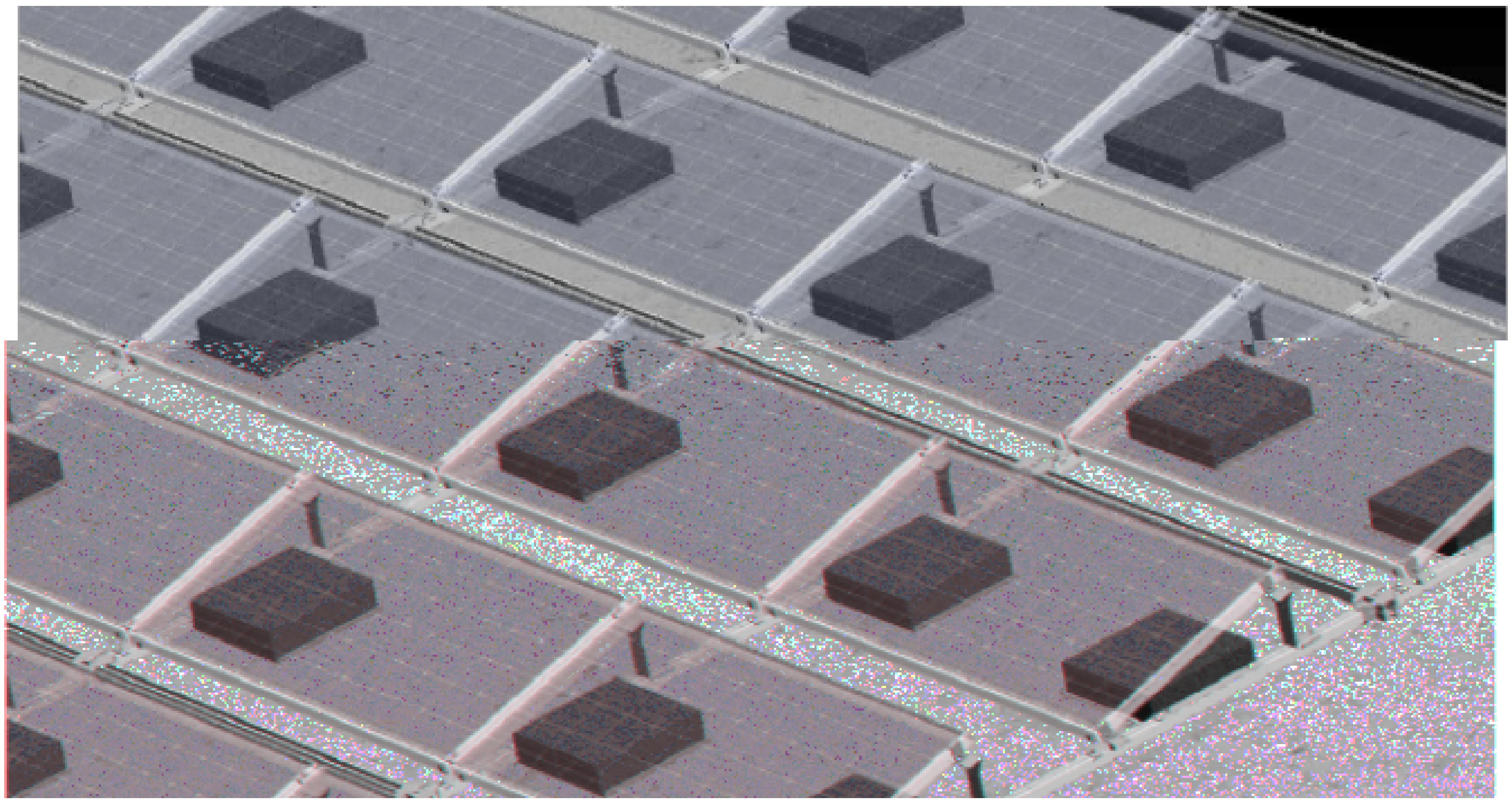


# 1.Determine the Design Wind Load

## [1.1] Using the Analytical Method - ASCE 7 - 05

The procedure to det ermine Design Wind Load is specified by the American Society of Civil Engineers (ASCE) and referenced in the International Building Code (IBC) 2006. F or purposes of this document, the values, equations, and procedures used in this document reference ASCE 7 05, Minimum Design Loads for Buildings and Other Structures. Please refer to ASCE 7 05 if you have any questions about the definitions or procedures presented in this manual

The wind force analysis is based on ASCE 7 05, Chapter 6. Upon review of the different methods available for calculating wind loading, it has been determined that Method 2 (Analytical Procedure) is most appropriate. Specifically Section 6.5.13 (Design Wind Loads on Open Buildings with Mono sloped, pit ched, or Troughed Roofs), was select ed as the method most closely approaching the application of Solar Matrix racking system. The pressures are det ermined following Section 6.5.13.2 (Main Wind Force Resisting System) according t o the following formula:

$p = q_h \times G \times C_n$ **Equation 1**

Where

p = design wind pressure (+ denotes down towards the roof)

qh = velocity pressure evaluated at mean roof height

G = gust effect factor as det ermined in ASCE 7 - 05Section 6.5.8

Cn = net pressure coefficient determined from ASCE 7 - 05 Fig.6 - 18A, p.66.

## [1.2] Determine the Velocity Pressure according 6.5.10

**$q_z = q_h = 0.00256 \times K_z \times K_{zt} \times K_d \times V^2 \times I = 17.63$( lb/ft$^2$,psf)**

**Wind Speed, V =100 mph(45m/s)**

**Importance Factor I = 1 (Table 6-1)**

**Direct. Factor, Kd = 0.85 (Table 6-4)**

**Topo. Factor, Kzt = 1.00 (Sect.6.5.7)**

**Topographic Factor, Kz= 0.81 (Table 6-3)**

[1.3] Determine the Gust Effect Factor, G

The gust factor, G , is determined to equal 0.85, according to Equation 1, then going to ASCE 7-05 Section 6.5.8.1, and using the structure definition from ASCE 7-05, Section 6-2.

[1.4] Determine the Net Pressure Coefficient, Cn

The net pressure coefficient, Cn, can be determined from ASCE 7-05 Fig. 6-18A, p.66.

**Cn=-0.9**

**Cn=-1.3**

[1.5] Calculate the Design Wind Load, p (psf)

The max uplift Velocity Pressure = **qh × G × Cn = -13.49 psf**

The max down Velocity Pressure = **qh × G × Cn = 19.48 psf**

## 2.Load Forces on Solar Matrix Mounting System

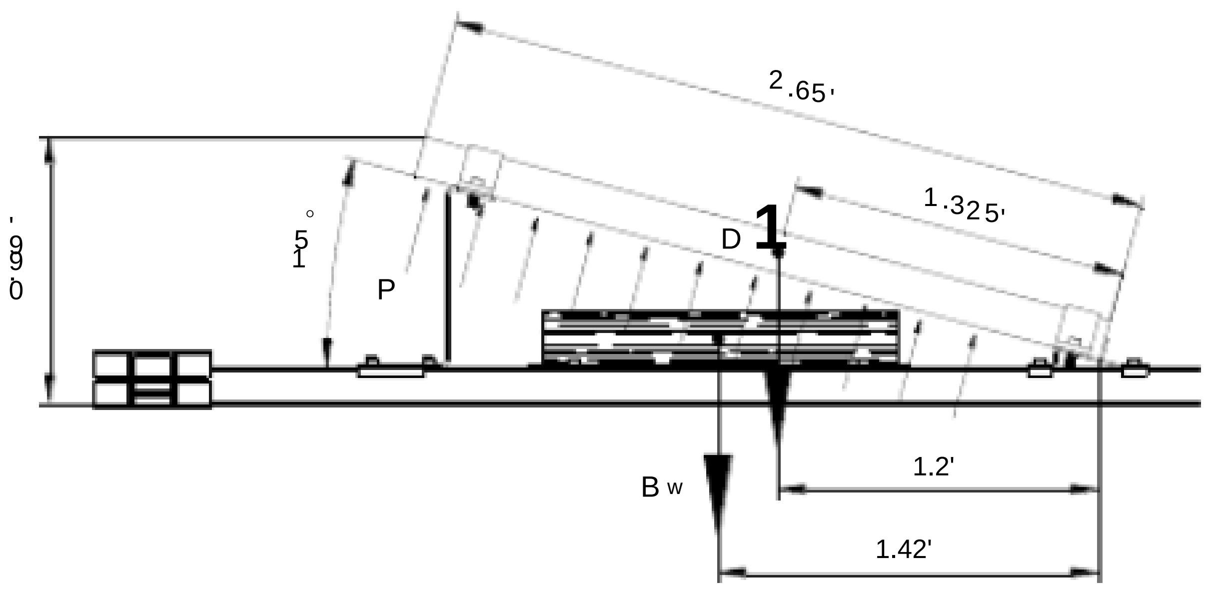
The solar panel's size is 5.18' × 2.65' × 0.15'

The weight is 18 Kg .

So the module area = 5.18 × 2.65 = 13.73 sq ft

The Dead load (not include the ballast) $D_1$ = 59 lbf

The total occupation area for the simplify system is A about 19.67 sq ft




OVER VIEW FOR THE SOLAR MATRIX STRUCTURE

For a large Solar Matrix system, the danger is to be turnover by the uplift wind force. We can check the panels on the last row to ensure the system's safety.

The force on the panels on the last row must keep equal. From the figure, we know:

**Bw×1.42+$D_1$×1.2= Wlu × 1.325**

Wlu= max uplift Velocity Pressure x the module area =19.48 ×13.73=267.5 lbf

So,

**Bw=( Wlu x 1.325 -$D_1$× 1.2) /1.42 =( 267.5×1. 325 -59*1.2 ) /1.42= 199.7lbf**

The safety factor is 1.5,

So,

**Bw=1.5 ×199.7=299.6 lbf (It means each ballast weight is 135 kg)**

From the above, the total dead load to roof is:

**D= $D_1$+ Bw= 299.6+59 =358.6 lbf**

So the uniformly distributed load for the Solar Matrix is :

**q= D/A= 358.6/19.67=18.23 psf**