

11/7/2024

Freedom Forever LLC 43445 Buisiness Park Dr., Suite 110 Temecula, CA 92590

Job Number: 514140
Project Name: Tiara Broadie

Project Address: 151 Barnsley Road , Angier, NC

Design Criteria:

Applicable Code = ASCE 7-16

Design Wind Speed = 130 mph (3 Second Gust)

Exposure Category = B

Ground Snow Load = 15 psf Roof Snow Load = 11.55 psf

Module Type = HANWHA QCELL: Q.PEAK DUO BLK ML-G10+ 410

Module Quantity = 10

To whom is may concern,

The above mentioned residential rooftop solar project has been designed to the specifications shown above. The team at Freedom Forever LLC has visited the site to observe the roof and its framing as well as gather other required information for the project. During this observation they did not see any signs of damage or distress to the roof structure which would preclude solar from being installed. Based on that review and the information provided, the calculations on the following pages were completed to determine the adequacy of the roof framing as well as the allowable attachment spacing for the PV panels. The calculations show that the roof can support the proposed PV system without structural modifications.

Mounting Plane	1	2	3	4	5	6	7	8	9	10
Roof Type	Comp Shingle									
Framing Type	Rafter									
Framing Size	2x4 @ 24									
Upgrade Size	NA									
Attachment Type	Ecotasten Rockit Smart									
Lag Count	2									
Embedment Depth	2									

Sincerely,

Taqi Khawaja, PE Freedom Forever LLC



Wind Calculations

Pressures based on Section 29.4.4

$$p = q_h(GC_p)(\gamma_E)(\gamma_a)$$

$$q_h = .00256 * K_z * K_{zt} * K_d * V^2$$

 $K_z = 0.62$

K_{zt} = 1.0

K_d = 0.85 ASCE7 Table 26.6-1

 $q_z = 22.9 \text{ psf}$

Mounting Plan	0		1		2		3		4		5
Wiounting Flan	E	GC	Wind	GC	Wind	GC	Wind	GC	Wind	GC	Wind
	1	-1.95	-44.72								
	2e	-1.95	-44.72								
	2r	-2.54	-58.18								
Zone	2n	-2.54	-58.18								
	3r	-3.02	-69.19								
	3e	-2.54	-58.18								
	Down	0.46	10.62								

Mounting Plan	0		6		7		8		9	10	
Mounting Plan	e	GC	Wind								
	1										
	2e										
	2r										
Zone	2n										
	3r										
	3e										
	Down										



Snow Load Calculations

Flat Roof Snow Load based on Section 7.3

 $p_f = 0.7C_eC_tI_sp_g$

p_g = 15 $p_f = 11.55$

C_e = 1.00

C_t = 1.10

I_s = 1.0

Mounting Plane		1		2		3		4		5	
Roof Snow Load (psf)	C _s	Snow									
Noor Show Load (psi)	0.83	9.63									

Mounting Plane		6		7		8		9		10	
Roof Snow Load (psf)	C _s	Snow	C _s	Snow	C_s	Snow	C _s	Snow	C_s	Snow	
Nooi Show Load (psi)											

Load Combinations

Dead Load =

3 psf

EM = Edge Module

IM = Interior Module

Uplift

 $\gamma_{\rm E}$ = 1.5

 γ_a = 0.55 per Figure 29.4-8

Mounting Plan	e		1		2		3		4		5
0.6D + 0.6W (psf)		EM	IM	EM	IM	EM	IM	EM	IM	EM	IM
	1	-20.36	-12.97								
	2e	-20.36	-12.97								
Zono	2r	-27.03	-17.42								
Zone	2n	-27.03	-17.42								
	3r	-32.49	-21.06								
	3e	-27.03	-17.42								

Mounting Pla	ne		6		7		8		9	1	10
0.6D + 0.6W (psf)		EM	IM								
	1										
	2e										
7000	2r										
Zone	2n										
	3r										
	3e										



Down Force

Mounting Plane		1		2		3		4		5
Module Location	EM	IM	EM	IM	EM	IM	EM	IM	EM	IM
D+S (psf)	11.32	11.32								
D+06W (psf)	8.08	6.33			·		·			

Mounting Plane		6		7		8		9	1	10
Module Location	EM	IM								
D+S (psf)										
D+06W (psf)										

Lateral Parallel to Roof

Mounting Plane	1	2	3	4	5
D+S (psf)	4.12				

Mounting Plane	6	7	8	9	10
D+S (psf)					

Framing Check

Lumber Species: DF

PV Load = 3 psf

Mounting Plane	1	2	3	4	5
Framing Type	Rafter				
Framing Size	2x4				
Framing Spacing (in)	24				
Span (ft)	7				
Moment (lb-ft)	224				
Shear (lbs)	128				
% Stressed	49%				
Upgrade Size	NA				
New % Stressed	NA				

Mounting Plane	6	7	8	9	10
Framing Type					
Framing Size					
Framing Spacing (in)					
Span (ft)					
Moment (lb-ft)					
Shear (lbs)					
% Stressed					
Upgrade Size					
New % Stressed					



Array Attachment Spacing

Module = HANWHA QCELL: Q.PEAK DUO BLK ML-G10+ 410

Mounting Plane	1	2	3	4	5
Roofing Material	Comp Shingle				
Attachment Type	Ecofasten RockIt Smart Slide				
Lag Count Per Attachment	2				
Min Lag Embedment (in)	2				
Landscape	72				
Portrait	48				

Mounting Plane	6	7	8	9	10
Roofing Material					
Attachment Type					
Lag Count Per Attachment					
Min Lag Embedment (in)					
Landscape					
Portrait					