9240 Limonite Ave.
Jurupa Valley, CA 92509
(909) 566-0066

24-03399

Re: The Vinyard Residence

Project Address: 9325 Sw Tustenuggee Ave Lake City , FL 32024

To whom it may concern:

I have reviewed the following information regarding photovoltaic module installation on the roof of the above referenced home:

Design drawings of the proposed PV system layout, including details to mount the new solar panels to the existing roof prepared for Better Earth.

Based on the above information, I have evaluated the structural capacity of the existing roof system to support the additional loads imposed by the solar panels and have the following comments related to my review and evaluation:

A. Description of Residence:

The existing residence is typical wood framing construction. All wood material utilized for the roof system is assumed to be SP #2 or better with standard construction components and consists of the following:

- Roofing: Metal Paneling
- Roof framing : 1x2 Trusses at 24 in. on center.

B. Loading Criteria - FBC 2023, ASCE 7-22, IRC SECTION R324

Dead Load:

2.0	PSF	Metal Paneling roofing
1.5	PSF	1/2" Plywood
1.5	PSF	1x2 Trusses
3.0	PSF	Proposed Solar Panels/Mounting Hardware
8.0	**PSF**	**= Roof Dead Load**
20.0	**PSF**	**= Roof Live Load**
156	**mph**	**Design Wind Speed (3-second gust) Risk Category II**
0	**PSF**	**= Snow Load (Based on local requirements)**

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C. Framing

Per the FBC 2023 , 1x2 SP #2 lumber at 24 in. on center with 10 psf dead load shall not exceed 7'-9" in unsupported span length.

D. Solar Panel Racking and Anchorage

1 The solar panels shall be mounted in accordance with the most recent "Unirac Flush Mount Installation Manual", which can be found on the Unirac Solar website (www.unirac.com).

2 Per the U-Builder Project Report, dated 01-20-21 and sealed by Paul K. Zacher, the maximum anchor spacing for 160 mph wind speed, 0 psf ground snow load, exposure C, and roof pitch of 7-27° is 64 in. O.C. which can be found on the Unirac Solar website (www.unirac.com).

3 Maximum allowable pullout per ICC ESR-1976 for a 1/4-14 HWH TEK self tapping screw is 273 lbs. Please see anchorage calculations on the following page. Maximum anchor spacing of 4 ft. is adequate.

4 Racking supports shall be staggered to the roof framing for best lifetime performance of the system.

E. Summary

Based on the information herein and attached to this letter, it is my professional opinion that the proposed installation of the roof mounted photovoltaic modules at the project referenced is structurally adequate and meets or exceeds current industry practices and standards.

F. Limitations

Installations of solar modules and related equipment must be performed in accordance with manufacturer recommendations, local codes, local regulations, industry best practices, and applicable safety standards. Owner and/or Contractor must notify Engineer should any damage, deterioration, or discrepancies between current condition of the structure or otherwise as this letter describes before proceeding with construction. This letter applies only to regions of the structure where solar modules will be supported and the supporting elements.

Please do not hesitate to contact me should you have any comments or questions.
Sincerely,

Ryan McPherson, P.E.
Lic. 91670

(909) 566-0066
se@mcpe.group

RYAN JAMES McPHERSON
LICENSE
No. 91670
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

EXP. 2/28/25

This item has been digitally signed and sealed by Ryan McPherson, PE, on Aug 16, 2024

Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Ryan J McPherson

Digitally signed by Ryan J McPherson
DN: CN=Ryan J McPherson, dnQualifier=A01410D000018FCB95B39700101A35, O=Unaffiliated, C=US
Reason: I have reviewed this document
Date: 2024.08.16 15:25:25-07'00'

Wind Uplift Anchorage

Rooftop Solar Panels Wind Pressures (ASCE 7 - Section 29.4)

V_{ult} =	156.0	mph	K_{zt} =	1.00	(sec 26.8.2)	h = 15	ft
Exposure Category =	C		K_z =	0.85	(sec 26.10.1)		
Roof Zone =	2		K_d =	0.85	(sec 26.6)		
Panel θ =	7-27	deg	K_e =	1.00	(sec 26.9)		
qh = 0.00256 Kz Kzt Kd Ke V			q_h =	45.01	(eq. 26.10-1)		
GP_p =	-2	uplift					

Flush Mounted Panels - ASCE Section 29.4.4 (where applicable)

γ_E =	1.5	FIG 29.4-7)	γ_c =	0.97	(fig 29.4-7)	hpt = 0	
γ_a =	0.76	(fig 29.4-8)	γ_p =	0.9	(fig 29.4-7)	ω =	0.00 deg (panel tilt)
GP_p =	-2	uplift	GC_{rm} =	1.4	uplift		

Flat Roof Panels - ASCE Section 29.4.3 (where applicable)

$p = q_h (GP_p) \gamma_E \gamma_a$ (eq 29.4-7) $p = q_h (GC_{rn}) \gamma_E \gamma_C \gamma_p$ (eq 29.4-6)

p = -103.1 p.s.f. p = 82.5 p.s.f.

Check Anchorage to Existing Structure

0.6DL - 0.6W controlling load combination (eq. 16-15 for ASD)

DL =	2.8	p.s.f.	dead load of panel (inlcuding rack system)
W =	103.1	p.s.f.	wind load normal to face of panel
$Area_{lag}$ =	12.3	sq. ft.	area tributary to each anchor
SP_{anc} =	4.0	ft.	spacing of anchors

$P_{uplift} = Area_{lag} (0.6DL - 0.6W)$ = 742.3 lbs total uplift on anchor

Material =	0.075	in. thk. stl	anchor material
Dia_{lag} =	1/4-14	in.	diameter of screw
□ $_{lag}$ =	273	lb.	withdrawal load per ICC ESR3223
No_{screws} =	3		number of screws in withdrawal

Pallow = Wlag * Noscrews = 819 lbs total allowable withdrawal on anchor

$$\frac{P_{uplift}}{P_{allow}} = \mathbf{0.91} \quad \mathbf{< 1.00} \quad \textbf{Anchor is OK!}$$

Anchorage = USE (1) S-5! VERSA BRACKET W/ (3) 1/4"-14 'HWH' SELF TAPPING TEK SCREWS

m 8m 6

$f := \min\left(\frac{1}{T_{min}}, \frac{1}{T_{max}}\right)$ $f = 2 \cdot Hz$ m m m m

Structure = "Is a rigid structure in accordance with ASCE 7-16 Section 26.2"

m mLm m(mav.) 9m 2ag UmLmag47

Exp := C m m(mag U2v237 $R_c := 1$ m m(m m) 25.) 7

$V_{ult} := 156mph$ m m m(6 m 2m) U94 7 $K_d := 0.85$ m m(mag U2J.) 7

$G_w = 0.85$ m m m(mag U242) 7 $K_z = 0.85$ m m(mag423.) 7

$C_f := 1.7$ 2m m m(m m 2ag42k.) 7m $K_{zt} := 1.0$ m m(mag U2M2g7

$h_{max} := 6ft$ $\omega := 1.3$ m m m 2m m m

$q_h := 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot V_{ult}^2$ $q_h = 45 \cdot psf$ m m(mav.) 9ag423 2g7

$p := \max\left(q_h \cdot G_w \cdot C_f, 16psf\right)$ $p = 65 \cdot psf$ m m m(mav.) 9m 2agM2k.) 7

$A_s := 9.28ft^2$ m m m m

$P_w := p \cdot A_s$ $P_w = 603.6\,lb$ m m m m m m

$M := P_w \cdot h_{max}$ $M = 3622\,lb \cdot ft$ m m m m m

PROPERTIES:

$h_{max} := 6ft$ $W_{pwrwl} := 400lb$ m m m m

SEISMIC LOADS: ASCE 7-16

Seismic Ground Motion Values

Site_Class := D Site Class (Section 11.4.2)

$S_s := 0.081$ Short-period Spectral Response Acceleration

$S_1 := 0.049$ 1-Sec Period Spectral Response Acceleration

$F_a := 1.2$ TABLE 11.4-1 $F_v := 1.7$ TABLE 11.4-2

$S_{DS} := \frac{2}{3} \cdot F_a \cdot S_s$ $S_{DS} = 0.086$ Short Period Design Spectral Acceleration Parameter (Eq. 11.4-3)

$a_p := 1$

$S_{D1} := \frac{2}{3} \cdot F_v \cdot S_1$ $S_{D1} = 0.078$ 1-Sec Period Design Spectral Acceleration Parameter (Eq. 11.4-4)

mv.) Um m) 32Jm m m

8

$R_p := 2.5$ $\Omega_0 := 1.5$) 32U.) $I_p := 1$ m) 32) 23

$z := 4 = 4$ $h := 6 = 6$ $W_p := W_{pwrwl} = 400\ lb$

$$F_p := \frac{0.4 \cdot a_p \cdot S_{DS} \cdot W_p}{\left(\frac{R_p}{I_p}\right)} \cdot \left(1 + 2\frac{z}{h}\right)$$

$F_{p\_max} := 1.6 \cdot S_{DS} \cdot I_p \cdot W_{pwrwl} = 55.3\ lb$

$F_{p\_min} := 0.3 \cdot S_{DS} \cdot I_p \cdot W_{pwrwl} = 10.4\ lb$

$F_p = 12.9\ lb$ m m

BATTERY ATTACHMENT TO RAIL:

$D := \frac{1}{4}in$ 2n m m $No_{lags} := 4$ m m m

$\frac{F_p}{No_{lags}} = 3.226\,lb$ m m m nk m m

$W := 376lb$ m m m m

$F_a := W = 376\,lb$

$Z_{ll} := 838lb$

$\frac{F_a \cdot No_{lags}}{F_p} = 116.567$ >m) 29

$\frac{Z_{ll} \cdot No_{lags}}{W_p} = 8.38$ >m) 29

m(k 7m) 6k .m) k m m m m m(7m) g. m m
m m m m m m m m m

RAIL ATTACHMENT TO PIPE:

$D := \frac{1}{4}in$ 2n m m $No_{lags} := 2$ m m m

$\frac{F_p}{No_{lags}} = 6.451\,lb$ m m ngm m

$W := 376lb$ m m m m

$F_a := W = 376\,lb$

$Z_{ll} := 838lb$

$\frac{F_a \cdot No_{lags}}{F_p} = 58.284$ >m) 29

$\frac{Z_{ll} \cdot No_{lags}}{W_p} = 4.19$ >m) 29

m(g 7m) 6k .) k m m m m m(7m) g. m m
m m m m m m m m m

McPherson Engineering
9240 Limonite Ave.
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(909) 566-0066

Project Title:
Engineer:
Project ID:
Project Descr: McPherson Engineering

Pole Footing Embedded in Soil

Project File: wall stud check_backup_1 - Copy.ec6

DESCRIPTION: Pole footing

Code References

Calculations per IBC 2021 1807.3, ASCE 7-16
Load Combinations Used : IBC 2021

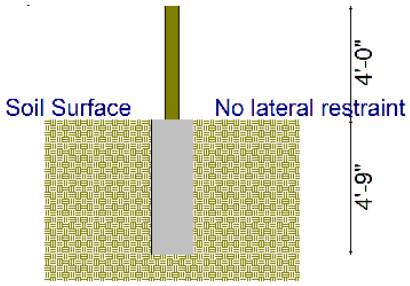
General Information

Pole Footing Shape	Circular
Pole Footing Diameter	18.0 in
Calculate Min. Depth for Allowable Pressures	
No Lateral Restraint at Ground Surface	
Allow Passive	150.0 pcf
Max Passive	1,500.0 psf

Controlling Values

Governing Load Combination	+D+0.60W
Lateral Load	0.3624 k
Moment	1.450 k-ft
NO Ground Surface Restraint	
Pressures at 1/3 Depth	
Actual	**233.001** psf
Allowable	**234.230** psf
Minimum Required Depth	**4.750 ft**
Footing Base Area	1.767 ft^2
Maximum Soil Pressure	0.2264 ksf

Point Load



Applied Loads

Lateral Concentrated Load (k)		Lateral Distributed Loads (k		Vertical Load (k)	
D : Dead Load	k		k/ft	0.40	k
Lr : Roof Live	k		k/ft		k
L : Live	k		k/ft		k
S : Snow	k		k/ft		k
W : Wind	0.6040 k		k/ft		k
E : Earthquake	k		k/ft		k
H : Lateral Earth	k		k/ft		k
Load distance above ground surface	4.0 ft	TOP of Load above ground surface	ft		
		BOTTOM of Load above ground surface	ft		

Load Combination Results

	Forces @ Ground Surface		Required	Pressure at 1/3 Depth		Soil Increase
Load Combination	Loads - (k)	Moments - (ft-k)	Depth - (ft)	Actual - (psf)	Allow - (psf)	Factor
D Only	0.000	0.000	0.13	0.0	0.0	1.000
+D+0.60W	0.362	1.450	4.75	233.0	234.2	1.000
+D+0.450W	0.272	1.087	4.25	207.9	208.6	1.000
+0.60D+0.60W	0.362	1.450	4.75	233.0	234.2	1.000
+0.60D	0.000	0.000	0.13	0.0	0.0	1.000