5/18/2025

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

| | |
|---|---|
| Job Number: | 559074 |
| Project Name: | Theresa Mcnulty |
| Project Address: | 110 Denali Dr , Angier, NC |

**Design Criteria:**

| | | | |
|---|---|---|---|
| Applicable Code = | ASCE 7-16 | | |
| Design Wind Speed = | 130 mph (3 Second Gust) | | |
| Exposure Category = | B | Seismic Design Cat= | A |
| Ground Snow Load = | 15 psf | Roof Snow Load= | 11.55 psf |
| Module Type = | JA Solar: JAM54S31-405/MR | | |
| Module Quantity = | 19 | | |

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 | Truss | | | | | | | | | |
| Framing Size | 2x6 @ 24 | | | | | | | | | |
| Upgrade Size | NA | | | | | | | | | |
| Attachment Type | SnapNRack RL Universal | | | | | | | | | |
| Lag Count | 1 | | | | | | | | | |
| Embedment Depth | 2.5 | | | | | | | | | |

Sincerely,

Taqi Khawaja, PE
Freedom Forever LLC

NORTH CAROLINA PROFESSIONAL SEAL 057554 ENGINEER TAQI KHAWAJA

Digitally Signed by: Taqi Khawaja, PE
Digitally Signed on: 05/18/2025

**Wind Calculations**

Pressures based on Section 29.4.4

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

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

$K_z$ = 0.70

$K_{zt}$ = 1.0

$K_d$ = 0.85 ASCE7 Table 26.6-1

$q_z$ = 25.8 psf

| Mounting Plane | | 1 | | 2 | | 3 | | 4 | | 5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GC | Wind | GC | Wind | GC | Wind | GC | Wind | GC | Wind |
| Zone | 1 | -1.49 | -38.32 | | | | | | | | |
| | 2e | -1.49 | -38.32 | | | | | | | | |
| | 2r | -2.14 | -55.23 | | | | | | | | |
| | 2n | -2.14 | -55.23 | | | | | | | | |
| | 3r | -2.42 | -62.30 | | | | | | | | |
| | 3e | -2.14 | -55.23 | | | | | | | | |
| | Down | 0.46 | 11.94 | | | | | | | | |

| Mounting Plane | | 6 | | 7 | | 8 | | 9 | | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GC | Wind | GC | Wind | GC | Wind | GC | Wind | GC | Wind |
| Zone | 1 | | | | | | | | | | |
| | 2e | | | | | | | | | | |
| | 2r | | | | | | | | | | |
| | 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 | $C_s$ | Snow | $C_s$ | Snow | $C_s$ | Snow | $C_s$ | Snow |
| | 0.73 | 8.47 | | | | | | | | |

| 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 |
| | | | | | | | | | | |

**Load Combinations**

Dead Load = 3 psf EM = Edge Module IM = Interior Module

**Uplift** $\gamma_E$= 1.5 $\gamma_a$= 0.55 per Figure 29.4-8

| Mounting Plane | | 1 | | 2 | | 3 | | 4 | | 5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.6D + 0.6W (psf) | | EM | IM | EM | IM | EM | IM | EM | IM | EM | IM |
| Zone | 1 | -17.21 | -10.87 | | | | | | | | |
| | 2e | -17.21 | -10.87 | | | | | | | | |
| | 2r | -25.59 | -16.46 | | | | | | | | |
| | 2n | -25.59 | -16.46 | | | | | | | | |
| | 3r | -29.10 | -18.80 | | | | | | | | |
| | 3e | -25.59 | -16.46 | | | | | | | | |

| Mounting Plane | | 6 | | 7 | | 8 | | 9 | | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.6D + 0.6W (psf) | | EM | IM | EM | IM | EM | IM | EM | IM | EM | IM |
| Zone | 1 | | | | | | | | | | |
| | 2e | | | | | | | | | | |
| | 2r | | | | | | | | | | |
| | 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) | 9.54 | 9.54 | | | | | | | | |
| D+06W (psf) | 8.62 | 6.64 | | | | | | | | |

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

**Lateral Parallel to Roof**

| Mounting Plane | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| D+S (psf) | 4.65 | | | | |

| 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 | Truss | | | | |
| Framing Size | 2x6 | | | | |
| Framing Spacing (in) | 24 | | | | |
| Span (ft) | 7 | | | | |
| Moment (lb-ft) | 203 | | | | |
| Shear (lbs) | 116 | | | | |
| % Stressed | 21% | | | | |
| 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 = JA Solar: JAM54S31-405/MR

| Mounting Plane | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Roofing Material | Comp Shingle | | | | |
| Attachment Type | SnapNRack RL Universal | | | | |
| Lag Count Per Attachment | 1 | | | | |
| Min Lag Embedment (in) | 2.5 | | | | |
| Landscape | 72 | | | | |
| Portrait | 72 | | | | |

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