	15 ft Zone 3	15 ft Down
1:12	-13.7	-25.7	-40.7	32.2	-11.1	-20.9	-33.3	32.2	-11.1	-20.9	-33.3	32.2
2:12	-12.2	-24.2	-37.7	30.3	-9.8	-19.7	-30.8	30.3	-9.8	-19.7	-30.8	30.3
3:12	-12.2	-24.2	-37.7	28.2	-9.9	-19.7	-30.8	28.2	-9.9	-19.7	-30.8	28.2
4:12	-12.3	-24.3	-37.7	26.1	-9.9	-19.8	-30.9	26.1	-9.9	-19.8	-30.9	26.1
5:12	-12.3	-24.3	-37.8	24.1	-9.9	-19.8	-30.9	24.1	-9.9	-19.8	-30.9	24.1
6:12	-12.3	-24.3	-37.8	22.2	-10.0	-19.8	-30.9	22.2	-10.0	-19.8	-30.9	22.2
7:12	-13.9	-16.9	-16.9	23.0	-11.2	-13.7	-13.7	21.2	-11.2	-13.7	-13.7	21.2
8:12	-13.9	-16.9	-16.9	21.4	-11.3	-13.7	-13.7	19.7	-11.3	-13.7	-13.7	19.7
9:12	-14.0	-17.0	-17.0	20.0	-11.3	-13.8	-13.8	18.3	-11.3	-13.8	-13.8	18.3
10:12	-14.0	-17.0	-17.0	18.8	-11.4	-13.8	-13.8	17.0	-11.4	-13.8	-13.8	17.0
11:12	-14.0	-17.0	-17.0	17.8	-11.4	-13.9	-13.9	16.0	-11.4	-13.9	-13.9	16.0
12:12	-14.1	-17.1	-17.1	16.9	-11.4	-13.9	-13.9	15.1	-11.4	-13.9	-13.9	15.1

Exposure Category C

Roof Pitch	60 ft Zone 1	60 ft Zone 2	60 ft Zone 3	60 ft Down	30 ft Zone 1	30 ft Zone 2	30 ft Zone 3	30 ft Down	15 ft Zone 1	15 ft Zone 2	15 ft Zone 3	15 ft Down
1:12	-18.6	-34.6	-54.5	32.2	-16.0	-29.8	-47.1	32.2	-13.7	-25.7	-40.7	32.2
2:12	-16.7	-32.6	-50.5	30.3	-14.3	-28.1	-43.6	30.3	-12.2	-24.2	-37.7	30.3
3:12	-16.7	-32.6	-50.5	28.2	-14.3	-28.1	-43.7	28.2	-12.2	-24.2	-37.7	28.2
4:12	-16.7	-32.6	-50.6	26.1	-14.3	-28.1	-43.7	26.1	-12.3	-24.3	-37.7	26.1
5:12	-16.7	-32.7	-50.6	24.1	-14.4	-28.2	-43.7	24.1	-12.3	-24.3	-37.8	24.1
6:12	-16.8	-32.7	-50.6	22.2	-14.4	-28.2	-43.8	22.2	-12.3	-24.3	-37.8	22.2
7:12	-18.8	-22.8	-22.8	26.3	-16.2	-19.6	-19.6	24.6	-13.9	-16.9	-16.9	23.0
8:12	-18.8	-22.8	-22.8	24.8	-16.2	-19.7	-19.7	23.0	-13.9	-16.9	-16.9	21.4
9:12	-18.9	-22.9	-22.9	23.4	-16.2	-19.7	-19.7	21.6	-14.0	-17.0	-17.0	20.0
10:12	-18.9	-22.9	-22.9	22.2	-16.3	-19.7	-19.7	20.4	-14.0	-17.0	-17.0	18.8
11:12	-19.0	-23.0	-23.0	21.1	-16.3	-19.8	-19.8	19.3	-14.0	-17.0	-17.0	17.8
12:12	-19.0	-23.0	-23.0	20.6	-16.4	-19.8	-19.8	18.4	-14.1	-17.1	-17.1	16.9

Exposure Category D

Roof Pitch	60 ft Zone 1	60 ft Zone 2	60 ft Zone 3	60 ft Down	30 ft Zone 1	30 ft Zone 2	30 ft Zone 3	30 ft Down	15 ft Zone 1	15 ft Zone 2	15 ft Zone 3	15 ft Down
1:12	-21.8	-40.3	-63.4	30.1	-19.2	-35.5	-56.0	30.1	-16.9	-31.4	-49.6	30.1
2:12	-19.5	-38.0	-58.8	29.6	-17.1	-33.5	-51.9	28.6	-15.1	-29.6	-45.9	28.4
3:12	-19.5	-38.0	-58.8	27.7	-17.2	-33.5	-51.9	26.7	-15.1	-29.6	-46.0	26.5
4:12	-19.6	-38.0	-58.8	25.8	-17.2	-33.5	-51.9	24.8	-15.1	-29.6	-46.0	24.6
5:12	-19.6	-38.1	-58.8	23.9	-17.2	-33.6	-52.0	23.0	-15.2	-29.7	-46.0	22.8
6:12	-19.6	-38.1	-58.9	22.2	-17.3	-33.6	-52.0	21.2	-15.2	-29.7	-46.1	21.0
7:12	-22.0	-26.6	-26.6	27.5	-19.3	-23.4	-23.4	25.7	-17.0	-20.7	-20.7	24.2
8:12	-22.0	-26.6	-26.6	26.1	-19.4	-23.5	-23.5	24.3	-17.1	-20.7	-20.7	22.8
9:12	-22.1	-26.7	-26.7	24.8	-19.4	-23.5	-23.5	23.0	-17.1	-20.8	-20.8	21.5
10:12	-22.1	-26.7	-26.7	23.7	-19.5	-23.5	-23.5	21.9	-17.2	-20.8	-20.8	20.4
11:12	-22.1	-26.8	-26.8	23.6	-19.5	-23.6	-23.6	21.2	-17.2	-20.8	-20.8	19.4
12:12	-22.2	-26.8	-26.8	23.5	-19.5	-23.6	-23.6	21.1	-17.2	-20.9	-20.9	19.1

Side Load (psf)

Down Slope

Roof Pitch	Ss=3.1	Ss=2.5	Ss=2.0	Ss=1.5	Ss=1.25	Ss=1.0	Ss=0.5	Ss=0.4	Ss=0.3	Ss=0.2	Ss=0.1	Ss=0.0
1:12	5.5	4.8	4.3	3.7	3.4	3.3	2.8	2.7	2.6	2.6	2.6	2.6
2:12	7.3	6.6	6.1	5.5	5.2	5.1	4.9	4.9	4.9	4.9	4.9	4.9
3:12	8.8	8.1	7.5	7.0	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
4:12	9.9	9.3	8.7	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
5:12	10.8	10.1	9.6	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3
6:12	11.4	10.7	10.2	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1
7:12	11.7	11.1	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6
8:12	11.9	11.3	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8
9:12	11.9	11.3	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9
10:12	11.8	11.2	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8
11:12	11.6	11.0	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6
12:12	11.4	10.8	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3

Lateral

Ss=3.1	Ss=2.5	Ss=2.0	Ss=1.5	Ss=1.25	Ss=1.0	Ss=0.5	Ss=0.4	Ss=0.3	Ss=0.2	Ss=0.1	Ss=0.0
4.5	3.6	2.9	2.2	1.8	1.6	1.0	0.9	0.7	0.5	0.2	0.0

Massachusetts*

ASCE 7-05

90 mph — Basic Wind Speed

40 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

Up and Down (psf)

Exposure Category B

Roof Pitch	Bldg Height 60 ft — Zone 1	Zone 2	Zone 3	Down (psf)	Bldg Height 30 ft — Zone 1	Zone 2	Zone 3	Down (psf)	Bldg Height 15 ft — Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-13.7	-25.7	-40.7	45.5	-11.1	-20.9	-33.3	45.5	-11.1	-20.9	-33.3	45.5
2:12	-12.2	-24.2	-37.7	41.9	-9.8	-19.7	-30.8	41.9	-9.8	-19.7	-30.8	41.9
3:12	-12.2	-24.2	-37.7	37.8	-9.9	-19.7	-30.8	37.8	-9.9	-19.7	-30.8	37.8
4:12	-12.3	-24.3	-37.7	33.6	-9.9	-19.8	-30.9	33.6	-9.9	-19.8	-30.9	33.6
5:12	-12.3	-24.3	-37.8	30.6	-9.9	-19.8	-30.9	30.6	-9.9	-19.8	-30.9	30.6
6:12	-12.3	-24.3	-37.8	27.8	-10.0	-19.8	-30.9	27.8	-10.0	-19.8	-30.9	27.8
7:12	-13.9	-16.9	-16.9	27.8	-11.2	-13.7	-13.7	26.0	-11.2	-13.7	-13.7	26.0
8:12	-13.9	-16.9	-16.9	25.5	-11.3	-13.7	-13.7	23.7	-11.3	-13.7	-13.7	23.7
9:12	-14.0	-17.0	-17.0	23.5	-11.3	-13.8	-13.8	21.7	-11.3	-13.8	-13.8	21.7
10:12	-14.0	-17.0	-17.0	21.7	-11.4	-13.8	-13.8	19.9	-11.4	-13.8	-13.8	19.9
11:12	-14.0	-17.0	-17.0	20.2	-11.4	-13.9	-13.9	18.4	-11.4	-13.9	-13.9	18.4
12:12	-14.1	-17.1	-17.1	18.9	-11.4	-13.9	-13.9	17.1	-11.4	-13.9	-13.9	17.1

Exposure Category C

Roof Pitch	Bldg Height 60 ft — Zone 1	Zone 2	Zone 3	Down (psf)	Bldg Height 30 ft — Zone 1	Zone 2	Zone 3	Down (psf)	Bldg Height 15 ft — Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-18.6	-34.6	-54.5	45.5	-16.0	-29.8	-47.1	45.5	-13.7	-25.7	-40.7	45.5
2:12	-16.7	-32.6	-50.5	41.9	-14.3	-28.1	-43.6	41.9	-12.2	-24.2	-37.7	41.9
3:12	-16.7	-32.6	-50.5	37.8	-14.3	-28.1	-43.7	37.8	-12.2	-24.2	-37.7	37.8
4:12	-16.7	-32.6	-50.6	33.6	-14.3	-28.1	-43.7	33.6	-12.3	-24.3	-37.7	33.6
5:12	-16.7	-32.7	-50.6	30.6	-14.4	-28.2	-43.7	30.6	-12.3	-24.3	-37.8	30.6
6:12	-16.8	-32.7	-50.6	27.8	-14.4	-28.2	-43.8	27.8	-12.3	-24.3	-37.8	27.8
7:12	-18.8	-22.8	-22.8	31.1	-16.2	-19.6	-19.6	29.4	-13.9	-16.9	-16.9	28.5
8:12	-18.8	-22.8	-22.8	28.8	-16.2	-19.7	-19.7	27.0	-13.9	-16.9	-16.9	26.4
9:12	-18.9	-22.9	-22.9	26.8	-16.2	-19.7	-19.7	25.0	-14.0	-17.0	-17.0	24.6
10:12	-18.9	-22.9	-22.9	25.0	-16.3	-19.7	-19.7	23.3	-14.0	-17.0	-17.0	23.0
11:12	-19.0	-23.0	-23.0	23.5	-16.3	-19.8	-19.8	21.7	-14.0	-17.0	-17.0	21.6
12:12	-19.0	-23.0	-23.0	22.2	-16.4	-19.8	-19.8	20.4	-14.1	-17.1	-17.1	20.4

Exposure Category D

Roof Pitch	Bldg Height 60 ft — Zone 1	Zone 2	Zone 3	Down (psf)	Bldg Height 30 ft — Zone 1	Zone 2	Zone 3	Down (psf)	Bldg Height 15 ft — Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-21.8	-40.3	-63.4	41.4	-19.2	-35.5	-56.0	41.4	-16.9	-31.4	-49.6	41.4
2:12	-19.5	-38.0	-58.8	38.1	-17.1	-33.5	-51.9	38.0	-15.1	-29.6	-45.9	38.0
3:12	-19.5	-38.0	-58.8	35.4	-17.2	-33.5	-51.9	34.4	-15.1	-29.6	-46.0	34.4
4:12	-19.6	-38.0	-58.8	32.5	-17.2	-33.5	-51.9	31.6	-15.1	-29.6	-46.0	31.4
5:12	-19.6	-38.1	-58.8	29.8	-17.2	-33.6	-52.0	28.8	-15.2	-29.7	-46.0	28.7
6:12	-19.6	-38.1	-58.9	27.3	-17.3	-33.6	-52.0	26.3	-15.2	-29.7	-46.1	26.1
7:12	-22.0	-26.6	-26.6	31.8	-19.3	-23.4	-23.4	30.1	-17.0	-20.7	-20.7	28.5
8:12	-22.0	-26.6	-26.6	29.8	-19.4	-23.5	-23.5	28.0	-17.1	-20.7	-20.7	26.4
9:12	-22.1	-26.7	-26.7	27.9	-19.4	-23.5	-23.5	26.1	-17.1	-20.8	-20.8	24.6
10:12	-22.1	-26.7	-26.7	26.3	-19.5	-23.5	-23.5	24.5	-17.2	-20.8	-20.8	23.0
11:12	-22.1	-26.8	-26.8	24.9	-19.5	-23.6	-23.6	23.2	-17.2	-20.8	-20.8	21.6
12:12	-22.2	-26.8	-26.8	23.8	-19.5	-23.6	-23.6	22.0	-17.2	-20.9	-20.9	20.4

Side Load (psf) — Down Slope (Lateral)

Roof Pitch	Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
1:12	3.8	3.8	4.1	4.6	5.0	5.4	6.8	7.3	8.2	9.9	11.9	14.7
2:12	7.1	7.1	7.1	7.1	7.4	7.8	9.1	9.7	10.5	12.2	13.8	15.9
3:12	9.7	9.7	9.7	9.7	9.7	9.7	11.0	11.5	12.3	13.9	15.5	17.4
4:12	11.8	11.8	11.8	11.8	11.8	11.8	12.4	12.9	13.7	15.2	16.7	18.5
5:12	13.3	13.3	13.3	13.3	13.3	13.3	13.4	13.9	14.6	16.0	17.4	19.1
6:12	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.5	15.1	16.5	17.8	19.4
7:12	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	15.4	16.6	17.9	19.4
8:12	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.4	16.5	17.7	19.1
9:12	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	16.3	17.3	18.6
10:12	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.9	16.9	18.1
11:12	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	15.4	16.3	17.4
12:12	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.8	15.7	16.7
(reference)	0.0	0.7	1.5	2.1	2.7	3.2	5.0	5.7	6.9	9.1	11.4	14.2

Mid US (High Snow)*

ASCE 7-05

90 mph — Basic Wind Speed

60 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

Up and Down (psf)

Bldg. Height = 60 ft.

Roof Pitch	Exp. B Zone 1	Exp. B Zone 2	Exp. B Zone 3	Exp. B Down	Exp. C Zone 1	Exp. C Zone 2	Exp. C Zone 3	Exp. C Down	Exp. D Zone 1	Exp. D Zone 2	Exp. D Zone 3	Exp. D Down
1:12	-17.2	-32.0	-50.5	24.4	-23.3	-43.0	-67.6	24.4	-27.2	-50.0	-78.5	23.1
2:12	-15.4	-30.2	-46.8	23.2	-20.9	-40.5	-62.7	24.9	-24.4	-47.2	-72.8	25.2
3:12	-15.4	-30.2	-46.8	21.9	-20.9	-40.6	-62.7	23.6	-24.4	-47.2	-72.9	24.0
4:12	-15.4	-30.2	-46.9	20.5	-20.9	-40.6	-62.7	22.2	-24.4	-47.2	-72.9	22.8
5:12	-15.5	-30.3	-46.9	19.2	-20.9	-40.6	-62.7	20.9	-24.5	-47.3	-72.9	21.6
6:12	-15.5	-30.3	-46.9	18.0	-21.0	-40.7	-62.8	19.7	-24.5	-47.3	-73.0	20.4
7:12	-17.4	-21.1	-21.1	21.8	-23.5	-28.4	-28.4	25.9	-27.4	-33.1	-33.1	29.0
8:12	-17.4	-21.1	-21.1	20.8	-23.5	-28.4	-28.4	25.3	-27.4	-33.1	-33.1	28.9
9:12	-17.5	-21.2	-21.2	19.8	-23.6	-28.5	-28.5	25.2	-27.5	-33.2	-33.2	28.7
10:12	-17.5	-21.2	-21.2	19.6	-23.6	-28.5	-28.5	25.1	-27.5	-33.2	-33.2	28.6
11:12	-17.5	-21.2	-21.2	19.5	-23.6	-28.6	-28.6	25.0	-27.6	-33.3	-33.3	28.5
12:12	-17.6	-21.3	-21.3	19.4	-23.7	-28.6	-28.6	24.9	-27.6	-33.3	-33.3	28.4

Bldg. Height = 30 ft.

Roof Pitch	Exp. B Zone 1	Exp. B Zone 2	Exp. B Zone 3	Exp. B Down	Exp. C Zone 1	Exp. C Zone 2	Exp. C Zone 3	Exp. C Down	Exp. D Zone 1	Exp. D Zone 2	Exp. D Zone 3	Exp. D Down
1:12	-14.0	-26.1	-41.4	24.4	-20.0	-37.1	-58.4	24.4	-24.0	-44.2	-69.4	23.1
2:12	-12.4	-24.6	-38.3	23.2	-17.9	-35.0	-54.2	23.7	-21.5	-41.6	-64.4	24.0
3:12	-12.5	-24.6	-38.4	21.9	-17.9	-35.0	-54.2	22.4	-21.5	-41.7	-64.4	22.8
4:12	-12.5	-24.7	-38.4	20.5	-18.0	-35.0	-54.2	21.0	-21.5	-41.7	-64.4	21.5
5:12	-12.5	-24.7	-38.4	19.2	-18.0	-35.1	-54.3	19.7	-21.5	-41.7	-64.4	20.4
6:12	-12.6	-24.7	-38.5	18.0	-18.0	-35.1	-54.3	18.5	-21.6	-41.8	-64.5	19.2
7:12	-14.1	-17.2	-17.2	19.6	-20.2	-24.5	-24.5	23.7	-24.1	-29.2	-29.2	26.0
8:12	-14.2	-17.2	-17.2	18.6	-20.3	-24.5	-24.5	22.7	-24.2	-29.2	-29.2	25.9
9:12	-14.2	-17.3	-17.3	17.6	-20.3	-24.6	-24.6	22.3	-24.2	-29.3	-29.3	25.8
10:12	-14.2	-17.3	-17.3	16.8	-20.3	-24.6	-24.6	22.1	-24.3	-29.3	-29.3	25.7
11:12	-14.3	-17.3	-17.3	16.5	-20.4	-24.6	-24.6	22.0	-24.3	-29.3	-29.3	25.6
12:12	-14.3	-17.4	-17.4	16.4	-20.4	-24.7	-24.7	21.9	-24.3	-29.4	-29.4	25.4

Bldg. Height = 15 ft.

Roof Pitch	Exp. B Zone 1	Exp. B Zone 2	Exp. B Zone 3	Exp. B Down	Exp. C Zone 1	Exp. C Zone 2	Exp. C Zone 3	Exp. C Down	Exp. D Zone 1	Exp. D Zone 2	Exp. D Zone 3	Exp. D Down
1:12	-14.0	-26.1	-41.4	24.4	-17.2	-32.0	-50.5	24.4	-21.1	-39.1	-61.5	23.1
2:12	-12.4	-24.6	-38.3	23.2	-15.4	-30.2	-46.8	23.2	-18.9	-36.8	-57.0	22.9
3:12	-12.5	-24.6	-38.4	21.9	-15.4	-30.2	-46.8	21.9	-18.9	-36.9	-57.0	21.7
4:12	-12.5	-24.7	-38.4	20.5	-15.4	-30.2	-46.9	20.5	-19.0	-36.9	-57.1	20.5
5:12	-12.5	-24.7	-38.4	19.2	-15.5	-30.3	-46.9	19.2	-19.0	-36.9	-57.1	19.3
6:12	-12.6	-24.7	-38.5	18.0	-15.5	-30.3	-46.9	18.0	-19.0	-37.0	-57.1	18.2
7:12	-14.1	-17.2	-17.2	19.6	-17.4	-21.1	-21.1	21.8	-21.3	-25.8	-25.8	23.8
8:12	-14.2	-17.2	-17.2	18.6	-17.4	-21.1	-21.1	20.8	-21.3	-25.8	-25.8	23.4
9:12	-14.2	-17.3	-17.3	17.6	-17.5	-21.2	-21.2	19.8	-21.4	-25.9	-25.9	23.2
10:12	-14.2	-17.3	-17.3	16.8	-17.5	-21.2	-21.2	19.6	-21.4	-25.9	-25.9	23.1
11:12	-14.3	-17.3	-17.3	16.5	-17.5	-21.2	-21.2	19.5	-21.5	-25.9	-25.9	23.0
12:12	-14.3	-17.4	-17.4	16.4	-17.6	-21.3	-21.3	19.4	-21.5	-26.0	-26.0	22.9

Side Load (psf)

Down Slope

Roof Pitch	Ss = 3.1	Ss = 2.5	Ss = 2.0	Ss = 1.5	Ss = 1.25	Ss = 1.0	Ss = 0.5	Ss = 0.4	Ss = 0.3	Ss = 0.2	Ss = 0.1	Ss = 0.0
1:12	4.8	4.1	3.6	3.1	2.8	2.6	2.2	2.1	1.9	1.8	1.8	1.8
2:12	6.1	5.4	4.9	4.3	4.0	3.9	3.4	3.3	3.3	3.3	3.3	3.3
3:12	7.1	6.4	5.9	5.3	5.1	4.9	4.6	4.6	4.6	4.6	4.6	4.6
4:12	7.9	7.3	6.7	6.2	5.9	5.7	5.6	5.6	5.6	5.6	5.6	5.6
5:12	8.6	7.9	7.4	6.8	6.5	6.4	6.4	6.4	6.4	6.4	6.4	6.4
6:12	9.0	8.4	7.8	7.3	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
7:12	9.3	8.6	8.1	7.6	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
8:12	9.4	8.8	8.3	7.8	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6
9:12	9.5	8.9	8.4	7.9	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
10:12	9.5	8.9	8.4	7.9	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
11:12	9.4	8.8	8.3	7.8	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6
12:12	9.2	8.7	8.2	7.7	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5

Lateral

Ss = 3.1	Ss = 2.5	Ss = 2.0	Ss = 1.5	Ss = 1.25	Ss = 1.0	Ss = 0.5	Ss = 0.4	Ss = 0.3	Ss = 0.2	Ss = 0.1	Ss = 0.0
4.5	3.6	2.9	2.2	1.8	1.6	1.0	0.9	0.7	0.5	0.2	0.0

East Coast (Medium Snow)*

ASCE 7-05

100 mph — Basic Wind Speed

25 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

Up and Down (psf)

Bldg. Height = 60 ft.

Roof Pitch	Exp. B Zone 1	Exp. B Zone 2	Exp. B Zone 3	Exp. B Down	Exp. C Zone 1	Exp. C Zone 2	Exp. C Zone 3	Exp. C Down	Exp. D Zone 1	Exp. D Zone 2	Exp. D Zone 3	Exp. D Down
1:12	-21.1	-39.0	-61.4	16.5	-28.5	-52.3	-82.0	16.5	-33.2	-60.8	-95.3	16.3
2:12	-18.9	-36.8	-56.9	16.9	-25.5	-49.3	-76.1	19.7	-29.8	-57.4	-88.4	21.0
3:12	-18.9	-36.8	-56.9	16.4	-25.5	-49.3	-76.1	19.1	-29.8	-57.4	-88.4	21.0
4:12	-18.9	-36.8	-57.0	15.8	-25.6	-49.4	-76.1	18.6	-29.8	-57.4	-88.5	20.9
5:12	-19.0	-36.9	-57.0	15.2	-25.6	-49.4	-76.2	18.4	-29.9	-57.5	-88.5	20.8
6:12	-19.0	-36.9	-57.0	14.6	-25.6	-49.4	-76.2	18.3	-29.9	-57.5	-88.5	20.7
7:12	-21.3	-25.7	-25.7	23.5	-28.6	-34.6	-34.6	30.1	-33.4	-40.3	-40.3	34.4
8:12	-21.3	-25.8	-25.8	23.3	-28.7	-34.6	-34.6	30.0	-33.4	-40.3	-40.3	34.2
9:12	-21.4	-25.8	-25.8	23.2	-28.7	-34.7	-34.7	29.9	-33.5	-40.4	-40.4	34.1
10:12	-21.4	-25.9	-25.9	23.1	-28.8	-34.7	-34.7	29.7	-33.5	-40.4	-40.4	34.0
11:12	-21.4	-25.9	-25.9	23.0	-28.8	-34.8	-34.8	29.6	-33.5	-40.4	-40.4	33.9
12:12	-21.5	-25.9	-25.9	22.9	-28.8	-34.8	-34.8	29.5	-33.6	-40.5	-40.5	33.8

Bldg. Height = 30 ft.

Roof Pitch	Exp. B Zone 1	Exp. B Zone 2	Exp. B Zone 3	Exp. B Down	Exp. C Zone 1	Exp. C Zone 2	Exp. C Zone 3	Exp. C Down	Exp. D Zone 1	Exp. D Zone 2	Exp. D Zone 3	Exp. D Down
1:12	-17.2	-31.9	-50.3	16.5	-24.5	-45.2	-71.0	16.5	-29.3	-53.7	-84.2	16.0
2:12	-15.3	-30.1	-46.7	16.1	-22.0	-42.6	-65.8	18.2	-26.2	-50.7	-78.1	19.5
3:12	-15.3	-30.1	-46.7	15.5	-22.0	-42.6	-65.8	17.7	-26.2	-50.7	-78.2	19.0
4:12	-15.4	-30.1	-46.7	14.9	-22.0	-42.6	-65.9	17.1	-26.3	-50.7	-78.2	18.9
5:12	-15.4	-30.1	-46.7	14.3	-22.1	-42.7	-65.9	16.5	-26.3	-50.7	-78.2	18.8
6:12	-15.4	-30.2	-46.8	13.7	-22.1	-42.7	-65.9	16.3	-26.3	-50.8	-78.3	18.7
7:12	-17.3	-21.0	-21.0	19.9	-24.7	-29.9	-29.9	26.5	-29.4	-35.5	-35.5	30.8
8:12	-17.4	-21.0	-21.0	19.8	-24.7	-29.9	-29.9	26.4	-29.5	-35.6	-35.6	30.7
9:12	-17.4	-21.1	-21.1	19.7	-24.8	-29.9	-29.9	26.3	-29.5	-35.6	-35.6	30.6
10:12	-17.4	-21.1	-21.1	19.5	-24.8	-30.0	-30.0	26.2	-29.6	-35.7	-35.7	30.4
11:12	-17.5	-21.2	-21.2	19.4	-24.9	-30.0	-30.0	26.1	-29.6	-35.7	-35.7	30.3
12:12	-17.5	-21.2	-21.2	19.3	-24.9	-30.1	-30.1	25.9	-29.6	-35.7	-35.7	30.2

Bldg. Height = 15 ft.

Roof Pitch	Exp. B Zone 1	Exp. B Zone 2	Exp. B Zone 3	Exp. B Down	Exp. C Zone 1	Exp. C Zone 2	Exp. C Zone 3	Exp. C Down	Exp. D Zone 1	Exp. D Zone 2	Exp. D Zone 3	Exp. D Down
1:12	-17.2	-31.9	-50.3	16.5	-21.1	-39.0	-61.4	16.5	-25.8	-47.5	-74.7	16.0
2:12	-15.3	-30.1	-46.7	16.1	-18.9	-36.8	-56.9	16.9	-23.1	-44.8	-69.2	18.2
3:12	-15.3	-30.1	-46.7	15.5	-18.9	-36.8	-56.9	16.4	-23.2	-44.9	-69.3	17.7
4:12	-15.4	-30.1	-46.7	14.9	-19.0	-36.8	-57.0	15.8	-23.2	-44.9	-69.3	17.2
5:12	-15.4	-30.1	-46.7	14.3	-19.0	-36.9	-57.0	15.2	-23.2	-44.9	-69.3	17.1
6:12	-15.4	-30.2	-46.8	13.7	-19.0	-36.9	-57.0	14.6	-23.3	-45.0	-69.4	17.0
7:12	-17.3	-21.0	-21.0	19.9	-21.3	-25.7	-25.7	23.5	-26.0	-31.4	-31.4	27.7
8:12	-17.4	-21.0	-21.0	19.8	-21.3	-25.8	-25.8	23.3	-26.1	-31.5	-31.5	27.6
9:12	-17.4	-21.1	-21.1	19.7	-21.4	-25.8	-25.8	23.2	-26.1	-31.5	-31.5	27.5
10:12	-17.4	-21.1	-21.1	19.5	-21.4	-25.9	-25.9	23.1	-26.1	-31.6	-31.6	27.4
11:12	-17.5	-21.2	-21.2	19.4	-21.4	-25.9	-25.9	23.0	-26.2	-31.6	-31.6	27.2
12:12	-17.5	-21.2	-21.2	19.3	-21.5	-25.9	-25.9	22.9	-26.2	-31.6	-31.6	27.1

Side Load (psf)

Down Slope

Roof Pitch	Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
1:12	0.9	0.9	1.1	1.3	1.5	2.0	2.1	2.5	3.2	4.0	4.8
2:12	1.7	1.7	1.8	2.0	2.2	2.7	2.8	3.1	3.7	4.3	5.2
3:12	2.4	2.4	2.4	2.5	2.8	3.3	3.4	3.7	4.3	4.8	5.5
4:12	3.0	3.0	3.0	3.1	3.3	3.8	3.9	4.2	4.7	5.3	6.0
5:12	3.4	3.4	3.4	3.5	3.7	4.2	4.3	4.6	5.1	5.7	6.4
6:12	3.8	3.8	3.8	3.8	4.0	4.5	4.6	4.9	5.5	6.0	6.6
7:12	4.1	4.1	4.1	4.1	4.3	4.7	4.9	5.2	5.7	6.2	6.9
8:12	4.3	4.3	4.3	4.3	4.5	4.9	5.1	5.3	5.9	6.4	7.0
9:12	4.4	4.4	4.4	4.4	4.6	5.0	5.2	5.4	6.0	6.5	7.1
10:12	4.5	4.5	4.5	4.5	4.7	5.1	5.3	5.5	6.0	6.5	7.1
11:12	4.6	4.6	4.6	4.6	4.8	5.2	5.3	5.6	6.1	6.5	7.1
12:12	4.6	4.6	4.6	4.6	4.8	5.2	5.3	5.6	6.1	6.5	7.1

Lateral

	Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
Lateral	0.0	0.2	0.5	0.7	1.0	1.6	1.8	2.2	2.9	3.6	4.5

East Coast (Low Snow)*

ASCE 7-05

110 mph — Basic Wind Speed

10 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

New Jersey*

ASCE 7-05

115 mph — Basic Wind Speed

25 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

Up and Down (psf)

Exposure Category B

Roof Pitch	60 ft Zone 1	60 ft Zone 2	60 ft Zone 3	60 ft Down	30 ft Zone 1	30 ft Zone 2	30 ft Zone 3	30 ft Down	15 ft Zone 1	15 ft Zone 2	15 ft Zone 3	15 ft Down
1:12	-23.2	-42.7	-67.2	24.4	-18.9	-35.0	-55.1	24.4	-18.9	-35.0	-55.1	24.4
2:12	-20.7	-40.3	-62.3	24.9	-16.9	-33.0	-51.1	23.2	-16.9	-33.0	-51.1	23.2
3:12	-20.8	-40.3	-62.4	23.5	-16.9	-33.0	-51.1	21.9	-16.9	-33.0	-51.1	21.9
4:12	-20.8	-40.4	-62.4	22.2	-16.9	-33.0	-51.2	20.6	-16.9	-33.0	-51.2	20.6
5:12	-20.8	-40.4	-62.4	20.9	-16.9	-33.1	-51.2	19.3	-16.9	-33.1	-51.2	19.3
6:12	-20.9	-40.4	-62.4	19.6	-17.0	-33.1	-51.2	18.0	-17.0	-33.1	-51.2	18.0
7:12	-23.4	-28.2	-28.2	25.8	-19.0	-23.1	-23.1	22.9	-19.0	-23.1	-23.1	22.9
8:12	-23.4	-28.3	-28.3	25.2	-19.1	-23.1	-23.1	21.9	-19.1	-23.1	-23.1	21.9
9:12	-23.4	-28.3	-28.3	25.1	-19.1	-23.1	-23.1	21.2	-19.1	-23.1	-23.1	21.2
10:12	-23.5	-28.4	-28.4	25.0	-19.2	-23.2	-23.2	21.1	-19.2	-23.2	-23.2	21.1
11:12	-23.5	-28.4	-28.4	24.9	-19.2	-23.2	-23.2	21.0	-19.2	-23.2	-23.2	21.0
12:12	-23.6	-28.4	-28.4	24.7	-19.2	-23.3	-23.3	20.9	-19.2	-23.3	-23.3	20.9

Exposure Category C

Roof Pitch	60 ft Zone 1	60 ft Zone 2	60 ft Zone 3	60 ft Down	30 ft Zone 1	30 ft Zone 2	30 ft Zone 3	30 ft Down	15 ft Zone 1	15 ft Zone 2	15 ft Zone 3	15 ft Down
1:12	-31.2	-57.3	-89.8	24.4	-26.9	-49.5	-77.7	24.4	-23.2	-42.7	-67.2	24.4
2:12	-28.0	-54.0	-83.3	27.9	-24.1	-46.7	-72.1	26.3	-20.7	-40.3	-62.3	24.9
3:12	-28.0	-54.0	-83.3	26.6	-24.1	-46.7	-72.1	24.9	-20.8	-40.3	-62.4	23.5
4:12	-28.0	-54.1	-83.3	25.2	-24.2	-46.7	-72.1	23.6	-20.8	-40.4	-62.4	22.2
5:12	-28.1	-54.1	-83.4	23.9	-24.2	-46.8	-72.1	22.3	-20.8	-40.4	-62.4	20.9
6:12	-28.1	-54.1	-83.4	22.7	-24.2	-46.8	-72.2	21.0	-20.9	-40.4	-62.4	19.6
7:12	-31.4	-37.9	-37.9	32.6	-27.1	-32.7	-32.7	28.7	-23.4	-28.2	-28.2	25.8
8:12	-31.5	-38.0	-38.0	32.5	-27.1	-32.8	-32.8	28.6	-23.4	-28.3	-28.3	25.2
9:12	-31.5	-38.0	-38.0	32.3	-27.2	-32.8	-32.8	28.5	-23.4	-28.3	-28.3	25.1
10:12	-31.5	-38.0	-38.0	32.2	-27.2	-32.9	-32.9	28.3	-23.5	-28.4	-28.4	25.0
11:12	-31.6	-38.1	-38.1	32.1	-27.3	-32.9	-32.9	28.2	-23.5	-28.4	-28.4	24.9
12:12	-31.6	-38.1	-38.1	32.0	-27.3	-32.9	-32.9	28.1	-23.6	-28.4	-28.4	24.7

Exposure Category D

Roof Pitch	60 ft Zone 1	60 ft Zone 2	60 ft Zone 3	60 ft Down	30 ft Zone 1	30 ft Zone 2	30 ft Zone 3	30 ft Down	15 ft Zone 1	15 ft Zone 2	15 ft Zone 3	15 ft Down
1:12	-36.4	-66.6	-104.3	24.0	-32.1	-58.8	-92.2	23.1	-28.4	-52.1	-81.7	23.1
2:12	-32.7	-62.8	-96.7	28.6	-28.8	-55.5	-85.5	27.0	-25.4	-49.1	-75.8	25.6
3:12	-32.7	-62.8	-96.8	27.4	-28.8	-55.5	-85.5	25.8	-25.4	-49.1	-75.8	24.4
4:12	-32.7	-62.9	-96.8	26.2	-28.8	-55.5	-85.6	24.6	-25.5	-49.2	-75.8	23.2
5:12	-32.7	-62.9	-96.8	25.0	-28.9	-55.6	-85.6	23.4	-25.5	-49.2	-75.9	22.0
6:12	-32.8	-62.9	-96.9	23.9	-28.9	-55.6	-85.6	22.3	-25.5	-49.2	-75.9	20.9
7:12	-36.6	-44.1	-44.1	37.3	-32.3	-38.9	-38.9	33.4	-28.5	-34.5	-34.5	30.0
8:12	-36.6	-44.2	-44.2	37.1	-32.3	-39.0	-39.0	33.2	-28.6	-34.5	-34.5	29.9
9:12	-36.7	-44.2	-44.2	37.0	-32.4	-39.0	-39.0	33.1	-28.6	-34.5	-34.5	29.8
10:12	-36.7	-44.3	-44.3	36.9	-32.4	-39.1	-39.1	33.0	-28.7	-34.6	-34.6	29.6
11:12	-36.8	-44.3	-44.3	36.8	-32.4	-39.1	-39.1	32.9	-28.7	-34.6	-34.6	29.5
12:12	-36.8	-44.3	-44.3	36.6	-32.5	-39.2	-39.2	32.8	-28.7	-34.7	-34.7	29.4

Side Load (psf)

Down Slope

Roof Pitch	S_s=3.1	S_s=2.5	S_s=2.0	S_s=1.5	S_s=1.25	S_s=1.0	S_s=0.5	S_s=0.4	S_s=0.3	S_s=0.2	S_s=0.1	S_s=0.0
1:12	4.8	4.1	3.6	3.1	2.8	2.6	2.2	2.1	1.9	1.8	1.8	1.8
2:12	6.1	5.4	4.9	4.3	4.0	3.9	3.4	3.3	3.3	3.3	3.3	3.3
3:12	7.1	6.4	5.9	5.3	5.1	4.9	4.6	4.6	4.6	4.6	4.6	4.6
4:12	7.9	7.3	6.7	6.2	5.9	5.7	5.6	5.6	5.6	5.6	5.6	5.6
5:12	8.6	7.9	7.4	6.8	6.5	6.4	6.4	6.4	6.4	6.4	6.4	6.4
6:12	9.0	8.4	7.8	7.3	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
7:12	9.3	8.6	8.1	7.6	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
8:12	9.4	8.8	8.3	7.8	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6
9:12	9.5	8.9	8.4	7.9	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
10:12	9.5	8.9	8.4	7.9	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
11:12	9.4	8.8	8.3	7.8	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6
12:12	9.2	8.7	8.2	7.7	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5

Lateral

S_s=3.1	S_s=2.5	S_s=2.0	S_s=1.5	S_s=1.25	S_s=1.0	S_s=0.5	S_s=0.4	S_s=0.3	S_s=0.2	S_s=0.1	S_s=0.0
4.5	3.6	2.9	2.2	1.8	1.6	1.0	0.9	0.7	0.5	0.2	0.0

SFM — SUN FRAME MICRORAIL

Up and Down (psf)

Exposure Category B

Roof Pitch	Bldg. Height = 60 ft — Zone 1	Zone 2	Zone 3	Down	Bldg. Height = 30 ft — Zone 1	Zone 2	Zone 3	Down	Bldg. Height = 15 ft — Zone 1	Zone 2	Zone 3	Down
1:12	-25.4	-46.7	-73.3	13.8	-20.7	-38.2	-60.1	13.8	-20.7	-38.2	-60.1	13.8
2:12	-22.7	-44.0	-68.0	17.1	-18.5	-36.0	-55.8	14.8	-18.5	-36.0	-55.8	14.8
3:12	-22.7	-44.0	-68.0	17.0	-18.5	-36.0	-55.8	14.7	-18.5	-36.0	-55.8	14.7
4:12	-22.8	-44.1	-68.0	17.0	-18.5	-36.1	-55.8	14.6	-18.5	-36.1	-55.8	14.6
5:12	-22.8	-44.1	-68.1	16.9	-18.6	-36.1	-55.8	14.5	-18.6	-36.1	-55.8	14.5
6:12	-22.8	-44.1	-68.1	16.8	-18.6	-36.1	-55.9	14.4	-18.6	-36.1	-55.9	14.4
7:12	-25.5	-30.9	-30.9	27.3	-20.8	-25.2	-25.2	23.1	-20.8	-25.2	-25.2	23.1
8:12	-25.6	-30.9	-30.9	27.2	-20.9	-25.3	-25.3	22.9	-20.9	-25.3	-25.3	22.9
9:12	-25.6	-30.9	-30.9	27.0	-20.9	-25.3	-25.3	22.8	-20.9	-25.3	-25.3	22.8
10:12	-25.6	-31.0	-31.0	26.9	-20.9	-25.3	-25.3	22.7	-20.9	-25.3	-25.3	22.7
11:12	-25.7	-31.0	-31.0	26.8	-21.0	-25.4	-25.4	22.6	-21.0	-25.4	-25.4	22.6
12:12	-25.7	-31.1	-31.1	26.7	-21.0	-25.4	-25.4	22.5	-21.0	-25.4	-25.4	22.5

Exposure Category C

Roof Pitch	Bldg. Height = 60 ft — Zone 1	Zone 2	Zone 3	Down	Bldg. Height = 30 ft — Zone 1	Zone 2	Zone 3	Down	Bldg. Height = 15 ft — Zone 1	Zone 2	Zone 3	Down
1:12	-34.1	-62.5	-97.9	14.5	-29.4	-54.0	-84.7	13.8	-25.4	-46.7	-73.3	13.8
2:12	-30.6	-58.9	-90.8	21.5	-26.4	-50.9	-78.6	19.1	-22.7	-44.0	-68.0	17.1
3:12	-30.6	-58.9	-90.8	21.4	-26.4	-51.0	-78.6	19.1	-22.7	-44.0	-68.0	17.0
4:12	-30.6	-59.0	-90.8	21.4	-26.4	-51.0	-78.6	19.0	-22.8	-44.1	-68.0	17.0
5:12	-30.7	-59.0	-90.9	21.3	-26.5	-51.0	-78.7	18.9	-22.8	-44.1	-68.1	16.9
6:12	-30.7	-59.0	-90.9	21.1	-26.5	-51.1	-78.7	18.8	-22.8	-44.1	-68.1	16.8
7:12	-34.3	-41.4	-41.4	35.2	-29.6	-35.7	-35.7	31.0	-25.5	-30.9	-30.9	27.3
8:12	-34.3	-41.4	-41.4	35.1	-29.6	-35.8	-35.8	30.8	-25.6	-30.9	-30.9	27.2
9:12	-34.4	-41.5	-41.5	34.9	-29.7	-35.8	-35.8	30.7	-25.6	-30.9	-30.9	27.0
10:12	-34.4	-41.5	-41.5	34.8	-29.7	-35.9	-35.9	30.6	-25.6	-31.0	-31.0	26.9
11:12	-34.5	-41.5	-41.5	34.7	-29.8	-35.9	-35.9	30.5	-25.7	-31.0	-31.0	26.8
12:12	-34.5	-41.6	-41.6	34.6	-29.8	-35.9	-35.9	30.4	-25.7	-31.1	-31.1	26.7

Exposure Category D

Roof Pitch	Bldg. Height = 60 ft — Zone 1	Zone 2	Zone 3	Down	Bldg. Height = 30 ft — Zone 1	Zone 2	Zone 3	Down	Bldg. Height = 15 ft — Zone 1	Zone 2	Zone 3	Down
1:12	-39.8	-72.6	-113.7	16.1	-35.1	-64.1	-100.5	14.7	-31.0	-56.8	-89.1	13.8
2:12	-35.7	-68.5	-105.5	24.3	-31.4	-60.5	-93.2	22.0	-27.8	-53.6	-82.6	19.9
3:12	-35.7	-68.5	-105.5	24.3	-31.5	-60.5	-93.3	21.9	-27.8	-53.6	-82.7	19.9
4:12	-35.7	-68.6	-105.5	24.2	-31.5	-60.6	-93.3	21.8	-27.8	-53.6	-82.7	19.8
5:12	-35.8	-68.6	-105.5	24.1	-31.5	-60.6	-93.3	21.7	-27.9	-53.7	-82.7	19.7
6:12	-35.8	-68.6	-105.6	24.0	-31.6	-60.6	-93.4	21.6	-27.9	-53.7	-82.8	19.6
7:12	-39.9	-48.1	-48.1	40.3	-35.2	-42.5	-42.5	36.0	-31.2	-37.6	-37.6	32.4
8:12	-40.0	-48.2	-48.2	40.1	-35.3	-42.5	-42.5	35.9	-31.2	-37.7	-37.7	32.2
9:12	-40.0	-48.2	-48.2	40.1	-35.3	-42.6	-42.6	35.8	-31.2	-37.7	-37.7	32.1
10:12	-40.1	-48.3	-48.3	40.0	-35.4	-42.6	-42.6	35.7	-31.3	-37.7	-37.7	32.0
11:12	-40.1	-48.3	-48.3	39.9	-35.4	-42.7	-42.7	35.5	-31.3	-37.8	-37.8	31.9
12:12	-40.1	-48.3	-48.3	39.7	-35.4	-42.7	-42.7	35.4	-31.4	-37.8	-37.8	31.8

Side Load (psf)

Down Slope

Roof Pitch	Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
1:12	0.3	0.6	0.8	1.0	1.2	1.3	1.9	2.1	2.5	3.2	4.0	4.8
2:12	0.6	0.9	1.1	1.3	1.5	1.7	2.3	2.5	2.8	3.6	4.3	5.2
3:12	0.9	1.2	1.4	1.6	1.8	2.0	2.6	2.8	3.2	3.9	4.6	5.5
4:12	1.2	1.5	1.7	1.9	2.1	2.3	2.8	3.1	3.4	4.2	4.9	5.8
5:12	1.5	1.7	1.9	2.2	2.3	2.5	3.1	3.3	3.7	4.4	5.1	6.0
6:12	1.7	2.0	2.2	2.4	2.6	2.7	3.3	3.5	3.9	4.6	5.3	6.2
7:12	1.9	2.2	2.4	2.6	2.8	2.9	3.5	3.7	4.1	4.8	5.5	6.3
8:12	2.1	2.4	2.6	2.8	3.0	3.1	3.7	3.9	4.2	4.9	5.6	6.5
9:12	2.3	2.5	2.7	2.9	3.1	3.3	3.8	4.0	4.4	5.0	5.7	6.5
10:12	2.5	2.7	2.9	3.1	3.3	3.4	3.9	4.1	4.5	5.1	5.8	6.6
11:12	2.6	2.8	3.0	3.2	3.4	3.5	4.0	4.2	4.6	5.2	5.9	6.6
12:12	2.7	2.9	3.1	3.3	3.5	3.6	4.1	4.3	4.6	5.3	5.9	6.7

Lateral

Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
0.0	0.2	0.5	0.7	0.9	1.0	1.6	1.8	2.2	2.9	3.6	4.5

Louisiana*

ASCE 7-05

120 mph — Basic Wind Speed

0 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

Up and Down (psf)

Exposure Category B

Roof Pitch	Bldg. Height = 60 ft — Up Pressures Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 30 ft — Up Pressures Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 15 ft — Up Pressures Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-35.0	-64.0	-100.2	14.7	-28.6	-52.5	-82.3	13.8	-28.6	-52.5	-82.3	13.8
2:12	-31.4	-60.4	-93.0	21.9	-25.6	-49.5	-76.4	18.7	-25.6	-49.5	-76.4	18.7
3:12	-31.4	-60.4	-93.0	21.9	-25.6	-49.5	-76.4	18.7	-25.6	-49.5	-76.4	18.7
4:12	-31.4	-60.4	-93.0	21.8	-25.7	-49.5	-76.4	18.6	-25.7	-49.5	-76.4	18.6
5:12	-31.4	-60.4	-93.1	21.7	-25.7	-49.6	-76.4	18.5	-25.7	-49.6	-76.4	18.5
6:12	-31.5	-60.5	-93.1	21.6	-25.7	-49.6	-76.5	18.4	-25.7	-49.6	-76.5	18.4
7:12	-35.1	-42.4	-42.4	36.0	-28.7	-34.7	-34.7	30.2	-28.7	-34.7	-34.7	30.2
8:12	-35.2	-42.4	-42.4	35.8	-28.8	-34.8	-34.8	30.1	-28.8	-34.8	-34.8	30.1
9:12	-35.2	-42.5	-42.5	35.7	-28.8	-34.8	-34.8	29.9	-28.8	-34.8	-34.8	29.9
10:12	-35.3	-42.5	-42.5	35.6	-28.9	-34.8	-34.8	29.8	-28.9	-34.8	-34.8	29.8
11:12	-35.3	-42.6	-42.6	35.5	-28.9	-34.9	-34.9	29.7	-28.9	-34.9	-34.9	29.7
12:12	-35.3	-42.6	-42.6	35.3	-28.9	-34.9	-34.9	29.6	-28.9	-34.9	-34.9	29.6

Exposure Category C

Roof Pitch	Bldg. Height = 60 ft — Up Pressures Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 30 ft — Up Pressures Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 15 ft — Up Pressures Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-46.9	-85.5	-133.7	18.3	-40.5	-74.0	-115.8	16.4	-35.0	-64.0	-100.2	14.7
2:12	-42.1	-80.7	-124.0	27.9	-36.4	-69.8	-107.4	24.7	-31.4	-60.4	-93.0	21.9
3:12	-42.1	-80.7	-124.1	27.8	-36.4	-69.8	-107.4	24.6	-31.4	-60.4	-93.0	21.9
4:12	-42.2	-80.7	-124.1	27.7	-36.4	-69.8	-107.5	24.5	-31.4	-60.4	-93.0	21.8
5:12	-42.2	-80.7	-124.1	27.6	-36.4	-69.9	-107.5	24.4	-31.4	-60.4	-93.1	21.7
6:12	-42.2	-80.8	-124.2	27.5	-36.5	-69.9	-107.5	24.3	-31.5	-60.5	-93.1	21.6
7:12	-47.1	-56.7	-56.7	46.7	-40.7	-49.0	-49.0	40.9	-35.1	-42.4	-42.4	36.0
8:12	-47.1	-56.8	-56.8	46.6	-40.7	-49.1	-49.1	40.8	-35.2	-42.4	-42.4	35.8
9:12	-47.2	-56.8	-56.8	46.5	-40.8	-49.1	-49.1	40.7	-35.2	-42.5	-42.5	35.7
10:12	-47.2	-56.8	-56.8	46.3	-40.8	-49.2	-49.2	40.6	-35.3	-42.5	-42.5	35.6
11:12	-47.2	-56.9	-56.9	46.2	-40.8	-49.2	-49.2	40.5	-35.3	-42.6	-42.6	35.5
12:12	-47.3	-56.9	-56.9	46.1	-40.9	-49.2	-49.2	40.3	-35.3	-42.6	-42.6	35.3

Exposure Category D

Roof Pitch	Bldg. Height = 60 ft — Up Pressures Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 30 ft — Up Pressures Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 15 ft — Up Pressures Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-54.6	-99.3	-155.2	20.6	-48.2	-87.8	-137.2	18.7	-42.6	-77.8	-121.7	17.0
2:12	-49.0	-93.7	-144.0	31.7	-43.3	-82.8	-127.4	28.5	-38.3	-73.4	-112.9	25.8
3:12	-49.0	-93.7	-144.0	31.7	-43.3	-82.9	-127.4	28.5	-38.3	-73.4	-113.0	25.7
4:12	-49.1	-93.8	-144.0	31.6	-43.3	-82.9	-127.4	28.4	-38.3	-73.5	-113.0	25.6
5:12	-49.1	-93.8	-144.1	31.5	-43.3	-82.9	-127.4	28.3	-38.4	-73.5	-113.0	25.5
6:12	-49.1	-93.8	-144.1	31.4	-43.4	-83.0	-127.5	28.2	-38.4	-73.5	-113.1	25.4
7:12	-54.8	-65.9	-65.9	53.6	-48.4	-58.3	-58.3	47.8	-42.8	-51.6	-51.6	42.9
8:12	-54.8	-66.0	-66.0	53.5	-48.4	-58.3	-58.3	47.7	-42.9	-51.6	-51.6	42.7
9:12	-54.8	-66.0	-66.0	53.4	-48.4	-58.3	-58.3	47.6	-42.9	-51.7	-51.7	42.6
10:12	-54.9	-66.1	-66.1	53.2	-48.5	-58.4	-58.4	47.5	-42.9	-51.7	-51.7	42.5
11:12	-54.9	-66.1	-66.1	53.1	-48.5	-58.4	-58.4	47.4	-43.0	-51.8	-51.8	42.4
12:12	-55.0	-66.1	-66.1	53.0	-48.6	-58.5	-58.5	47.2	-43.0	-51.8	-51.8	42.3

Side Load (psf) — Lateral

Down Slope

Roof Pitch	Ss = 0.0	Ss = 0.1	Ss = 0.2	Ss = 0.3	Ss = 0.4	Ss = 0.5	Ss = 1.0	Ss = 1.25	Ss = 1.5	Ss = 2.0	Ss = 2.5	Ss = 3.1
1:12	0.3	0.6	0.8	1.0	1.2	1.3	1.9	2.1	2.5	3.2	4.0	4.8
2:12	0.6	0.9	1.1	1.3	1.5	1.7	2.3	2.5	2.8	3.6	4.3	5.2
3:12	0.9	1.2	1.4	1.6	1.8	2.0	2.6	2.8	3.2	3.9	4.6	5.5
4:12	1.2	1.5	1.7	1.9	2.1	2.3	2.8	3.1	3.4	4.2	4.9	5.8
5:12	1.5	1.7	1.9	2.2	2.3	2.5	3.1	3.3	3.7	4.4	5.1	6.0
6:12	1.7	2.0	2.2	2.4	2.6	2.7	3.3	3.5	3.9	4.6	5.3	6.2
7:12	1.9	2.2	2.4	2.6	2.8	2.9	3.5	3.7	4.1	4.8	5.5	6.3
8:12	2.1	2.4	2.6	2.8	3.0	3.1	3.7	3.9	4.2	4.9	5.6	6.5
9:12	2.3	2.5	2.7	2.9	3.1	3.3	3.8	4.0	4.4	5.0	5.7	6.5
10:12	2.5	2.7	2.9	3.1	3.3	3.4	3.9	4.1	4.5	5.1	5.8	6.6
11:12	2.6	2.8	3.0	3.2	3.4	3.5	4.0	4.2	4.6	5.2	5.9	6.6
12:12	2.7	2.9	3.1	3.3	3.5	3.6	4.1	4.3	4.6	5.3	5.9	6.7
	0.0	0.2	0.5	0.7	0.9	1.0	1.6	1.8	2.2	2.9	3.6	4.5

Florida*

ASCE 7-05

140 mph — Basic Wind Speed

0 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

Up and Down (psf)

Exposure Category B

Roof Pitch	H60 Zone 1	H60 Zone 2	H60 Zone 3	H60 Down	H30 Zone 1	H30 Zone 2	H30 Zone 3	H30 Down	H15 Zone 1	H15 Zone 2	H15 Zone 3	H15 Down
1:12	-12.1	-22.9	-36.3	13.6	-9.8	-18.6	-29.7	13.6	-9.8	-18.6	-29.7	13.6
2:12	-10.8	-21.6	-33.6	13.4	-8.7	-17.5	-27.5	13.4	-8.7	-17.5	-27.5	13.4
3:12	-10.8	-21.6	-33.7	13.3	-8.7	-17.6	-27.5	13.3	-8.7	-17.6	-27.5	13.3
4:12	-10.9	-21.6	-33.7	13.2	-8.7	-17.6	-27.5	13.2	-8.7	-17.6	-27.5	13.2
5:12	-10.9	-21.6	-33.7	13.2	-8.8	-17.6	-27.6	13.2	-8.8	-17.6	-27.6	13.2
6:12	-10.9	-21.7	-33.8	13.0	-8.8	-17.7	-27.6	13.0	-8.8	-17.7	-27.6	13.0
7:12	-12.3	-15.0	-15.0	15.4	-9.9	-12.2	-12.2	13.3	-9.9	-12.2	-12.2	13.3
8:12	-12.4	-15.0	-15.0	15.3	-10.0	-12.2	-12.2	13.2	-10.0	-12.2	-12.2	13.2
9:12	-12.4	-15.1	-15.1	15.2	-10.0	-12.2	-12.2	13.0	-10.0	-12.2	-12.2	13.0
10:12	-12.4	-15.1	-15.1	15.0	-10.1	-12.3	-12.3	12.9	-10.1	-12.3	-12.3	12.9
11:12	-12.5	-15.2	-15.2	14.9	-10.1	-12.3	-12.3	12.8	-10.1	-12.3	-12.3	12.8
12:12	-12.5	-15.2	-15.2	14.8	-10.2	-12.4	-12.4	12.7	-10.2	-12.4	-12.4	12.7

Exposure Category C

Roof Pitch	H60 Zone 1	H60 Zone 2	H60 Zone 3	H60 Down	H30 Zone 1	H30 Zone 2	H30 Zone 3	H30 Down	H15 Zone 1	H15 Zone 2	H15 Zone 3	H15 Down
1:12	-16.6	-30.9	-48.7	13.6	-14.2	-26.6	-42.1	13.6	-15.0	-28.0	-44.3	13.6
2:12	-14.8	-29.1	-45.1	13.4	-12.7	-25.1	-39.0	13.4	-13.4	-26.4	-41.0	13.4
3:12	-14.8	-29.1	-45.2	13.3	-12.7	-25.1	-39.0	13.3	-13.4	-26.4	-41.1	13.3
4:12	-14.8	-29.1	-45.2	13.2	-12.7	-25.1	-39.0	13.2	-13.4	-26.4	-41.1	13.2
5:12	-14.9	-29.2	-45.2	13.2	-12.7	-25.1	-39.1	13.2	-13.5	-26.5	-41.1	13.2
6:12	-14.9	-29.2	-45.3	13.0	-12.8	-25.2	-39.1	13.0	-13.5	-26.5	-41.2	13.0
7:12	-16.7	-20.3	-20.3	19.4	-14.4	-17.5	-17.5	17.3	-15.2	-18.4	-18.4	18.0
8:12	-16.8	-20.4	-20.4	19.3	-14.4	-17.5	-17.5	17.1	-15.2	-18.5	-18.5	17.8
9:12	-16.8	-20.4	-20.4	19.1	-14.5	-17.6	-17.6	17.0	-15.2	-18.5	-18.5	17.7
10:12	-16.9	-20.4	-20.4	19.0	-14.5	-17.6	-17.6	16.9	-15.3	-18.5	-18.5	17.6
11:12	-16.9	-20.5	-20.5	18.9	-14.5	-17.6	-17.6	16.8	-15.3	-18.6	-18.6	17.5
12:12	-16.9	-20.5	-20.5	18.8	-14.6	-17.7	-17.7	16.7	-15.4	-18.6	-18.6	17.4

Exposure Category D

Roof Pitch	H60 Zone 1	H60 Zone 2	H60 Zone 3	H60 Down	H30 Zone 1	H30 Zone 2	H30 Zone 3	H30 Down	H15 Zone 1	H15 Zone 2	H15 Zone 3	H15 Down
1:12	-19.4	-36.0	-56.7	13.4	-17.0	-31.7	-50.0	13.4	-17.0	-31.7	-50.0	13.4
2:12	-17.4	-33.9	-52.5	14.1	-15.2	-29.9	-46.4	13.4	-15.2	-29.9	-46.4	13.4
3:12	-17.4	-33.9	-52.6	14.1	-15.2	-29.9	-46.4	13.3	-15.2	-29.9	-46.4	13.3
4:12	-17.4	-34.0	-52.6	14.0	-15.3	-29.9	-46.4	13.2	-15.3	-29.9	-46.4	13.2
5:12	-17.4	-34.0	-52.6	13.9	-15.3	-30.0	-46.5	13.2	-15.3	-30.0	-46.5	13.2
6:12	-17.5	-34.0	-52.7	13.8	-15.3	-30.0	-46.5	13.0	-15.3	-30.0	-46.5	13.0
7:12	-19.6	-23.7	-23.7	21.9	-17.2	-20.9	-20.9	19.8	-17.2	-20.9	-20.9	19.8
8:12	-19.6	-23.8	-23.8	21.8	-17.3	-20.9	-20.9	19.7	-17.3	-20.9	-20.9	19.7
9:12	-19.7	-23.8	-23.8	21.7	-17.3	-21.0	-21.0	19.6	-17.3	-21.0	-21.0	19.6
10:12	-19.7	-23.8	-23.8	21.6	-17.3	-21.0	-21.0	19.4	-17.3	-21.0	-21.0	19.4
11:12	-19.7	-23.9	-23.9	21.5	-17.4	-21.0	-21.0	19.3	-17.4	-21.0	-21.0	19.3
12:12	-19.8	-23.9	-23.9	21.3	-17.4	-21.1	-21.1	19.2	-17.4	-21.1	-21.1	19.2

Side Load (psf)

Down Slope

Roof Pitch	Ss = 3.1	Ss = 2.5	Ss = 2.0	Ss = 1.5	Ss = 1.25	Ss = 1.0	Ss = 0.5	Ss = 0.4	Ss = 0.3	Ss = 0.2	Ss = 0.1	Ss = 0.0
1:12	4.8	4.0	3.2	2.5	2.1	1.9	1.3	1.2	1.0	0.9	0.7	0.6
2:12	5.2	4.3	3.6	2.8	2.5	2.3	1.8	1.7	1.5	1.4	1.2	1.2
3:12	5.5	4.6	3.9	3.2	2.9	2.7	2.2	2.1	2.0	1.8	1.6	1.6
4:12	5.8	4.9	4.2	3.5	3.2	3.1	2.6	2.5	2.4	2.2	2.0	2.0
5:12	6.0	5.1	4.4	3.8	3.5	3.4	2.9	2.8	2.7	2.5	2.4	2.4
6:12	6.2	5.3	4.6	4.0	3.8	3.6	3.2	3.1	2.9	2.8	2.7	2.7
7:12	6.3	5.5	4.8	4.2	4.0	3.8	3.4	3.3	3.1	3.0	2.9	2.9
8:12	6.5	5.6	4.9	4.4	4.1	4.0	3.5	3.4	3.3	3.1	3.0	3.0
9:12	6.5	5.7	5.0	4.5	4.2	4.1	3.7	3.6	3.4	3.3	3.2	3.2
10:12	6.6	5.8	5.1	4.6	4.3	4.2	3.8	3.7	3.5	3.4	3.3	3.3
11:12	6.6	5.9	5.2	4.6	4.4	4.2	3.8	3.7	3.6	3.5	3.3	3.3
12:12	6.7	5.9	5.3	4.7	4.4	4.3	3.9	3.8	3.7	3.5	3.4	3.4

Lateral

Ss = 3.1	Ss = 2.5	Ss = 2.0	Ss = 1.5	Ss = 1.25	Ss = 1.0	Ss = 0.5	Ss = 0.4	Ss = 0.3	Ss = 0.2	Ss = 0.1	Ss = 0.0
4.5	3.6	2.9	2.2	1.8	1.6	1.0	0.9	0.7	0.5	0.2	0.0

California*

ASCE 7-10

110 mph — Basic Wind Speed

5 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verified for the specific install location.

Southwest*

ASCE 7-10

115 mph — Basic Wind Speed

5 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verified for the specific install location.

Up and Down (psf)

Up Pressures (psf): Zone 1, Zone 2, Zone 3; and Down (psf).

Bldg. Height = 60 ft

Roof Pitch	Exp. B Zone 1	Exp. B Zone 2	Exp. B Zone 3	Exp. B Down	Exp. C Zone 1	Exp. C Zone 2	Exp. C Zone 3	Exp. C Down	Exp. D Zone 1	Exp. D Zone 2	Exp. D Zone 3	Exp. D Down
1:12	-13.4	-25.1	-39.8	13.6	-18.2	-33.8	-53.4	13.6	-21.3	-39.4	-62.1	13.4
2:12	-11.9	-23.7	-36.9	13.4	-16.3	-31.9	-49.5	13.6	-19.1	-37.2	-57.5	15.1
3:12	-12.0	-23.7	-36.9	13.3	-16.3	-31.9	-49.5	13.5	-19.1	-37.2	-57.6	15.0
4:12	-12.0	-23.7	-36.9	13.2	-16.3	-32.0	-49.5	13.4	-19.1	-37.2	-57.6	15.0
5:12	-12.0	-23.8	-37.0	13.2	-16.4	-32.0	-49.5	13.3	-19.2	-37.3	-57.6	14.9
6:12	-12.1	-23.8	-37.0	13.0	-16.4	-32.0	-49.6	13.2	-19.2	-37.3	-57.7	14.8
7:12	-13.6	-16.5	-16.5	16.5	-18.4	-22.3	-22.3	20.9	-21.5	-26.0	-26.0	23.7
8:12	-13.6	-16.5	-16.5	16.4	-18.4	-22.3	-22.3	20.8	-21.6	-26.1	-26.1	23.6
9:12	-13.6	-16.6	-16.6	16.3	-18.5	-22.4	-22.4	20.6	-21.6	-26.1	-26.1	23.4
10:12	-13.7	-16.6	-16.6	16.2	-18.5	-22.4	-22.4	20.5	-21.6	-26.2	-26.2	23.3
11:12	-13.7	-16.7	-16.7	16.0	-18.6	-22.5	-22.5	20.4	-21.7	-26.2	-26.2	23.2
12:12	-13.8	-16.7	-16.7	15.9	-18.6	-22.5	-22.5	20.3	-21.7	-26.2	-26.2	23.1

Bldg. Height = 30 ft

Roof Pitch	Exp. B Zone 1	Exp. B Zone 2	Exp. B Zone 3	Exp. B Down	Exp. C Zone 1	Exp. C Zone 2	Exp. C Zone 3	Exp. C Down	Exp. D Zone 1	Exp. D Zone 2	Exp. D Zone 3	Exp. D Down
1:12	-10.8	-20.5	-32.6	13.6	-15.6	-29.2	-46.1	13.6	-18.7	-34.8	-54.8	13.4
2:12	-9.6	-19.3	-30.2	13.4	-14.0	-27.5	-42.7	13.4	-16.8	-32.8	-50.8	13.8
3:12	-9.6	-19.3	-30.2	13.3	-14.0	-27.5	-42.7	13.3	-16.8	-32.8	-50.8	13.7
4:12	-9.7	-19.3	-30.2	13.2	-14.0	-27.5	-42.8	13.2	-16.8	-32.8	-50.9	13.7
5:12	-9.7	-19.4	-30.2	13.2	-14.0	-27.6	-42.8	13.2	-16.8	-32.9	-50.9	13.6
6:12	-9.7	-19.4	-30.3	13.0	-14.1	-27.6	-42.8	13.0	-16.9	-32.9	-50.9	13.5
7:12	-11.0	-13.4	-13.4	14.2	-15.8	-19.2	-19.2	18.6	-18.9	-22.9	-22.9	21.3
8:12	-11.0	-13.4	-13.4	14.1	-15.9	-19.2	-19.2	18.4	-19.0	-23.0	-23.0	21.2
9:12	-11.1	-13.5	-13.5	14.0	-15.9	-19.3	-19.3	18.3	-19.0	-23.0	-23.0	21.1
10:12	-11.1	-13.5	-13.5	13.8	-15.9	-19.3	-19.3	18.2	-19.0	-23.0	-23.0	21.0
11:12	-11.1	-13.6	-13.6	13.7	-16.0	-19.4	-19.4	18.1	-19.1	-23.1	-23.1	20.9
12:12	-11.2	-13.6	-13.6	13.6	-16.0	-19.4	-19.4	17.9	-19.1	-23.1	-23.1	20.7

Bldg. Height = 15 ft

Roof Pitch	Exp. B Zone 1	Exp. B Zone 2	Exp. B Zone 3	Exp. B Down	Exp. C Zone 1	Exp. C Zone 2	Exp. C Zone 3	Exp. C Down	Exp. D Zone 1	Exp. D Zone 2	Exp. D Zone 3	Exp. D Down
1:12	-10.8	-20.5	-32.6	13.6	-13.4	-25.1	-39.8	13.6	-16.5	-30.7	-48.5	13.4
2:12	-9.6	-19.3	-30.2	13.4	-11.9	-23.7	-36.9	13.4	-14.7	-29.0	-45.0	13.4
3:12	-9.6	-19.3	-30.2	13.3	-12.0	-23.7	-36.9	13.3	-14.8	-29.0	-45.0	13.3
4:12	-9.7	-19.3	-30.2	13.2	-12.0	-23.7	-36.9	13.2	-14.8	-29.0	-45.0	13.2
5:12	-9.7	-19.4	-30.2	13.2	-12.0	-23.8	-37.0	13.2	-14.8	-29.0	-45.1	13.2
6:12	-9.7	-19.4	-30.3	13.0	-12.1	-23.8	-37.0	13.0	-14.9	-29.1	-45.1	13.0
7:12	-11.0	-13.4	-13.4	14.2	-13.6	-16.5	-16.5	16.5	-16.7	-20.2	-20.2	19.3
8:12	-11.0	-13.4	-13.4	14.1	-13.6	-16.5	-16.5	16.4	-16.7	-20.3	-20.3	19.2
9:12	-11.1	-13.5	-13.5	14.0	-13.6	-16.6	-16.6	16.3	-16.8	-20.3	-20.3	19.1
10:12	-11.1	-13.5	-13.5	13.8	-13.7	-16.6	-16.6	16.2	-16.8	-20.4	-20.4	19.0
11:12	-11.1	-13.6	-13.6	13.7	-13.7	-16.7	-16.7	16.0	-16.8	-20.4	-20.4	18.8
12:12	-11.2	-13.6	-13.6	13.6	-13.8	-16.7	-16.7	15.9	-16.9	-20.4	-20.4	18.7

Side Load (psf) — Down Slope

Roof Pitch	Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
1:12	0.6	0.7	0.9	1.0	1.2	1.3	1.9	2.1	2.5	3.2	4.0	4.8
2:12	1.2	1.2	1.4	1.5	1.7	1.8	2.3	2.5	2.8	3.6	4.3	5.2
3:12	1.6	1.6	1.8	2.0	2.1	2.2	2.7	2.9	3.2	3.9	4.6	5.5
4:12	2.0	2.0	2.2	2.4	2.5	2.6	3.1	3.2	3.5	4.2	4.9	5.8
5:12	2.4	2.4	2.5	2.7	2.8	2.9	3.4	3.5	3.8	4.4	5.1	6.0
6:12	2.7	2.7	2.8	2.9	3.1	3.2	3.6	3.8	4.0	4.6	5.3	6.2
7:12	2.9	2.9	3.0	3.1	3.3	3.4	3.8	4.0	4.2	4.8	5.5	6.3
8:12	3.0	3.0	3.1	3.3	3.4	3.5	4.0	4.1	4.4	4.9	5.6	6.5
9:12	3.2	3.2	3.3	3.4	3.6	3.7	4.1	4.2	4.5	5.0	5.7	6.5
10:12	3.3	3.3	3.4	3.5	3.7	3.8	4.2	4.3	4.6	5.1	5.8	6.6
11:12	3.3	3.3	3.5	3.6	3.7	3.8	4.2	4.4	4.6	5.2	5.9	6.6
12:12	3.4	3.4	3.5	3.7	3.8	3.9	4.3	4.4	4.7	5.3	5.9	6.7
Lateral	0.0	0.2	0.5	0.7	0.9	1.0	1.6	1.8	2.2	2.9	3.6	4.5

SFM — SUN FRAME MICRORAIL

Up and Down (psf)

The up/down portion is divided into three building-height super-sections (Bldg. Height = 60 ft., 30 ft., 15 ft.), each reporting Up Pressures (psf) — Zone 1, Zone 2, Zone 3 — and Down (psf), for Roof Pitch 1:12 through 12:12, across Exposure Categories B, C and D.

Bldg. Height = 60 ft.

Roof Pitch	Exp B Zone 1	Exp B Zone 2	Exp B Zone 3	Exp B Down	Exp C Zone 1	Exp C Zone 2	Exp C Zone 3	Exp C Down	Exp D Zone 1	Exp D Zone 2	Exp D Zone 3	Exp D Down
1:12	-13.4	-25.1	-39.8	24.1	-18.2	-33.8	-53.4	24.1	-21.3	-39.4	-62.1	22.8
2:12	-11.9	-23.7	-36.9	22.9	-16.3	-31.9	-49.5	23.0	-19.1	-37.2	-57.5	23.0
3:12	-12.0	-23.7	-36.9	21.6	-16.3	-31.9	-49.5	21.7	-19.1	-37.2	-57.6	21.8
4:12	-12.0	-23.7	-36.9	20.2	-16.3	-32.0	-49.5	20.3	-19.1	-37.2	-57.6	20.6
5:12	-12.0	-23.8	-37.0	18.9	-16.4	-32.0	-49.5	19.0	-19.2	-37.3	-57.6	19.4
6:12	-12.1	-23.8	-37.0	17.7	-16.4	-32.0	-49.6	17.8	-19.2	-37.3	-57.7	18.2
7:12	-13.6	-16.5	-16.5	19.2	-18.4	-22.3	-22.3	22.5	-21.5	-26.0	-26.0	24.0
8:12	-13.6	-16.5	-16.5	18.2	-18.4	-22.3	-22.3	21.4	-21.6	-26.1	-26.1	23.6
9:12	-13.6	-16.6	-16.6	17.3	-18.5	-22.4	-22.4	20.6	-21.6	-26.1	-26.1	23.4
10:12	-13.7	-16.6	-16.6	16.5	-18.5	-22.4	-22.4	20.5	-21.6	-26.2	-26.2	23.3
11:12	-13.7	-16.7	-16.7	16.0	-18.6	-22.5	-22.5	20.4	-21.7	-26.2	-26.2	23.2
12:12	-13.8	-16.7	-16.7	15.9	-18.6	-22.5	-22.5	20.3	-21.7	-26.2	-26.2	23.1

Bldg. Height = 30 ft. (Exposure Category B shown)

Roof Pitch	Zone 1	Zone 2	Zone 3	Down
1:12	-15.6	-29.2	-46.1	24.1
2:12	-14.0	-27.5	-42.7	22.9
3:12	-14.0	-27.5	-42.7	21.6
4:12	-14.0	-27.5	-42.8	20.2
5:12	-14.0	-27.6	-42.8	18.9
6:12	-14.1	-27.6	-42.8	17.7
7:12	-15.8	-19.2	-19.2	20.7
8:12	-15.9	-19.2	-19.2	19.7
9:12	-15.9	-19.3	-19.3	18.8
10:12	-15.9	-19.3	-19.3	18.2
11:12	-16.0	-19.4	-19.4	18.1
12:12	-16.0	-19.4	-19.4	17.9

(The Bldg. Height = 30 ft. and = 15 ft. super-sections likewise contain Exposure Categories B, C and D; Down values for Exposure B, 30 ft. also read 17.5, 16.4, 15.5, 14.7, 14.0, 13.6 in the lower pitch half.)

Exposure Category B — Exposure Category C — Exposure Category D

Side Load (psf) — Down Slope

Roof Pitch	Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
1:12	1.8	1.8	1.8	1.9	2.1	2.2	2.6	2.8	3.0	3.6	4.1	4.8
2:12	3.3	3.3	3.3	3.3	3.3	3.4	3.8	4.0	4.3	4.8	5.4	6.0
3:12	4.5	4.5	4.5	4.5	4.5	4.5	4.8	5.0	5.3	5.8	6.4	7.0
4:12	5.4	5.4	5.4	5.4	5.4	5.4	5.6	5.7	6.0	6.6	7.1	7.8
5:12	6.0	6.0	6.0	6.0	6.0	6.0	6.1	6.2	6.5	7.1	7.6	8.3
6:12	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.6	6.9	7.4	7.9	8.6
7:12	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.8	7.0	7.6	8.1	8.7
8:12	6.6	6.6	6.6	6.6	6.6	6.6	6.7	6.8	7.1	7.6	8.1	8.8
9:12	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.8	7.1	7.6	8.1	8.7
10:12	6.5	6.5	6.5	6.5	6.5	6.5	6.6	6.7	7.0	7.5	8.0	8.6
11:12	6.3	6.3	6.3	6.3	6.3	6.3	6.4	6.6	6.8	7.3	7.8	8.4
12:12	6.1	6.1	6.1	6.1	6.1	6.1	6.3	6.4	6.7	7.1	7.6	8.2

Lateral

	Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
Lateral	0.0	0.2	0.5	0.7	0.9	1.0	1.6	1.8	2.2	2.9	3.6	4.5

Mid US (Medium Snow)*

ASCE 7-10

115 mph — Basic Wind Speed

25 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verified for the specific install location.

Up and Down (psf)

Bldg. Height = 60 ft. — Up Pressures (psf)

Roof Pitch	Exp B Zone 1	Exp B Zone 2	Exp B Zone 3	Exp B Down	Exp C Zone 1	Exp C Zone 2	Exp C Zone 3	Exp C Down	Exp D Zone 1	Exp D Zone 2	Exp D Zone 3	Exp D Down
1:12	-13.4	-25.1	-39.8	31.9	-18.2	-33.8	-53.4	31.9	-21.3	-39.4	-62.1	29.8
2:12	-11.9	-23.7	-36.9	30.0	-16.3	-31.9	-49.5	30.1	-19.1	-37.2	-57.5	29.4
3:12	-12.0	-23.7	-36.9	27.9	-16.3	-31.9	-49.5	28.1	-19.1	-37.2	-57.6	27.5
4:12	-12.0	-23.7	-36.9	25.8	-16.3	-32.0	-49.5	26.0	-19.1	-37.2	-57.6	25.6
5:12	-12.0	-23.8	-37.0	23.8	-16.4	-32.0	-49.6	23.9	-19.2	-37.3	-57.6	23.8
6:12	-12.1	-23.8	-37.0	21.9	-16.4	-32.0	-49.6	22.0	-19.2	-37.3	-57.7	22.0
7:12	-13.6	-16.5	-16.5	22.8	-18.4	-22.3	-22.3	26.1	-21.5	-26.0	-26.0	27.2
8:12	-13.6	-16.5	-16.5	21.2	-18.4	-22.3	-22.3	24.5	-21.6	-26.1	-26.1	25.8
9:12	-13.6	-16.6	-16.6	19.8	-18.5	-22.4	-22.4	23.1	-21.6	-26.1	-26.1	24.5
10:12	-13.7	-16.6	-16.6	18.6	-18.5	-22.4	-22.4	21.9	-21.6	-26.2	-26.2	23.4
11:12	-13.7	-16.7	-16.7	17.6	-18.6	-22.5	-22.5	20.8	-21.7	-26.2	-26.2	23.2
12:12	-13.8	-16.7	-16.7	16.7	-18.6	-22.5	-22.5	20.3	-21.7	-26.2	-26.2	23.1

Bldg. Height = 30 ft. — Up Pressures (psf)

Roof Pitch	Exp B Zone 1	Exp B Zone 2	Exp B Zone 3	Exp B Down	Exp C Zone 1	Exp C Zone 2	Exp C Zone 3	Exp C Down	Exp D Zone 1	Exp D Zone 2	Exp D Zone 3	Exp D Down
1:12	-10.8	-20.5	-32.6	31.9	-15.6	-29.2	-46.1	31.9	-18.7	-34.8	-54.8	29.8
2:12	-9.6	-19.3	-30.2	30.0	-14.0	-27.5	-42.7	30.0	-16.8	-32.8	-50.8	28.4
3:12	-9.6	-19.3	-30.2	27.9	-14.0	-27.5	-42.7	27.9	-16.8	-32.8	-50.8	26.6
4:12	-9.7	-19.3	-30.2	25.8	-14.0	-27.5	-42.8	25.8	-16.8	-32.8	-50.9	24.7
5:12	-9.7	-19.4	-30.2	23.8	-14.0	-27.6	-42.8	23.8	-16.8	-32.9	-50.9	22.8
6:12	-9.7	-19.4	-30.3	21.9	-14.1	-27.6	-42.8	21.9	-16.9	-32.9	-50.9	21.1
7:12	-11.0	-13.4	-13.4	21.1	-15.8	-19.2	-19.2	24.3	-18.9	-22.9	-22.9	25.5
8:12	-11.0	-13.4	-13.4	19.5	-15.9	-19.2	-19.2	22.7	-19.0	-23.0	-23.0	24.0
9:12	-11.1	-13.5	-13.5	18.1	-15.9	-19.3	-19.3	21.4	-19.0	-23.0	-23.0	22.8
10:12	-11.1	-13.5	-13.5	16.9	-15.9	-19.3	-19.3	20.1	-19.0	-23.0	-23.0	21.7
11:12	-11.1	-13.6	-13.6	15.8	-16.0	-19.4	-19.4	19.1	-19.1	-23.1	-23.1	20.9
12:12	-11.2	-13.6	-13.6	14.9	-16.0	-19.4	-19.4	18.2	-19.1	-23.1	-23.1	20.7

Bldg. Height = 15 ft. — Up Pressures (psf)

Roof Pitch	Exp B Zone 1	Exp B Zone 2	Exp B Zone 3	Exp B Down	Exp C Zone 1	Exp C Zone 2	Exp C Zone 3	Exp C Down	Exp D Zone 1	Exp D Zone 2	Exp D Zone 3	Exp D Down
1:12	-10.8	-20.5	-32.6	31.9	-13.4	-25.1	-39.8	31.9	-16.5	-30.7	-48.5	29.8
2:12	-9.6	-19.3	-30.2	30.0	-11.9	-23.7	-36.9	30.0	-14.7	-29.0	-45.0	28.1
3:12	-9.6	-19.3	-30.2	27.9	-12.0	-23.7	-36.9	27.9	-14.8	-29.0	-45.0	26.2
4:12	-9.7	-19.3	-30.2	25.8	-12.0	-23.7	-36.9	25.8	-14.8	-29.0	-45.0	24.3
5:12	-9.7	-19.4	-30.2	23.8	-12.0	-23.8	-37.0	23.8	-14.8	-29.0	-45.1	22.5
6:12	-9.7	-19.4	-30.3	21.9	-12.1	-23.8	-37.0	21.9	-14.9	-29.1	-45.1	20.7
7:12	-11.0	-13.4	-13.4	21.1	-13.6	-16.5	-16.5	22.8	-16.7	-20.2	-20.2	24.0
8:12	-11.0	-13.4	-13.4	19.5	-13.6	-16.5	-16.5	21.2	-16.7	-20.3	-20.3	22.5
9:12	-11.1	-13.5	-13.5	18.1	-13.6	-16.6	-16.6	19.8	-16.8	-20.3	-20.3	21.2
10:12	-11.1	-13.5	-13.5	16.9	-13.7	-16.6	-16.6	18.6	-16.8	-20.4	-20.4	20.1
11:12	-11.1	-13.6	-13.6	15.8	-13.7	-16.7	-16.7	17.6	-16.8	-20.4	-20.4	19.2
12:12	-11.2	-13.6	-13.6	14.9	-13.8	-16.7	-16.7	16.7	-16.9	-20.4	-20.4	18.7

Side Load (psf) — Down Slope

Roof Pitch	Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
1:12	2.6	2.6	2.6	2.6	2.7	2.8	3.3	3.4	3.7	4.2	4.8	5.5
2:12	4.9	4.9	4.9	4.9	4.9	4.9	5.0	5.2	5.5	6.0	6.6	7.2
3:12	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.9	7.4	8.0	8.6
4:12	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	8.4	9.0	9.6
5:12	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	9.1	9.7	10.3
6:12	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.5	10.0	10.7
7:12	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.7	10.2	10.8
8:12	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.6	10.2	10.8
9:12	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.3	10.0	10.6
10:12	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	9.0	9.8	10.4
11:12	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.7	9.5	10.0
12:12	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.2	8.7	9.1	9.7
Lateral	0.0	0.2	0.5	0.7	0.9	1.0	1.6	1.8	2.2	2.9	3.6	4.5

Massachusetts*

ASCE 7-10

115 mph — Basic Wind Speed

40 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

SFM — SUN FRAME MICRORAIL

Mid US (High Snow)*

ASCE 7-10

115 mph — Basic Wind Speed

60 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

Up and Down (psf)

Bldg. Height = 15 ft

Roof Pitch	B Zone 1	B Zone 2	B Zone 3	B Down	C Zone 1	C Zone 2	C Zone 3	C Down	D Zone 1	D Zone 2	D Zone 3	D Down
1:12	-10.8	-20.5	-32.6	45.5	-15.6	-30.7	-48.5	45.5	-16.5	-30.7	-48.5	41.4
2:12	-9.6	-19.3	-30.2	41.9	-14.0	-29.0	-45.0	41.9	-14.7	-29.0	-45.0	38.0
3:12	-9.6	-19.3	-30.2	37.8	-14.0	-29.0	-45.0	37.8	-14.8	-29.0	-45.0	34.4
4:12	-9.7	-19.3	-30.2	33.6	-14.0	-29.0	-45.0	33.6	-14.8	-29.0	-45.0	31.1
5:12	-9.7	-19.4	-30.2	30.3	-14.0	-29.0	-45.1	30.3	-14.8	-29.0	-45.1	28.4
6:12	-9.7	-19.4	-30.3	27.5	-14.1	-29.1	-45.1	27.5	-14.9	-29.1	-45.1	25.8
7:12	-11.0	-13.4	-13.4	25.9	-15.8	-20.2	-20.2	28.3	-16.7	-20.2	-20.2	28.3
8:12	-11.0	-13.4	-13.4	23.5	-15.9	-20.3	-20.3	26.2	-16.7	-20.3	-20.3	26.2
9:12	-11.1	-13.5	-13.5	21.5	-15.9	-20.3	-20.3	24.3	-16.8	-20.3	-20.3	24.3
10:12	-11.1	-13.5	-13.5	19.7	-15.9	-20.4	-20.4	22.7	-16.8	-20.4	-20.4	22.7
11:12	-11.1	-13.6	-13.6	18.2	-16.0	-20.4	-20.4	21.4	-16.8	-20.4	-20.4	21.4
12:12	-11.2	-13.6	-13.6	16.9	-16.0	-20.4	-20.4	20.2	-16.9	-20.4	-20.4	20.2

Bldg. Height = 30 ft

Roof Pitch	B Zone 1	B Zone 2	B Zone 3	B Down	C Zone 1	C Zone 2	C Zone 3	C Down	D Zone 1	D Zone 2	D Zone 3	D Down
1:12	-10.8	-20.5	-32.6	45.5	-15.6	-29.2	-46.1	45.5	-18.7	-34.8	-54.8	41.4
2:12	-9.6	-19.3	-30.2	41.9	-14.0	-27.5	-42.7	41.9	-16.8	-32.8	-50.8	38.0
3:12	-9.6	-19.3	-30.2	37.8	-14.0	-27.5	-42.7	37.8	-16.8	-32.8	-50.8	34.4
4:12	-9.7	-19.3	-30.2	33.6	-14.0	-27.5	-42.8	33.6	-16.8	-32.8	-50.9	31.4
5:12	-9.7	-19.4	-30.2	30.3	-14.0	-27.6	-42.8	30.3	-16.8	-32.9	-50.9	28.7
6:12	-9.7	-19.4	-30.3	27.5	-14.1	-27.6	-42.8	27.5	-16.9	-32.9	-50.9	26.1
7:12	-11.0	-13.4	-13.4	25.9	-15.8	-19.2	-19.2	29.1	-18.9	-22.9	-22.9	29.8
8:12	-11.0	-13.4	-13.4	23.5	-15.9	-19.2	-19.2	26.8	-19.0	-23.0	-23.0	27.7
9:12	-11.1	-13.5	-13.5	21.5	-15.9	-19.3	-19.3	24.8	-19.0	-23.0	-23.0	25.8
10:12	-11.1	-13.5	-13.5	19.7	-15.9	-19.3	-19.3	23.0	-19.0	-23.0	-23.0	24.2
11:12	-11.1	-13.6	-13.6	18.2	-16.0	-19.4	-19.4	21.5	-19.1	-23.1	-23.1	22.9
12:12	-11.2	-13.6	-13.6	16.9	-16.0	-19.4	-19.4	20.2	-19.1	-23.1	-23.1	21.7

Bldg. Height = 60 ft

Roof Pitch	B Zone 1	B Zone 2	B Zone 3	B Down	C Zone 1	C Zone 2	C Zone 3	C Down	D Zone 1	D Zone 2	D Zone 3	D Down
1:12	-13.4	-25.1	-39.8	45.5	-18.2	-33.8	-53.4	45.5	-21.3	-39.4	-62.1	41.4
2:12	-11.9	-23.7	-36.9	41.9	-16.3	-31.9	-49.5	41.9	-19.1	-37.2	-57.5	38.0
3:12	-12.0	-23.7	-36.9	37.8	-16.3	-31.9	-49.5	37.8	-19.1	-37.2	-57.6	35.2
4:12	-12.0	-23.7	-36.9	33.6	-16.3	-32.0	-49.5	33.6	-19.1	-37.2	-57.6	32.4
5:12	-12.0	-23.8	-37.0	30.3	-16.4	-32.0	-49.5	30.4	-19.2	-37.3	-57.6	29.6
6:12	-12.1	-23.8	-37.0	27.5	-16.4	-32.0	-49.6	27.6	-19.2	-37.3	-57.7	27.1
7:12	-13.6	-16.5	-16.5	27.6	-18.4	-22.3	-22.3	30.9	-21.5	-26.0	-26.0	31.5
8:12	-13.6	-16.5	-16.5	25.3	-18.4	-22.3	-22.3	28.6	-21.6	-26.1	-26.1	29.4
9:12	-13.6	-16.6	-16.6	23.3	-18.5	-22.4	-22.4	26.5	-21.6	-26.1	-26.1	27.6
10:12	-13.7	-16.6	-16.6	21.5	-18.5	-22.4	-22.4	24.8	-21.6	-26.2	-26.2	26.0
11:12	-13.7	-16.7	-16.7	20.0	-18.6	-22.5	-22.5	23.2	-21.7	-26.2	-26.2	24.6
12:12	-13.8	-16.7	-16.7	18.7	-18.6	-22.5	-22.5	21.9	-21.7	-26.2	-26.2	23.4

Side Load (psf) — Down Slope

Roof Pitch	Ss = 0.0	Ss = 0.1	Ss = 0.2	Ss = 0.3	Ss = 0.4	Ss = 0.5	Ss = 1.0	Ss = 1.25	Ss = 1.5	Ss = 2.0	Ss = 2.5	Ss = 3.1
1:12	3.8	3.8	4.0	4.6	5.0	5.4	6.8	7.3	8.2	9.9	11.9	14.7
2:12	7.0	7.0	7.0	7.0	7.4	7.7	9.1	9.6	10.4	12.1	13.8	15.8
3:12	9.4	9.4	9.4	9.4	9.4	9.6	10.8	11.3	12.1	13.7	15.3	17.2
4:12	11.2	11.2	11.2	11.2	11.2	11.2	12.0	12.5	13.3	14.8	16.3	18.1
5:12	12.3	12.3	12.3	12.3	12.3	12.3	12.8	13.2	13.9	15.3	16.7	18.5
6:12	12.9	12.9	12.9	12.9	12.9	12.9	13.1	13.5	14.1	15.5	16.8	18.4
7:12	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.4	14.1	15.3	16.5	18.0
8:12	13.0	13.0	13.0	13.1	13.0	13.0	13.0	13.2	13.7	14.9	16.1	17.5
9:12	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.7	13.3	14.3	15.4	16.7
10:12	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.2	12.7	13.7	14.7	15.9
11:12	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.6	12.1	13.0	13.9	15.1
12:12	10.8	10.8	10.8	10.8	10.8	10.8	10.8	11.0	11.4	12.3	13.2	14.2

Lateral

	Ss = 0.0	Ss = 0.1	Ss = 0.2	Ss = 0.3	Ss = 0.4	Ss = 0.5	Ss = 1.0	Ss = 1.25	Ss = 1.5	Ss = 2.0	Ss = 2.5	Ss = 3.1
Lateral	0.0	0.7	1.5	2.1	2.7	3.2	5.0	5.7	6.9	9.1	11.4	14.2

Up and Down (psf)

Exposure Category B

Roof Pitch	Bldg. Height = 60 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 30 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 15 ft. Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-14.7	-27.5	-43.5	24.1	-11.9	-22.4	-35.6	24.1	-11.9	-22.4	-35.6	24.1
2:12	-13.1	-25.9	-40.3	22.9	-10.6	-21.1	-33.0	22.9	-10.6	-21.1	-33.0	22.9
3:12	-13.1	-25.9	-40.3	21.6	-10.6	-21.1	-33.0	21.6	-10.6	-21.1	-33.0	21.6
4:12	-13.2	-25.9	-40.3	20.2	-10.6	-21.2	-33.0	20.2	-10.6	-21.2	-33.0	20.2
5:12	-13.2	-26.0	-40.4	18.9	-10.7	-21.2	-33.0	18.9	-10.7	-21.2	-33.0	18.9
6:12	-13.2	-26.0	-40.4	17.7	-10.7	-21.2	-33.1	17.7	-10.7	-21.2	-33.1	17.7
7:12	-14.9	-18.1	-18.1	20.1	-12.1	-14.7	-14.7	18.2	-12.1	-14.7	-14.7	18.2
8:12	-14.9	-18.1	-18.1	19.1	-12.1	-14.7	-14.7	17.2	-12.1	-14.7	-14.7	17.2
9:12	-15.0	-18.1	-18.1	18.1	-12.1	-14.8	-14.8	16.2	-12.1	-14.8	-14.8	16.2
10:12	-15.0	-18.2	-18.2	17.3	-12.2	-14.8	-14.8	15.4	-12.2	-14.8	-14.8	15.4
11:12	-15.0	-18.2	-18.2	17.2	-12.2	-14.8	-14.8	14.7	-12.2	-14.8	-14.8	14.7
12:12	-15.1	-18.3	-18.3	17.1	-12.3	-14.9	-14.9	14.6	-12.3	-14.9	-14.9	14.6

Exposure Category C

Roof Pitch	Bldg. Height = 60 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 30 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 15 ft. Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-20.0	-37.0	-58.2	24.1	-17.1	-31.9	-50.3	24.1	-14.7	-27.5	-43.5	24.1
2:12	-17.9	-34.8	-54.0	23.7	-15.3	-30.1	-46.6	22.9	-13.1	-25.9	-40.3	22.9
3:12	-17.9	-34.9	-54.0	22.3	-15.3	-30.1	-46.7	21.6	-13.1	-25.9	-40.3	21.6
4:12	-17.9	-34.9	-54.0	21.0	-15.4	-30.1	-46.7	20.2	-13.2	-25.9	-40.3	20.2
5:12	-17.9	-34.9	-54.1	19.7	-15.4	-30.1	-46.7	18.9	-13.2	-26.0	-40.4	18.9
6:12	-18.0	-35.0	-54.1	18.4	-15.4	-30.2	-46.8	17.7	-13.2	-26.0	-40.4	17.7
7:12	-20.1	-24.4	-24.4	23.7	-17.3	-21.0	-21.0	21.7	-14.9	-18.1	-18.1	20.1
8:12	-20.2	-24.4	-24.4	22.6	-17.4	-21.0	-21.0	20.7	-14.9	-18.1	-18.1	19.1
9:12	-20.2	-24.5	-24.5	22.2	-17.4	-21.1	-21.1	19.8	-15.0	-18.1	-18.1	18.1
10:12	-20.3	-24.5	-24.5	22.1	-17.4	-21.1	-21.1	19.5	-15.0	-18.2	-18.2	17.3
11:12	-20.3	-24.5	-24.5	22.0	-17.5	-21.2	-21.2	19.4	-15.0	-18.2	-18.2	17.2
12:12	-20.3	-24.6	-24.6	21.8	-17.5	-21.2	-21.2	19.3	-15.1	-18.3	-18.3	17.1

Exposure Category D

Roof Pitch	Bldg. Height = 60 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 30 ft. Zone 1	Zone 2	Zone 3	Down (psf)	Bldg. Height = 15 ft. Zone 1	Zone 2	Zone 3	Down (psf)
1:12	-23.3	-43.1	-67.7	22.8	-20.5	-38.0	-59.8	22.8	-18.1	-33.6	-52.9	22.8
2:12	-20.9	-40.6	-62.8	22.7	-18.4	-35.8	-55.4	21.8	-16.2	-31.7	-49.1	21.8
3:12	-20.9	-40.6	-62.8	21.5	-18.4	-35.8	-55.5	20.6	-16.2	-31.7	-49.1	20.6
4:12	-20.9	-40.7	-62.8	20.3	-18.4	-35.9	-55.5	19.3	-16.2	-31.7	-49.1	19.3
5:12	-21.0	-40.7	-62.8	20.1	-18.4	-35.9	-55.5	18.1	-16.2	-31.7	-49.2	18.1
6:12	-21.0	-40.7	-62.9	19.0	-18.5	-35.9	-55.6	17.0	-16.3	-31.8	-49.2	17.0
7:12	-23.5	-28.4	-28.4	25.5	-20.7	-25.1	-25.1	21.8	-18.3	-22.1	-22.1	21.8
8:12	-23.6	-28.5	-28.5	25.4	-20.7	-25.1	-25.1	20.8	-18.3	-22.2	-22.2	20.8
9:12	-23.6	-28.5	-28.5	25.2	-20.8	-25.1	-25.1	20.5	-18.3	-22.2	-22.2	20.5
10:12	-23.6	-28.6	-28.6	25.1	-20.8	-25.2	-25.2	20.4	-18.4	-22.3	-22.3	20.4
11:12	-23.7	-28.6	-28.6	25.0	-20.9	-25.2	-25.2	20.3	-18.4	-22.3	-22.3	20.3
12:12	-23.7	-28.6	-28.6	24.9	-20.9	-25.3	-25.3	20.1	-18.5	-22.3	-22.3	20.1

Side Load (psf)

Down Slope

Roof Pitch	Ss=3.1	Ss=2.5	Ss=2.0	Ss=1.5	Ss=1.25	Ss=1.0	Ss=0.5	Ss=0.4	Ss=0.3	Ss=0.2	Ss=0.1	Ss=0.0
1:12	4.8	4.1	3.6	3.0	2.8	2.6	2.2	2.1	1.9	1.8	1.8	1.8
2:12	6.0	5.4	4.8	4.3	4.0	3.8	3.4	3.3	3.3	3.3	3.3	3.3
3:12	7.0	6.4	5.8	5.3	5.0	4.8	4.5	4.5	4.5	4.5	4.5	4.5
4:12	7.8	7.1	6.6	6.0	5.7	5.6	5.4	5.4	5.4	5.4	5.4	5.4
5:12	8.3	7.6	7.1	6.5	6.2	6.1	6.0	6.0	6.0	6.0	6.0	6.0
6:12	8.6	7.9	7.4	6.9	6.6	6.4	6.4	6.4	6.4	6.4	6.4	6.4
7:12	8.7	8.1	7.6	7.0	6.8	6.6	6.6	6.6	6.6	6.6	6.6	6.6
8:12	8.8	8.1	7.6	7.1	6.8	6.7	6.6	6.6	6.6	6.6	6.6	6.6
9:12	8.7	8.1	7.6	7.1	6.8	6.6	6.6	6.6	6.6	6.6	6.6	6.6
10:12	8.6	8.0	7.5	7.0	6.7	6.6	6.5	6.5	6.5	6.5	6.5	6.5
11:12	8.4	7.8	7.3	6.8	6.6	6.4	6.3	6.3	6.3	6.3	6.3	6.3
12:12	8.2	7.6	7.1	6.7	6.4	6.3	6.1	6.1	6.1	6.1	6.1	6.1

Lateral

	Ss=3.1	Ss=2.5	Ss=2.0	Ss=1.5	Ss=1.25	Ss=1.0	Ss=0.5	Ss=0.4	Ss=0.3	Ss=0.2	Ss=0.1	Ss=0.0
Lateral	4.5	3.6	2.9	2.2	1.8	1.6	1.0	0.9	0.7	0.5	0.2	0.0

East Coast (Medium Snow)*

ASCE 7-10

120 mph — Basic Wind Speed

25 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

East Coast (Low Snow)*

ASCE 7-10

130 mph — Basic Wind Speed

10 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

Up and Down (psf)

Bldg. Height = 60 ft.

Roof Pitch	B Zone 1	B Zone 2	B Zone 3	B Down	C Zone 1	C Zone 2	C Zone 3	C Down	D Zone 1	D Zone 2	D Zone 3	D Down
1:12	-17.5	-32.5	-51.2	16.2	-23.7	-43.6	-68.5	16.2	-27.6	-50.7	-79.7	15.7
2:12	-15.6	-30.6	-47.5	15.8	-21.2	-41.1	-63.6	17.9	-24.7	-47.9	-73.9	18.9
3:12	-15.6	-30.6	-47.5	15.2	-21.2	-41.1	-63.6	17.3	-24.8	-47.9	-73.9	18.4
4:12	-15.7	-30.7	-47.5	14.6	-21.3	-41.2	-63.6	16.7	-24.8	-47.9	-73.9	18.1
5:12	-15.7	-30.7	-47.6	14.0	-21.3	-41.2	-63.6	16.2	-24.8	-48.0	-74.0	18.0
6:12	-15.7	-30.7	-47.6	13.4	-21.3	-41.2	-63.7	15.9	-24.9	-48.0	-74.0	17.9
7:12	-17.6	-21.4	-21.4	20.2	-23.8	-28.8	-28.8	25.8	-27.8	-33.6	-33.6	29.3
8:12	-17.7	-21.4	-21.4	20.1	-23.9	-28.9	-28.9	25.6	-27.8	-33.6	-33.6	29.2
9:12	-17.7	-21.5	-21.5	20.0	-23.9	-28.9	-28.9	25.5	-27.9	-33.7	-33.7	29.1
10:12	-17.8	-21.5	-21.5	19.8	-23.9	-28.9	-28.9	25.4	-27.9	-33.7	-33.7	29.0
11:12	-17.8	-21.6	-21.6	19.7	-24.0	-29.0	-29.0	25.3	-28.0	-33.7	-33.7	28.9
12:12	-17.8	-21.6	-21.6	19.6	-24.0	-29.0	-29.0	25.2	-28.0	-33.8	-33.8	28.7

Bldg. Height = 30 ft.

Roof Pitch	B Zone 1	B Zone 2	B Zone 3	B Down	C Zone 1	C Zone 2	C Zone 3	C Down	D Zone 1	D Zone 2	D Zone 3	D Down
1:12	-14.2	-26.5	-42.0	16.2	-20.3	-37.6	-59.3	16.2	-24.3	-44.8	-70.4	15.7
2:12	-12.6	-25.0	-38.9	15.8	-18.2	-35.5	-55.0	16.7	-21.8	-42.2	-65.3	17.7
3:12	-12.7	-25.0	-38.9	15.2	-18.2	-35.5	-55.0	16.1	-21.8	-42.3	-65.3	17.2
4:12	-12.7	-25.0	-38.9	14.6	-18.2	-35.5	-55.0	15.5	-21.8	-42.3	-65.3	16.6
5:12	-12.7	-25.1	-39.0	14.0	-18.3	-35.6	-55.0	14.9	-21.9	-42.3	-65.4	16.3
6:12	-12.8	-25.1	-39.0	13.4	-18.3	-35.6	-55.1	14.4	-21.9	-42.4	-65.4	16.2
7:12	-14.3	-17.4	-17.4	17.2	-20.5	-24.8	-24.8	22.8	-24.5	-29.6	-29.6	26.4
8:12	-14.4	-17.5	-17.5	17.1	-20.6	-24.9	-24.9	22.7	-24.5	-29.6	-29.6	26.2
9:12	-14.4	-17.5	-17.5	17.0	-20.6	-24.9	-24.9	22.5	-24.6	-29.7	-29.7	26.1
10:12	-14.5	-17.5	-17.5	16.9	-20.6	-25.0	-25.0	22.4	-24.6	-29.7	-29.7	26.0
11:12	-14.5	-17.6	-17.6	16.7	-20.7	-25.0	-25.0	22.3	-24.6	-29.8	-29.8	25.9
12:12	-14.5	-17.6	-17.6	16.6	-20.7	-25.0	-25.0	22.2	-24.7	-29.8	-29.8	25.8

Bldg. Height = 15 ft.

Roof Pitch	B Zone 1	B Zone 2	B Zone 3	B Down	C Zone 1	C Zone 2	C Zone 3	C Down	D Zone 1	D Zone 2	D Zone 3	D Down
1:12	-14.2	-26.5	-42.0	16.2	-17.5	-32.5	-51.2	16.2	-21.4	-39.6	-62.4	15.7
2:12	-12.6	-25.0	-38.9	15.8	-15.6	-30.6	-47.5	15.8	-19.2	-37.4	-57.8	16.6
3:12	-12.7	-25.0	-38.9	15.2	-15.6	-30.6	-47.5	15.2	-19.2	-37.4	-57.8	16.1
4:12	-12.7	-25.0	-38.9	14.6	-15.7	-30.7	-47.5	14.6	-19.2	-37.4	-57.9	15.5
5:12	-12.7	-25.1	-39.0	14.0	-15.7	-30.7	-47.6	14.0	-19.3	-37.4	-57.9	15.0
6:12	-12.8	-25.1	-39.0	13.4	-15.7	-30.7	-47.6	13.4	-19.3	-37.5	-57.9	14.8
7:12	-14.3	-17.4	-17.4	17.2	-17.6	-21.4	-21.4	20.2	-21.6	-26.2	-26.2	23.8
8:12	-14.4	-17.5	-17.5	17.1	-17.7	-21.4	-21.4	20.1	-21.7	-26.2	-26.2	23.7
9:12	-14.4	-17.5	-17.5	17.0	-17.7	-21.5	-21.5	20.0	-21.7	-26.2	-26.2	23.5
10:12	-14.5	-17.5	-17.5	16.9	-17.8	-21.5	-21.5	19.8	-21.7	-26.3	-26.3	23.4
11:12	-14.5	-17.6	-17.6	16.7	-17.8	-21.6	-21.6	19.7	-21.8	-26.3	-26.3	23.3
12:12	-14.5	-17.6	-17.6	16.6	-17.8	-21.6	-21.6	19.6	-21.8	-26.4	-26.4	23.2

Exposure Category B | Exposure Category C | Exposure Category D

Side Load (psf)

Down Slope

Roof Pitch	Ss = 3.1	Ss = 2.5	Ss = 2.0	Ss = 1.5	Ss = 1.25	Ss = 1.0	Ss = 0.5	Ss = 0.4	Ss = 0.3	Ss = 0.2	Ss = 0.1	Ss = 0.0
1:12	4.8	4.0	3.2	2.5	2.1	2.0	1.5	1.4	1.3	1.1	0.9	0.9
2:12	5.2	4.3	3.6	3.1	2.8	2.6	2.2	2.1	1.9	1.8	1.7	1.7
3:12	5.5	4.8	4.2	3.7	3.4	3.2	2.8	2.7	2.5	2.4	2.4	2.4
4:12	5.9	5.2	4.7	4.1	3.9	3.7	3.2	3.1	3.0	2.9	2.9	2.9
5:12	6.2	5.6	5.0	4.5	4.2	4.0	3.6	3.5	3.4	3.3	3.3	3.3
6:12	6.5	5.8	5.3	4.7	4.5	4.3	3.9	3.8	3.6	3.6	3.6	3.6
7:12	6.6	6.0	5.5	4.9	4.7	4.5	4.1	4.0	3.8	3.8	3.8	3.8
8:12	6.7	6.1	5.6	5.1	4.8	4.6	4.2	4.1	4.0	3.9	3.9	3.9
9:12	6.8	6.2	5.7	5.1	4.9	4.7	4.3	4.2	4.1	4.0	4.0	4.0
10:12	6.8	6.2	5.7	5.2	4.9	4.8	4.4	4.3	4.1	4.1	4.1	4.1
11:12	6.7	6.1	5.6	5.2	4.9	4.8	4.4	4.3	4.2	4.1	4.1	4.1
12:12	6.7	6.1	5.6	5.2	4.9	4.8	4.4	4.3	4.2	4.1	4.1	4.1

Lateral

Ss = 3.1	Ss = 2.5	Ss = 2.0	Ss = 1.5	Ss = 1.25	Ss = 1.0	Ss = 0.5	Ss = 0.4	Ss = 0.3	Ss = 0.2	Ss = 0.1	Ss = 0.0
4.5	3.6	2.9	2.2	1.8	1.6	1.0	0.9	0.7	0.5	0.2	0.0

Up and Down (psf)

Bldg. Height = 60 ft.

Roof Pitch	Exp B Zone 1	Exp B Zone 2	Exp B Zone 3	Exp B Down	Exp C Zone 1	Exp C Zone 2	Exp C Zone 3	Exp C Down	Exp D Zone 1	Exp D Zone 2	Exp D Zone 3	Exp D Down
1:12	-17.5	-32.5	-51.2	24.1	-23.7	-43.6	-68.5	24.1	-27.6	-50.7	-79.7	22.8
2:12	-15.6	-30.6	-47.5	22.9	-21.2	-41.1	-63.6	25.0	-24.7	-47.9	-73.9	25.3
3:12	-15.6	-30.6	-47.5	21.6	-21.2	-41.1	-63.6	23.7	-24.8	-47.9	-73.9	24.1
4:12	-15.7	-30.7	-47.5	20.2	-21.2	-41.2	-63.6	22.4	-24.8	-47.9	-73.9	22.9
5:12	-15.7	-30.7	-47.6	18.9	-21.3	-41.2	-63.6	21.1	-24.8	-48.0	-74.0	21.7
6:12	-15.7	-30.7	-47.6	17.7	-21.3	-41.2	-63.7	19.8	-24.9	-48.0	-74.0	20.6
7:12	-17.6	-21.4	-21.4	22.0	-23.8	-28.8	-28.8	26.1	-27.8	-33.6	-33.6	29.3
8:12	-17.7	-21.4	-21.4	20.9	-23.9	-28.9	-28.9	25.6	-27.8	-33.6	-33.6	29.2
9:12	-17.7	-21.5	-21.5	20.0	-23.9	-28.9	-28.9	25.5	-27.9	-33.7	-33.7	29.1
10:12	-17.8	-21.5	-21.5	19.8	-23.9	-28.9	-28.9	25.4	-27.9	-33.7	-33.7	29.0
11:12	-17.8	-21.6	-21.6	19.7	-24.0	-29.0	-29.0	25.3	-28.0	-33.7	-33.7	28.9
12:12	-17.8	-21.6	-21.6	19.6	-24.0	-29.0	-29.0	25.2	-28.0	-33.8	-33.8	28.7

Bldg. Height = 30 ft.

Roof Pitch	Exp B Zone 1	Exp B Zone 2	Exp B Zone 3	Exp B Down	Exp C Zone 1	Exp C Zone 2	Exp C Zone 3	Exp C Down	Exp D Zone 1	Exp D Zone 2	Exp D Zone 3	Exp D Down
1:12	-20.3	-37.6	-59.3	24.1	-21.9	-42.4	-65.3	22.8	-24.3	-44.8	-70.4	22.8
2:12	-18.2	-35.5	-55.0	23.8	-21.9	-42.3	-65.3	24.1	-21.8	-42.2	-65.3	24.1
3:12	-18.2	-35.5	-55.0	22.5	-20.5	-42.3	-65.3	22.9	-21.8	-42.3	-65.3	22.9
4:12	-18.2	-35.5	-55.0	21.1	-20.6	-42.3	-65.3	21.7	-21.8	-42.3	-65.3	21.7
5:12	-18.3	-35.6	-55.0	19.8	-20.6	-42.4	-65.4	20.5	-21.9	-42.3	-65.4	20.5
6:12	-18.3	-35.6	-55.1	18.6	-20.6	-42.4	-65.4	19.4	-21.9	-42.4	-65.4	19.4
7:12	-20.5	-24.8	-24.8	23.9	-24.5	-29.6	-29.6	26.4	-24.5	-29.6	-29.6	26.4
8:12	-20.6	-24.9	-24.9	22.9	-24.5	-29.6	-29.6	26.2	-24.5	-29.6	-29.6	26.2
9:12	-20.6	-24.9	-24.9	22.5	-24.6	-29.7	-29.7	26.1	-24.6	-29.7	-29.7	26.1
10:12	-20.6	-25.0	-25.0	22.4	-24.6	-29.7	-29.7	26.0	-24.6	-29.7	-29.7	26.0
11:12	-20.7	-25.0	-25.0	22.3	-24.6	-29.8	-29.8	25.9	-24.6	-29.8	-29.8	25.9
12:12	-20.7	-25.0	-25.0	22.2	-24.7	-29.8	-29.8	25.8	-24.7	-29.8	-29.8	25.8

Bldg. Height = 15 ft.

Roof Pitch	Exp B Zone 1	Exp B Zone 2	Exp B Zone 3	Exp B Down	Exp C Zone 1	Exp C Zone 2	Exp C Zone 3	Exp C Down	Exp D Zone 1	Exp D Zone 2	Exp D Zone 3	Exp D Down
1:12	-14.2	-26.5	-42.0	24.1	-17.5	-32.5	-51.2	24.1	-21.4	-39.6	-62.4	22.8
2:12	-12.6	-25.0	-38.9	22.9	-15.6	-30.6	-47.5	22.9	-19.2	-37.4	-57.8	23.0
3:12	-12.7	-25.0	-38.9	21.6	-15.6	-30.6	-47.5	21.6	-19.2	-37.4	-57.8	21.8
4:12	-12.7	-25.0	-38.9	20.2	-15.7	-30.7	-47.5	20.2	-19.2	-37.4	-57.9	20.6
5:12	-12.7	-25.1	-39.0	18.9	-15.7	-30.7	-47.6	18.9	-19.3	-37.4	-57.9	19.4
6:12	-12.8	-25.1	-39.0	17.7	-15.7	-30.7	-47.6	17.7	-19.3	-37.5	-57.9	18.3
7:12	-14.3	-17.4	-17.4	19.7	-17.6	-21.4	-21.4	22.0	-21.6	-26.2	-26.2	24.1
8:12	-14.4	-17.5	-17.5	18.7	-17.7	-21.4	-21.4	20.9	-21.7	-26.2	-26.2	23.7
9:12	-14.4	-17.5	-17.5	17.8	-17.7	-21.5	-21.5	20.0	-21.7	-26.2	-26.2	23.5
10:12	-14.5	-17.5	-17.5	17.0	-17.8	-21.5	-21.5	19.8	-21.7	-26.3	-26.3	23.4
11:12	-14.5	-17.6	-17.6	16.7	-17.8	-21.6	-21.6	19.7	-21.8	-26.3	-26.3	23.3
12:12	-14.5	-17.6	-17.6	16.6	-17.8	-21.6	-21.6	19.6	-21.8	-26.4	-26.4	23.2

Side Load (psf) — Down Slope

Roof Pitch	$S_s=0.0$	$S_s=0.1$	$S_s=0.2$	$S_s=0.3$	$S_s=0.4$	$S_s=0.5$	$S_s=1.0$	$S_s=1.25$	$S_s=1.5$	$S_s=2.0$	$S_s=2.5$	$S_s=3.1$
1:12	1.8	1.8	1.8	1.9	2.1	2.2	2.6	2.8	3.0	3.6	4.1	4.8
2:12	3.3	3.3	3.3	3.3	3.3	3.4	3.8	4.0	4.3	4.8	5.4	6.0
3:12	4.5	4.5	4.5	4.5	4.5	4.5	4.8	5.0	5.3	5.8	6.4	7.0
4:12	5.4	5.4	5.4	5.4	5.4	5.4	5.6	5.7	6.0	6.6	7.1	7.8
5:12	6.0	6.0	6.0	6.0	6.0	6.0	6.1	6.2	6.5	6.6	7.6	8.3
6:12	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.6	6.9	7.4	7.9	8.6
7:12	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.8	7.0	7.6	8.1	8.7
8:12	6.6	6.6	6.6	6.6	6.6	6.6	6.7	6.8	7.1	7.6	8.1	8.8
9:12	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.8	7.1	7.6	8.1	8.7
10:12	6.5	6.5	6.5	6.5	6.5	6.5	6.6	6.7	7.0	7.5	8.0	8.6
11:12	6.3	6.3	6.3	6.3	6.3	6.3	6.4	6.6	6.8	7.3	7.8	8.4
12:12	6.1	6.1	6.1	6.1	6.1	6.1	6.3	6.4	6.7	7.1	7.6	8.2
Lateral	0.0	0.2	0.5	0.7	0.9	1.0	1.6	1.8	2.2	2.9	3.6	4.5

New Jersey*

ASCE 7-10

130 mph — Basic Wind Speed

25 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

Up and Down (psf)

Bldg. Height = 60 ft.

Roof Pitch	Exposure B Zone 1	Exposure B Zone 2	Exposure B Zone 3	Exposure B Down	Exposure C Zone 1	Exposure C Zone 2	Exposure C Zone 3	Exposure C Down	Exposure D Zone 1	Exposure D Zone 2	Exposure D Zone 3	Exposure D Down
1:12	-27.1	-49.9	-78.3	13.4	-36.5	-66.7	-104.5	15.2	-42.5	-77.5	-121.3	17.0
2:12	-24.3	-47.0	-72.6	18.0	-32.7	-62.9	-96.9	22.7	-38.1	-73.2	-112.6	25.7
3:12	-24.3	-47.1	-72.6	17.9	-32.7	-63.0	-97.0	22.6	-38.2	-73.2	-112.6	25.6
4:12	-24.4	-47.1	-72.6	17.9	-32.8	-63.0	-97.0	22.5	-38.2	-73.2	-112.6	25.5
5:12	-24.4	-47.1	-72.7	17.8	-32.8	-63.0	-97.0	22.4	-38.2	-73.2	-112.7	25.4
6:12	-24.4	-47.1	-72.7	17.6	-32.8	-63.1	-97.0	22.3	-38.3	-73.3	-112.7	25.3
7:12	-27.3	-33.0	-33.0	28.9	-36.7	-44.2	-44.2	37.3	-42.7	-51.4	-51.4	42.7
8:12	-27.3	-33.0	-33.0	28.8	-36.7	-44.3	-44.3	37.2	-42.7	-51.5	-51.5	42.6
9:12	-27.4	-33.1	-33.1	28.6	-36.7	-44.3	-44.3	37.1	-42.8	-51.5	-51.5	42.5
10:12	-27.4	-33.1	-33.1	28.5	-36.8	-44.3	-44.3	36.9	-42.8	-51.6	-51.6	42.4
11:12	-27.5	-33.1	-33.1	28.4	-36.8	-44.4	-44.4	36.8	-42.8	-51.6	-51.6	42.2
12:12	-27.5	-33.2	-33.2	28.3	-36.9	-44.4	-44.4	36.7	-42.9	-51.6	-51.6	42.1

Bldg. Height = 30 ft.

Roof Pitch	Exposure B Zone 1	Exposure B Zone 2	Exposure B Zone 3	Exposure B Down	Exposure C Zone 1	Exposure C Zone 2	Exposure C Zone 3	Exposure C Down	Exposure D Zone 1	Exposure D Zone 2	Exposure D Zone 3	Exposure D Down
1:12	-22.1	-40.8	-64.2	13.4	-31.5	-57.7	-90.4	13.7	-37.5	-68.5	-107.3	15.5
2:12	-19.8	-38.5	-59.6	15.5	-28.2	-54.4	-83.9	20.2	-33.6	-64.6	-99.5	23.2
3:12	-19.8	-38.5	-59.6	15.4	-28.2	-54.4	-83.9	20.1	-33.6	-64.7	-99.6	23.1
4:12	-19.8	-38.6	-59.6	15.3	-28.3	-54.5	-83.9	20.0	-33.7	-64.7	-99.6	23.0
5:12	-19.9	-38.6	-59.6	15.2	-28.3	-54.5	-84.0	19.9	-33.7	-64.7	-99.6	22.9
6:12	-19.9	-38.6	-59.7	15.1	-28.3	-54.5	-84.0	19.8	-33.7	-64.8	-99.7	22.8
7:12	-22.3	-27.0	-27.0	24.4	-31.6	-38.2	-38.2	32.8	-37.7	-45.4	-45.4	38.2
8:12	-22.3	-27.0	-27.0	24.3	-31.7	-38.2	-38.2	32.7	-37.7	-45.5	-45.5	38.1
9:12	-22.4	-27.0	-27.0	24.1	-31.7	-38.3	-38.3	32.6	-37.7	-45.5	-45.5	38.0
10:12	-22.4	-27.1	-27.1	24.0	-31.8	-38.3	-38.3	32.4	-37.7	-45.5	-45.5	37.8
11:12	-22.4	-27.1	-27.1	23.9	-31.8	-38.4	-38.4	32.3	-37.8	-45.6	-45.6	37.7
12:12	-22.5	-27.2	-27.2	23.8	-31.8	-38.4	-38.4	32.2	-37.9	-45.6	-45.6	37.6

Bldg. Height = 15 ft.

Roof Pitch	Exposure B Zone 1	Exposure B Zone 2	Exposure B Zone 3	Exposure B Down	Exposure C Zone 1	Exposure C Zone 2	Exposure C Zone 3	Exposure C Down	Exposure D Zone 1	Exposure D Zone 2	Exposure D Zone 3	Exposure D Down
1:12	-22.1	-40.8	-64.2	13.4	-27.1	-49.9	-78.3	13.4	-33.1	-60.7	-95.1	14.2
2:12	-19.8	-38.5	-59.6	15.5	-24.3	-47.0	-72.6	18.0	-29.7	-57.3	-88.2	21.0
3:12	-19.8	-38.5	-59.6	15.4	-24.3	-47.1	-72.6	17.9	-29.7	-57.3	-88.3	20.9
4:12	-19.8	-38.6	-59.6	15.3	-24.4	-47.1	-72.6	17.9	-29.8	-57.3	-88.3	20.9
5:12	-19.9	-38.6	-59.6	15.2	-24.4	-47.1	-72.7	17.8	-29.8	-57.3	-88.3	20.8
6:12	-19.9	-38.6	-59.7	15.1	-24.4	-47.1	-72.7	17.6	-29.8	-57.4	-88.4	20.7
7:12	-22.3	-27.0	-27.0	24.4	-27.3	-33.0	-33.0	28.9	-33.3	-40.2	-40.2	34.3
8:12	-22.3	-27.0	-27.0	24.3	-27.3	-33.0	-33.0	28.8	-33.4	-40.2	-40.2	34.2
9:12	-22.4	-27.0	-27.0	24.1	-27.4	-33.1	-33.1	28.6	-33.4	-40.3	-40.3	34.1
10:12	-22.4	-27.1	-27.1	24.0	-27.4	-33.1	-33.1	28.5	-33.4	-40.3	-40.3	33.9
11:12	-22.4	-27.1	-27.1	23.9	-27.5	-33.1	-33.1	28.4	-33.5	-40.4	-40.4	33.8
12:12	-22.5	-27.2	-27.2	23.8	-27.5	-33.2	-33.2	28.3	-33.5	-40.4	-40.4	33.7

Side Load (psf) — Down Slope

Bldg. Height = 60 ft.

Roof Pitch	Ss = 1.5	Ss = 2.0	Ss = 2.5	Ss = 3.1
1:12	2.5	3.2	4.0	4.8
2:12	2.8	3.6	4.3	5.2
3:12	3.2	3.9	4.6	5.5
4:12	3.4	4.2	4.9	5.8
5:12	3.7	4.4	5.1	6.0
6:12	3.9	4.6	5.3	6.2
7:12	4.1	4.8	5.5	6.3
8:12	4.2	4.9	5.6	6.5
9:12	4.4	5.0	5.7	6.5
10:12	4.5	5.1	5.8	6.6
11:12	4.6	5.2	5.9	6.6
12:12	4.6	5.3	5.9	6.7

Bldg. Height = 30 ft.

Roof Pitch	Ss = 0.4	Ss = 0.5	Ss = 1.0	Ss = 1.25
1:12	1.2	1.3	1.9	2.1
2:12	1.5	1.7	2.3	2.5
3:12	1.8	2.0	2.6	2.8
4:12	2.1	2.3	2.8	3.1
5:12	2.3	2.5	3.1	3.3
6:12	2.6	2.7	3.3	3.5
7:12	2.8	2.9	3.5	3.7
8:12	3.0	3.1	3.7	3.9
9:12	3.1	3.3	3.8	4.0
10:12	3.3	3.4	3.9	4.1
11:12	3.4	3.5	4.0	4.2
12:12	3.5	3.6	4.1	4.3

Bldg. Height = 15 ft.

Roof Pitch	Ss = 0.0	Ss = 0.1	Ss = 0.2	Ss = 0.3
1:12	0.3	0.6	0.8	1.0
2:12	0.6	0.9	1.1	1.3
3:12	0.9	1.2	1.4	1.6
4:12	1.2	1.5	1.7	1.9
5:12	1.5	1.7	1.9	2.2
6:12	1.7	2.0	2.2	2.4
7:12	1.9	2.2	2.4	2.6
8:12	2.1	2.4	2.6	2.8
9:12	2.3	2.5	2.7	2.9
10:12	2.5	2.7	2.9	3.1
11:12	2.6	2.8	3.0	3.2
12:12	2.7	2.9	3.1	3.3

Lateral

Ss	Value (psf)
Ss = 3.1	4.5
Ss = 2.5	3.6
Ss = 2.0	2.9
Ss = 1.5	2.2
Ss = 1.25	1.8
Ss = 1.0	1.6
Ss = 0.5	1.0
Ss = 0.4	0.9
Ss = 0.3	0.7
Ss = 0.2	0.5
Ss = 0.1	0.2
Ss = 0.0	0.0

Florida*

ASCE 7-10

160 mph — Basic Wind Speed

0 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

Louisiana*

ASCE 7-10

170 mph — Basic Wind Speed

0 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independantly verifed for the specific install location.

Up and Down (psf)

Columns: Zone 1 / Zone 2 / Zone 3 = Up Pressures (psf); Down (psf)

Bldg. Height = 60 ft

Roof Pitch	Exposure B — Zone 1	Zone 2	Zone 3	Down	Exposure C — Zone 1	Zone 2	Zone 3	Down	Exposure D — Zone 1	Zone 2	Zone 3	Down
1:12	-30.8	-56.4	-88.5	13.5	-41.4	-75.5	-118.1	16.6	-48.1	-87.7	-137.1	18.7
2:12	-27.6	-53.3	-82.1	19.8	-37.1	-71.2	-109.6	25.1	-43.2	-82.8	-127.2	28.5
3:12	-27.6	-53.3	-82.1	19.8	-37.1	-71.2	-109.6	25.1	-43.2	-82.8	-127.3	28.4
4:12	-27.6	-53.3	-82.2	19.7	-37.2	-71.3	-109.6	25.0	-43.3	-82.8	-127.3	28.4
5:12	-27.7	-53.3	-82.2	19.6	-37.2	-71.3	-109.7	24.9	-43.3	-82.8	-127.3	28.3
6:12	-27.7	-53.4	-82.2	19.5	-37.2	-71.3	-109.7	24.8	-43.3	-82.9	-127.4	28.2
7:12	-31.0	-37.4	-37.4	32.2	-41.5	-50.1	-50.1	41.7	-48.3	-58.2	-58.2	47.8
8:12	-31.0	-37.4	-37.4	32.1	-41.6	-50.1	-50.1	41.6	-48.4	-58.2	-58.2	47.7
9:12	-31.0	-37.5	-37.5	31.9	-41.6	-50.1	-50.1	41.5	-48.4	-58.3	-58.3	47.6
10:12	-31.1	-37.5	-37.5	31.8	-41.7	-50.2	-50.2	41.3	-48.4	-58.3	-58.3	47.4
11:12	-31.1	-37.5	-37.5	31.7	-41.7	-50.2	-50.2	41.2	-48.5	-58.4	-58.4	47.3
12:12	-31.2	-37.6	-37.6	31.6	-41.7	-50.3	-50.3	41.1	-48.5	-58.4	-58.4	47.2

Bldg. Height = 30 ft

Roof Pitch	Exposure B — Zone 1	Zone 2	Zone 3	Down	Exposure C — Zone 1	Zone 2	Zone 3	Down	Exposure D — Zone 1	Zone 2	Zone 3	Down
1:12	-25.1	-46.3	-72.7	13.4	-35.7	-65.3	-102.3	14.9	-42.5	-77.5	-121.3	17.0
2:12	-22.5	-43.6	-67.4	17.0	-32.0	-61.6	-94.9	22.3	-38.1	-73.1	-112.5	25.7
3:12	-22.5	-43.7	-67.4	16.9	-32.0	-61.6	-94.9	22.2	-38.1	-73.2	-112.6	25.6
4:12	-22.6	-43.7	-67.5	16.9	-32.1	-61.6	-94.9	22.1	-38.2	-73.2	-112.6	25.5
5:12	-22.6	-43.7	-67.5	16.8	-32.1	-61.7	-95.0	22.0	-38.2	-73.2	-112.6	25.4
6:12	-22.6	-43.8	-67.5	16.6	-32.1	-61.7	-95.0	21.9	-38.2	-73.3	-112.7	25.3
7:12	-25.3	-30.6	-30.6	27.1	-35.9	-43.3	-43.3	36.6	-42.7	-51.4	-51.4	42.7
8:12	-25.3	-30.6	-30.6	27.0	-35.9	-43.3	-43.3	36.5	-42.7	-51.5	-51.5	42.6
9:12	-25.4	-30.7	-30.7	26.8	-35.9	-43.3	-43.3	36.4	-42.7	-51.5	-51.5	42.5
10:12	-25.4	-30.7	-30.7	26.7	-36.0	-43.4	-43.4	36.2	-42.8	-51.5	-51.5	42.3
11:12	-25.5	-30.7	-30.7	26.6	-36.0	-43.4	-43.4	36.1	-42.8	-51.6	-51.6	42.2
12:12	-25.5	-30.8	-30.8	26.5	-36.1	-43.5	-43.5	36.0	-42.9	-51.6	-51.6	42.1

Bldg. Height = 15 ft

Roof Pitch	Exposure B — Zone 1	Zone 2	Zone 3	Down	Exposure C — Zone 1	Zone 2	Zone 3	Down	Exposure D — Zone 1	Zone 2	Zone 3	Down
1:12	-25.1	-46.3	-72.7	13.4	-30.8	-56.4	-88.5	13.5	-37.6	-68.7	-107.5	15.5
2:12	-22.5	-43.6	-67.4	17.0	-27.6	-53.3	-82.1	19.8	-33.7	-64.8	-99.8	23.2
3:12	-22.5	-43.7	-67.4	16.9	-27.6	-53.3	-82.1	19.8	-33.7	-64.8	-99.8	23.2
4:12	-22.6	-43.7	-67.5	16.9	-27.6	-53.3	-82.2	19.7	-33.8	-64.9	-99.8	23.1
5:12	-22.6	-43.7	-67.5	16.8	-27.7	-53.3	-82.2	19.6	-33.8	-64.9	-99.9	23.0
6:12	-22.6	-43.8	-67.5	16.6	-27.7	-53.4	-82.2	19.5	-33.8	-64.9	-99.9	22.9
7:12	-25.3	-30.6	-30.6	27.1	-31.0	-37.4	-37.4	32.2	-37.8	-45.5	-45.5	38.3
8:12	-25.3	-30.6	-30.6	27.0	-31.0	-37.4	-37.4	32.1	-37.8	-45.6	-45.6	38.2
9:12	-25.4	-30.7	-30.7	26.8	-31.0	-37.5	-37.5	31.9	-37.8	-45.6	-45.6	38.1
10:12	-25.4	-30.7	-30.7	26.7	-31.1	-37.5	-37.5	31.8	-37.9	-45.6	-45.6	37.9
11:12	-25.5	-30.7	-30.7	26.6	-31.1	-37.5	-37.5	31.7	-37.9	-45.7	-45.7	37.8
12:12	-25.5	-30.8	-30.8	26.5	-31.2	-37.6	-37.6	31.6	-38.0	-45.7	-45.7	37.7

Side Load (psf) — Down Slope

Roof Pitch	Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
1:12	0.3	0.6	0.8	1.0	1.2	1.3	1.9	2.1	2.5	3.2	4.0	4.8
2:12	0.6	0.9	1.1	1.3	1.5	1.7	2.3	2.5	2.8	3.6	4.3	5.2
3:12	0.9	1.2	1.4	1.6	1.8	2.0	2.6	2.8	3.2	3.9	4.6	5.5
4:12	1.2	1.5	1.7	1.9	2.1	2.3	2.8	3.1	3.4	4.2	4.9	5.8
5:12	1.5	1.7	1.9	2.2	2.3	2.5	3.1	3.3	3.7	4.4	5.1	6.0
6:12	1.7	2.0	2.2	2.4	2.6	2.7	3.3	3.5	3.9	4.6	5.3	6.2
7:12	1.9	2.2	2.4	2.6	2.8	2.9	3.5	3.7	4.1	4.8	5.5	6.3
8:12	2.1	2.4	2.6	2.8	3.0	3.1	3.7	3.9	4.2	4.9	5.6	6.5
9:12	2.3	2.5	2.7	2.9	3.1	3.3	3.8	4.0	4.4	5.0	5.7	6.5
10:12	2.5	2.7	2.9	3.1	3.3	3.4	3.9	4.1	4.5	5.1	5.8	6.6
11:12	2.6	2.8	3.0	3.2	3.4	3.5	4.0	4.2	4.6	5.2	5.9	6.6
12:12	2.7	2.9	3.1	3.3	3.5	3.6	4.1	4.3	4.6	5.3	5.9	6.7

Lateral

	Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
	0.0	0.2	0.5	0.7	0.9	1.0	1.6	1.8	2.2	2.9	3.6	4.5

Roof Pitch to Angle Conversion

Pitch	Angle		
12 : 12	45°	Steep	
11 : 12	42.5°		
10 : 12	39.8°		
9 : 12	36.9°		
8 : 12	33.7°		
7 : 12	30.3°		
6 : 12	26.6°	Moderate	Still walkable
5 : 12	22.6°		
4 : 12	18.4°		Standard roof pitch
3 : 12	14.0°	Slight	Typical in southern climates
2 : 12	9.5°		Low pitch roof
1 : 12	4.5°		
0 : 12	0°	Flat	

Dead Load Calculation

The Prescriptive Pressure Tables and U-Building include service dead loads ranging from 2.1 to 3.8 psf and include the wiehgt of the SFM system and module.

To calculate the dead load of your system, please refer to Appendix H - Technical Data Sheets and the project specific module specification sheet. If your loads fall outside the range listed aboe, please use the Analytical Method in this guide for analysis.

`

Sample Calculation (ASCE 7-05)

1. Obtain Project Location

   Allentown, NJ

2. Contact local AHJ (Authority Having Jurisdiction) to determine Current Adopted Building Code (City web page will either list adopted code or list contact information for Building/Engineering Department)

   Assume ASCE7-05 for sample calculation

3. Determine if there are any local amendments to the Current Adopted Building Code (City web page will generally list local amendments)

   Assume no local amendments for sample calculation

4. Determine Occupancy Category utilizing Table 1-1 (pg. 3)

   Occupancy Category II

Step 1: User Inputs (ASCE 7-05)

5. Determine Roof Height

   10' - 0" to top of wall & 16'-2" to ridge

6. Determine Roof Angle (degrees)

   5/12 – 22.62 degrees

7. Determine Basic Wind Speed utilizing Figure 6-1 continued (pg. 33)

   100 mph

8. Determine Wind Exp. Category utilizing definitions for Surface Roughness Categories found in sections 6.5.6.2 & 6.5.6.3 (pg 25-26)

   Exposure C

9. Determine roof zones utilizing Figure 6-3 (pg. 41)

a = 10% of least horizontal dimension = 24ft x 0.1 = *2.4 ft*

or

a = 0.4 x h = 0.4 x 10ft = *4 ft*

whichever is smaller

but not less than either 4% of least horizontal dimension or *3 ft*

10. Determine Ground Snow Load utilizing Figure 7-1 continued (pg. 85)

25 psf

11. Determine the mapped MCE spectral response acceleration at short periods, Ss utilizing figure 22-1 continued (pg. 211)

0.30 g

12. Determine the minimum uniform distributed Live Load utilizing Table 4-1 (continued) (pg. 13)

20 psf

13. Confirm User Inputs by utilizing DesignCriteriabyZIP program (output attached)

Wind Speed – 100mph, Ground Snow Load – 25 psf, Ss – 0.293

14. Module Manufacturer/Type

TRINA TSM – PA05.08 - 260

15. Module Length, Module Width, Module Weight

64.96 in, 37.05 in, 41 lbs

<u>Step 2</u>: Wind Pressure (ASCE 7-05, Chapter 6)

16.   Calculate Effective Wind Area:

$$L = 64.96in/(12in/ft) = 5.41 \text{ ft}$$
$$W = 37.05in/(12in/ft) = 3.09 \text{ ft}$$
$$Area = (5.41ft \times 3.09ft)/4 = \textbf{\textit{4.18 ft}}^2$$

17.   Per section 6.5.12.4 (pg. 28), determine External Pressure Coefficients, GCpp and GCpn utilizing Figure 6-11C (pg. 57)

Zone 1:
$$GCpp = \textbf{\textit{-0.9}}$$
$$GCpn = \textbf{\textit{0.5}}$$

Zone 2:
$$GCpp = \textbf{\textit{-1.7}}$$
$$GCpn = \textbf{\textit{0.5}}$$

Zone 3:
$$GCpp = \textbf{\textit{-2.6}}$$
$$GCpn = \textbf{\textit{0.5}}$$

18.   Determine Velocity Pressure Coefficient, K_z utilizing Table 6-3 (pg. 79)
       0.85

19.   Determine Topographic Factor, K_{zt} utilizing Figure 6-4 (cont'd) (pg. 46)

1

20.   Determine Directionality Factor, K_d utilizing Table 6-4 (pg. 80)

0.85

21.   Determine Wind Importance Factor utilizing Table 6-1 (pg. 77)

1

22.   Calculate Velocity Pressure, $q_z = q_h$ utilizing equation (6-15) in section 6.5.10 (pg. 27)

$$q_h = 0.00256K_zK_{zt}K_dV^2I_w = 0.00256(0.85)(1.0)(0.85)(100)^2(1.0) = \textbf{\textit{18.5 psf}}$$

23.   Calculate Design Wind Pressures, Pp(positive) and Pn(negative) utilizing equation (6-22) in section 6.5.12.4.1 (pg. 28)

Zone 1:

Pp = q_h(GCpn) = 18.5(0.5) = *9.25 psf = 10 psf min*

Pn = q_h(GCpp) = 18.5(-0.9) = *-16.7 psf*

Zone 2:

Pp = q_h(GCpn) = 18.5(0.5) = *9.25 psf = 10 psf min*

Pn = q_h(GCpp) = 18.5(-1.7) = *-31.5 psf*

Zone 3:

Pp = q_h(GCpn) = 18.5(0.5) = *9.25 psf = 10 psf min*

Pn = q_h(GCpp) = 18.5(-2.6) = *-48.1 psf*

Step 3: Dead Load

24. Determine Racking System Dead Load (See Appendix D)
Min = 2.14 psf
Max = 3.85 psf

Step 4: Snow Load (ASCE 7-05, Chapter 7)

25. Ground Snow Load, p_g from Step 1
25 psf

26. Determine Exposure Factor, C_e utilizing Table 7-2 (pg. 92)
1

27. Determine Thermal Factor, Ct utilizing Table 7-3 (pg. 93)
1

28. Determine Snow Importance Factor, I_s utilizing Table 7-4 (pg. 93)
1

29. Calculate Flat Roof Snow Load, p_f utilizing equation (7-1) in section 7.3 (pg. 81)

$$p_f = 0.7C_eC_tIp_g = 0.7(1.0)(1.0)(1.0)(25) = \textit{17.5 psf}$$

30. Determine Slope Factor, C_s utilizing Figure 7-2a

     0.73

31. Calculate Sloped Roof Snow Load, p_s utilizing equation (7-2) in section 7.4 (pg. 81)

     $p_s = C_s p_f = (0.729)(17.5) =$ ***12.76 psf***

Step 5: Seismic Load (ASCE 7-05, Chapters 12 & 13)

32. Amplification Factor, a_p utilizing AC428, section 3.1.3.3 & ASCE 7-05 Table 13.6-1 (pg. 149)

     1

33. Determine Component Response Modification Factor, R_p utilizing AC428 Table 3.1.3.3 & ASCE 7-05 Table 13.6-1 (pg. 149)

     1.5

34. Mapped MCE spectral response acceleration at short periods, S_s from Step 1

     0.3

35. Determine Site Coefficient, F_a utilizing Table 11.4-1

     1.56

36. Calculate the MCE Spectral Response Acceleration for Short Periods, S_{MS} utilizing equation (11.4-1) in section 11.4.3 (pg. 115)

     $S_{MS} = F_a S_s = (1.56)(0.3) =$ ***0.468***

37. Calculate the Design Earthquake Spectral Response Acceleration Parameter at Short Periods, S_{DS} utilizing equation (11.4-3) in section 11.4.4 (pg. 115)

     $S_{DS} = 2/3 S_{MS} = (2/3)(0.468) =$ ***0.312***

38. From Step 3, Effective Seismic Weight, W_p
    3.85 psf

39. Determine Seismic Importance Factor, I_p utilizing section 13.1.3 (pg. 143)
    1

40. Determine height in structure of point of attachment of component with respect to the base, z utilizing section 13.3.1 (pg. 145)
    15.5 ft

41. Determine average roof height of structure, h utilizing section 13.3.1 (pg. 145)
    15 ft

42. Calculate Horizontal Seismic Design Force, F_{ph} utilizing equation (13.3-1) in section 13.3.1 (pg. 144)

    F_{ph} = $((0.4a_p S_{DS} W_p)/(R_p/I_p)) \times (1+2(z/h))$

    = $((0.4(1.0)(0.312)(3.85))/(1.5/1.0)) \times (1+2(1))$

    = *0.961 psf*

    is not required to be taken as greater than (13.3-2)

    F_{ph} = $1.6 S_{DS} I_p W_p$

    = $1.6(0.312)(1.0)(3.85)$

    = *1.922 psf*

    Shall not be taken as less than (13.3-3)

    F_{ph} = $0.3 S_{DS} I_p W_p$

    = $0.3(0.312)(1.0)(3.85)$ = *0.360 psf*

43. Calculate Vertical Seismic Design Force, F_{pv} utilizing equation (12.4-4) in section 12.4.2.2 (pg. 126)

$$= 0.2S_{DS}D$$
$$= 0.2(0.312)(3.85)$$
$$= \textit{0.240 psf}$$

44. Summarize Calculated Design Forces

Wind:	Zone 1 = **10 psf** (down)	
	Zone 1 = **-16.7 psf** (up)	
	Zone 2 **= 10 psf** (down)	
	Zone 2 = **-31.5 psf** (up)	
	Zone 3 = **10 psf** (down)	
	Zone 3 = **-48.1 psf** (up)	
Dead:	Min = **2.14 psf**	
	Max = **3.85 psf**	
Snow:	**12.76 psf**	
Seismic:	Horizontal = **0.961 psf**	
	Vertical = **0.241 psf**	

45.   Calculate *Local* Horizontal (parallel to module face) and Vertical (perpendicular to module face) Components of Design Forces at 22.62 Degree Roof Tilt

Wind: *(Note: wind design forces already take into account roof tilt and represent vertical loading perpendicular to the module surface)*

Vertical Down:	Zone 1, 2 & 3 = **10psf**
Vertical Up:	Zone 1 = **-16.7psf**, Zone 2 = **-31.5psf**, Zone 3 = **-48.1psf**

Dead:

Vertical Down:	Min = 2.14 x cosine (22.62) = **1.98psf**
	Max = 3.85 x cosine (22.62) = **3.55psf**
Horizontal:	Min = 2.14 x sine (22.62) = **0.82psf**
	Max = 3.85 x sine (22.62) = **1.48psf**

Snow:

Vertical Down:	12.76 x cosine (22.62) x cosine (22.62) = **10.87psf**
Horizontal:	12.76 x sine (22.62) = **4.91psf**

Seismic:

Vertical Down:	0.241 x cosine (22.62) + 0.961 x sine (22.62) = **0.59pdf**
Horizontal:	0.241 x sine (22.62) + 0.961 x cosine (22.62) = **0.98psf**

46. Identify Controlling Load Combination for Both Vertical (up and down) and Horizontal Directions

	Vertical (psf) *Zone 1, Zone 2, Zone 3*	**Horizontal (psf)**
1) D	3.55	1.48
2) D + S	15.3	**6.39**
3) D + W_{up}	-14.72, -29.52, -46.12	0.82
4) D + W_{down}	13.6	1.48
5) D + 0.75W_{down} + 0.75S	**19.2**	5.16
6) D + 0.75(0.7E) + 0.75S	12.0	5.68
7) D + 0.7E	3.96	2.17
8) 0.6D + W_{up}	**-15.51, -30.31, -46.92**	0.49
9) 0.6D + W_{down}	12.1	0.89
10) 0.6D + 0.7E	2.54	1.57

47. Create Initial Array Layout
    3 x 3 Landscape Array

Up and Down (psf)

Exposure Category B

Roof Pitch	Bldg. Height = 60 ft Down (psf)	Zone 3	Zone 2	Zone 1	Bldg. Height = 30 ft Down (psf)	Zone 3	Zone 2	Zone 1	Bldg. Height = 15 ft Down (psf)	Zone 3	Zone 2	Zone 1
1:12	26.2	-50.5	-32.0	-17.2	26.2	-41.4	-26.1	-14.0	26.2	-41.4	-32.0	-17.2
2:12	24.9	-46.8	-30.2	-15.4	24.9	-38.3	-24.6	-12.4	24.9	-38.3	-30.2	-15.4
3:12	23.4	-46.8	-30.2	-15.4	23.4	-38.4	-24.6	-12.5	23.4	-38.4	-30.2	-15.4
4:12	20.5	-46.9	-30.2	-15.4	20.5	-38.4	-24.7	-12.5	20.5	-46.9	-30.2	-15.5
5:12	19.2	-46.9	-30.3	-15.5	19.2	-38.4	-24.7	-12.5	19.2	-46.9	-30.3	-15.5
6:12	18.0	-46.9	-30.3	-15.5	18.0	-38.5	-24.7	-12.6	18.0	-46.9	-30.3	-15.5
7:12	21.8	-21.1	-21.1	-17.4	19.6	-17.2	-17.2	-14.1	21.8	-21.1	-21.1	-17.4
8:12	20.8	-21.1	-21.1	-17.4	18.6	-17.2	-17.2	-14.2	20.8	-21.1	-21.1	-17.4
9:12	19.8	-21.2	-21.2	-17.5	17.6	-17.3	-17.3	-14.2	19.8	-21.2	-21.2	-17.5
10:12	19.6	-21.2	-21.2	-17.5	16.8	-17.3	-17.3	-14.2	19.6	-21.2	-21.2	-17.5
11:12	19.5	-21.2	-21.2	-17.5	16.5	-17.3	-17.3	-14.3	19.5	-21.2	-21.2	-17.5
12:12	19.4	-21.3	-21.3	-17.6	16.4	-17.4	-17.4	-14.3	19.4	-21.3	-21.3	-17.6

Exposure Category C

Roof Pitch	Bldg. Height = 60 ft Down (psf)	Zone 3	Zone 2	Zone 1	Bldg. Height = 30 ft Down (psf)	Zone 3	Zone 2	Zone 1	Bldg. Height = 15 ft Down (psf)	Zone 3	Zone 2	Zone 1
1:12	26.2	-67.6	-43.0	-23.3	26.2	-58.4	-37.1	-20.0	26.2	-50.5	-32.0	-17.2
2:12	26.6	-62.7	-40.5	-20.9	25.4	-54.2	-35.0	-17.9	24.9	-46.8	-30.2	-15.4
3:12	25.1	-62.7	-40.6	-20.9	23.9	-54.2	-35.0	-17.9	23.4	-46.8	-30.2	-15.4
4:12	22.2	-62.7	-40.6	-20.9	21.0	-54.2	-35.0	-18.0	20.5	-46.9	-30.2	-15.5
5:12	20.9	-62.7	-40.6	-20.9	19.7	-54.3	-35.1	-18.0	19.2	-46.9	-30.3	-15.5
6:12	19.7	-62.8	-40.7	-21.0	18.5	-54.3	-35.1	-18.0	18.0	-46.9	-30.3	-15.5
7:12	25.9	-28.4	-28.4	-23.5	23.7	-24.5	-24.5	-20.2	21.8	-21.1	-21.1	-17.4
8:12	25.3	-28.4	-28.4	-23.5	22.7	-24.5	-24.5	-20.3	20.8	-21.1	-21.1	-17.4
9:12	25.2	-28.5	-28.5	-23.6	22.3	-24.6	-24.6	-20.3	19.8	-21.2	-21.2	-17.5
10:12	25.1	-28.5	-28.5	-23.6	22.1	-24.6	-24.6	-20.3	19.6	-21.2	-21.2	-17.5
11:12	25.0	-28.6	-28.6	-23.6	22.0	-24.6	-24.6	-20.4	19.5	-21.2	-21.2	-17.5
12:12	24.9	-28.6	-28.6	-23.7	21.9	-24.7	-24.7	-20.4	19.4	-21.3	-21.3	-17.6

Exposure Category D

Roof Pitch	Bldg. Height = 60 ft Down (psf)	Zone 3	Zone 2	Zone 1	Bldg. Height = 30 ft Down (psf)	Zone 3	Zone 2	Zone 1	Bldg. Height = 15 ft Down (psf)	Zone 3	Zone 2	Zone 1
1:12	26.2	-78.5	-50.0	-27.2	26.2	-69.4	-44.2	-24.0	26.2	-61.5	-39.1	-21.1
2:12	28.1	-72.8	-47.2	-24.4	26.9	-64.4	-41.6	-21.5	25.8	-57.0	-36.8	-18.9
3:12	26.6	-72.9	-47.2	-24.4	25.4	-64.4	-41.7	-21.5	24.3	-57.0	-36.9	-18.9
4:12	22.8	-72.9	-47.2	-24.4	21.5	-64.4	-41.7	-21.5	20.5	-57.1	-36.9	-19.0
5:12	21.6	-72.9	-47.3	-24.5	20.4	-64.4	-41.7	-21.6	19.3	-57.1	-36.9	-19.0
6:12	20.4	-73.0	-47.3	-24.5	19.2	-64.5	-41.8	-21.6	18.2	-57.1	-37.0	-19.0
7:12	29.0	-33.1	-33.1	-27.4	26.0	-29.2	-29.2	-24.1	23.8	-25.8	-25.8	-21.3
8:12	28.9	-33.1	-33.1	-27.4	25.9	-29.2	-29.2	-24.2	23.4	-25.8	-25.8	-21.3
9:12	28.7	-33.2	-33.2	-27.5	25.8	-29.3	-29.3	-24.2	23.2	-25.9	-25.9	-21.4
10:12	28.6	-33.2	-33.2	-27.5	25.7	-29.3	-29.3	-24.3	23.1	-25.9	-25.9	-21.4
11:12	28.5	-33.3	-33.3	-27.6	25.6	-29.3	-29.3	-24.3	23.0	-25.9	-25.9	-21.5
12:12	28.4	-33.3	-33.3	-27.6	25.4	-29.4	-29.4	-24.3	22.9	-26.0	-26.0	-21.5

Side Load (psf) — Down Slope

Roof Pitch	Ss=0.0	Ss=0.1	Ss=0.2	Ss=0.3	Ss=0.4	Ss=0.5	Ss=1.0	Ss=1.25	Ss=1.5	Ss=2.0	Ss=2.5	Ss=3.1
1:12	2.0	2.0	2.0	2.1	2.2	2.3	2.8	2.9	3.2	3.8	4.3	5.0
2:12	3.7	3.7	3.7	3.7	3.7	3.7	4.1	4.3	4.6	5.1	5.7	6.3
3:12	5.0	5.0	5.0	5.0	5.0	5.0	5.2	5.4	5.6	6.2	6.7	7.4
4:12	5.4	5.4	5.4	5.4	5.4	5.4	5.6	5.7	6.0	6.6	7.1	7.8
5:12	6.0	6.0	6.0	6.0	6.0	6.0	6.1	6.2	6.5	7.1	7.6	8.3
6:12	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.6	6.9	7.4	7.9	8.6
7:12	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.8	7.0	7.6	8.1	8.7
8:12	6.6	6.6	6.6	6.6	6.6	6.6	6.7	6.8	7.1	7.6	8.1	8.8
9:12	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.8	7.1	7.6	8.1	8.7
10:12	6.5	6.5	6.5	6.5	6.5	6.5	6.6	6.7	7.0	7.5	8.0	8.6
11:12	6.3	6.3	6.3	6.3	6.3	6.3	6.4	6.6	6.8	7.3	7.8	8.4
12:12	6.1	6.1	6.1	6.1	6.1	6.1	6.3	6.4	6.7	7.1	7.6	8.2

Lateral

Ss	Value
Ss=0.0	0.0
Ss=0.1	0.2
Ss=0.2	0.5
Ss=0.3	0.7
Ss=0.4	0.9
Ss=0.5	1.0
Ss=1.0	1.6
Ss=1.25	1.8
Ss=1.5	2.2
Ss=2.0	2.9
Ss=2.5	3.6
Ss=3.1	4.5

East Coast (Medium Snow)*

ASCE 7-05

100 mph — Basic Wind Speed

25 psf — Ground Snow Load

* This table is not inclusive of all areas within the state or region. The local wind speeds and snow loads should be independently verified for the specific install location.

49. Determine System Application Rules

Pull loads form page 88.   Compare to the table on page 26.

Roof Zone 1:

Down =	19.2 psf	Rule 1 controls
Up =	-15.5 psf	Rule 1 controls
Down Slope =	6.0 psf	Rule 1 controls
Lateral =	0.7 psf	Rule 1 controls

Since Rule 1 controls; use the following dimensions;

Overhang Maximum =   24"   (MicroRail and Trim Rail
Span Maximum =   72"   dimensions in roof zone 1)

Pull loads form page 88.   Compare to the table on page 26.

Roof Zone 2:

Note: Rule 3 controls for the MicroRail dimensions And Rule 1 controls for Trim Rail dimensions.

Down =	19.2 psf	Rule 1 controls
Up =	-30.3 psf	See note
Down Slope =	6.0 psf	Rule 1 controls
Lateral =	0.7 psf	Rule 1 controls

Overhang Maximum =   18"   (MicroRail dimensions in
Span Maximum =   48"   roof zone 2)
Overhang Maximum =   24"   (Trim Rail dimensions in
Span Maximum =   72"   roof zone 2)

Pull loads form page 88.   Compare to the table on page 26.

Roof Zone 3:

Note: The uplift pressure is greater than those listed in rules 1, 2, & 3 for Both the MicroRail and Trim Rail dimensions.

Down =	19.2 psf	Rule 1 controls
Up =	-46.9 psf	See note
Down Slope =	6.0 psf	Rule 1 controls
Lateral =	0.7 psf	Rule 1 controls

Overhang Maximum =   10"   (MicroRail and Trim Rail
Span Maximum =   32"   dimensions)

50. Locate Array and Support Locations Based on System Application and Layout Rules

22" module overhang ✔ok
48" span ✔ok
72" span ✔ok
48" span ✔ok
7" module overhang ✔ok

Ridge

Roof zone 1
Roof zone 2
Roof zone 3

Optimized layout in roof zone 1 - using minimal attachments and satisfying max. overhang (24") and span (72") requirements.

48" span ✔ok
7" module overhang ✔ok

Roof zone 2
Roof zone 3

For example; if the array edge shifts into roof zones 2 & 3, add attachments as required - see table on page 26.
This portion of the layout checks out okay. No span or overhang dimensions are exceeded.

51.   Calculate Maximum Point Load for Each Support Type (Area of 1 Panel = 16.71sf)

52.   Corner Support (1/4 Panel Tributary Area)

·	Maximum Downward Point Load Acting Perpendicular to the Roof Surface:	19.2psf x (.25 x 16.71) =	**80 lbs**
·	Maximum Upward Point Load Acting Perpendicular to the roof surface (Zone 1):	-15.5psf x (.25 x 16.71) =	**-65 lbs**
·	Maximum Shear Point Load Acting Parallel to the roof surface:	6.0psf x (.25 x 16.71) =	**26 lbs**

53.   Edge Support (1/2 Panel Tributary Area)

·	Maximum Downward Point Load Acting Perpendicular to the Roof Surface:	19.2psf x (.50 x 16.71) =	**160 lbs**
·	Maximum Upward Point Load Acting Perpendicular to the roof surface (Zone 1):	-15.5psf x (.50 x 16.71) =	**-130 lbs**
·	Maximum Shear Point Load Acting Parallel to the roof surface:	6.0psf x (.50 x 16.71) =	**52 lbs**

54.   Interior Support (1 Panel Tributary Area)

·	Maximum Downward Point Load Acting Perpendicular to the Roof Surface:	19.2psf x (1 x 16.71) =	**321 lbs**
·	Maximum Upward Point Load Acting Perpendicular to the roof surface (Zone 1):	-15.5psf x (1x 16.71) =	**-259 lbs**
·	Maximum Shear Point Load Acting Parallel to the roof surface:	6.0psf x (1x 16.71) =	**101 lbs**

NOTE TO BASE STRUCTURE ENGINEER: Refer to Section C7.8 of both ASCE 7-05 and ASCE 7-10 for application of solar loading to base structure

SUNFRAME MicroRail - 2" Assembly

- Allowable and design loads are valid when components are assembled according to authorized UNIRAC documents.

- Values represent the allowable and design load capacity of a single 2" MicroRail assembly to retain a module(s) in the direction indicated

- Resistance factors and safety factors are determined according to Part 1 Appendix 1 of the 2015 Aluminum Design Manual

Assembly Part Numbers:	*250020U*
Extruded Components material:	*6005A-T61, 6061-T6*
Ultimate Tensile:	*38ksi*
Yield:	*35ksi*
Finish:	*Dark Anodized Cap*
Weight :	*Cap .604 lbs (274g)*

No Intersection (North Row)
(See System Layout Rules - Connection/Attachment Rules 1 & X)

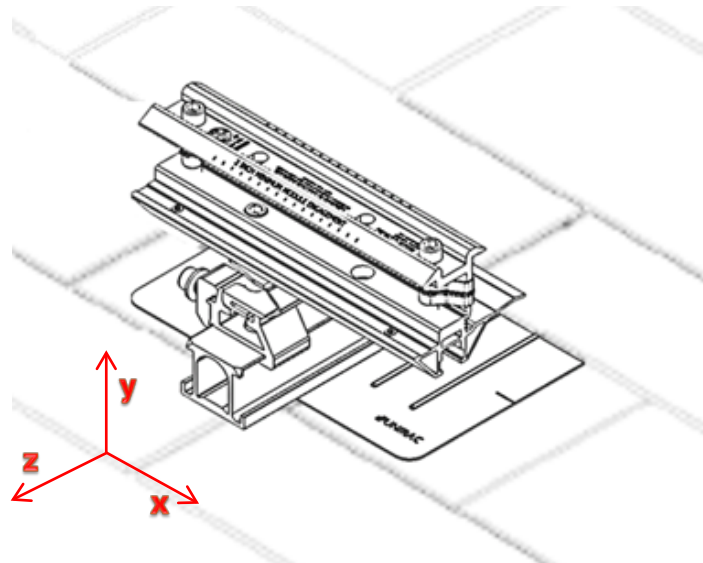| Direction	Allowable Loads (lbs)	Design Loads (lbs)
X +/- Lateral	62	94
Y + Tension	956	1446
Y - Compression	2402	3633
Z + Down Slope	57*	86*

2 Modules Vertical (Interior Row)
(See System Layout Rules - Connection/Attachment Rule 2v & X)

Direction	Allowable Loads (lbs)	Design Loads (lbs)
X +/- Sliding	62	94
Y + Tension	1626	2459
Y - Compression	1979	2993
Z +/- Transverse	809*	1224*

*System Down Slope load capacity = sum of north row load + interior load (or + trim rail load on single row assembly)

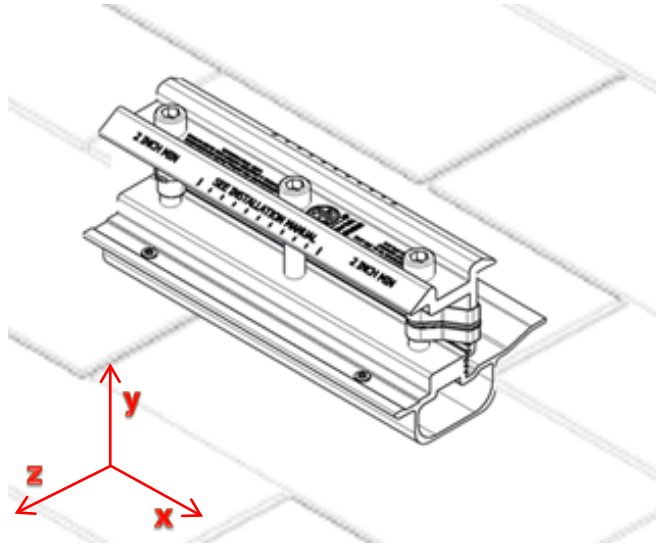## SUNFRAME MicroRail - 8" Assembly

- Allowable and design loads are valid when components are assembled according to authorized UNIRAC documents.

- Values represent the allowable and design load capacity of a single 8" MicroRail assembly to retain a module(s) in the direction indicated

- Resistance factors and safety factors are determined according to Part 1 Appendix 1 of the 2015 Aluminum Design Manual

Assembly Part Numbers:	*250030U*
Extruded Components material:	*6005A-T61, 6061-T6*
Ultimate Tensile:	*38ksi*
Yield:	*35ksi*
Finish:	*Dark Anodized Cap*
Weight :	*1.413 lbs (641g)*

2 Modules (North Row)
(See System Layout Rules - Connection/Attachment Rule 5)

Direction	Allowable Loads (lbs)	Design Loads (lbs)
X +/- Lateral	278	421
Y + Tension	787	1191
Y - Compression	1321	1999
Z + Down Slope	451	682

4 Modules Max (Interior Row)
(See System Layout Rules - Connection/Attachment Rule 5)

Direction	Allowable Loads (lbs)	Design Loads (lbs)
X +/- Sliding	278	421
Y + Tension	3166	1963
Y - Compression	5446	3677
Z +/- Transverse	875	1324

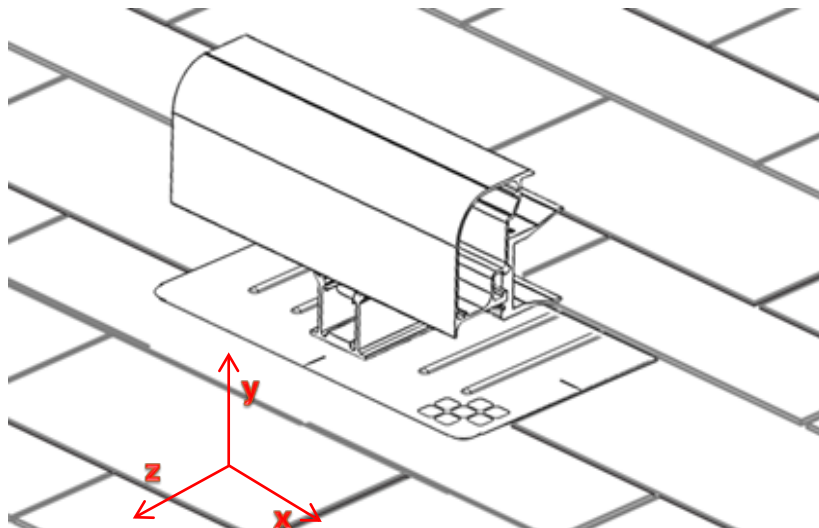## SUNFRAME MicroRail - 6.5" Splice Assembly

- Allowable and design loads are valid when components are assembled according to authorized UNIRAC documents.

- Values represent the allowable and design load capacity of a single 6.5" MicroRail Splice to retain a module(s) in the direction indicated

- Resistance factors and safety factors are determined according to Part 1 Appendix 1 of the 2015 Aluminum Design Manual

Assembly Part Numbers:	*250010U*
Extruded Components material:	*6005A-T61, 6061-T6*
Ultimate Tensile:	*38ksi*
Yield:	*35ksi*
Finish:	*Dark Anodized Cap*
Weight	*0.936 lbs (425g)*

2 Modules (North Row)
(See System Layout Rules - Connection/Attachment Rule 2h)

Direction	Allowable Loads (ft-lbs)
Y + Bending	429
Y - Bending	357

4 Modules Max (Interior Row)
(See System Layout Rules - Connection/Attachment Rule 3 & 4)

Direction	Allowable Loads (ft-lbs)
Y + Bending	589
Y - Bending	565

SUNFRAME MicroRail - Trim Rail

- Allowable and design loads are valid when components are assembled according to authorized UNIRAC documents.

- Values represent the allowable and design load capacity of a single L-Foot capture connection to retain a module(s) in the direction indicated

- Resistance factors and safety factors are determined according to Part 1 Appendix 1 of the 2015 Aluminum Design Manual

Trim Rail

Part Numbers:	*250100U - Trim Rail*
	250110U - Trimrail Module Clip
Extruded Components material:	*6005A-T61, 6061-T6*
Ultimate Tensile/Yield:	*38ksi/35ksi*
Finish:	*Trim Rail: Dark Anodized*
Weight	*0.94 lbs/ft (426 g/ft) - Trim Rail*
	0.160 lbs(73g) - Trimrail Module Clip

Trim Splice

Part Number:	*250120U*
Weight	*0.436 lbs(198g)*

Trim Roof Attachment Assembly

Part Number:	*004200D*
Weight	*0.439 lbs(199g)*

Load Testing Results

Direction	Allowable Load (lbs)	Design Load (lbs)
Z + Down Slope	502	760
Y + Tension	999	1512
Y - Compression	672	1017