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

24-07673

Re: The Carlisle Residence

Project Address: 246 SW Crockett Way 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 the above mentioned property.

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 : 2x4 Rafters at 24 in. on center.

B. Loading Criteria - FBC 2020, ASCE 7-16, IRC SECTION R324

Dead Load:

2.0	PSF	Metal Paneling roofing
1.5	PSF	1/2" Plywood
1.5	PSF	2x4 Rafters
3.0	PSF	Proposed Solar Panels/Mounting Hardware
8.0	**PSF**	**= Roof Dead Load**
20.0	**PSF**	**= Roof Live Load**
120	**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 CBC 2022 , 2x4 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 "K2 Systems Assembly Instructions", which can be found on the K2 Systems website (www.k2-systems.com).

2 Per the K2 Systems Master Certification Letter, dated 6-7-2022 and sealed by Paul K. Zacher, the maximum anchor spacing for 120 mph wind speed, 0 psf ground snow load, exposure C, and roof pitch of 7-27° is 62 in. O.C.which can be found on the K2 Systems website (www.k2-systems.com).

3 Maximum allowable pullout per ICC ESR-1976 for a #14 HWH TEK self tapping screw is 208 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 J McPherson

Digitally signed by Ryan J McPherson
Date: 2024.11.06 17:07:41 -08'00'

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 Nov 06, 2024

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

Wind Uplift Anchorage

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

V_{ult} =	120.0 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 =	26.63	(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)
γ_a =	0.76	(fig 29.4-8)	γ_p =	0.9	(fig 29.4-7)
GP_p =	-2	uplift	GC_{rm} =	1.4	uplift

Flat Roof Panels - ASCE Section 29.4.3 (where applicable)

hpt = 0

ω = 0.00 deg (panel tilt)

$p = q_h (GP_p) \gamma_E \gamma_a$ (eq 29.4-7) p = -61.0 p.s.f.

$p = q_h (GC_{rn}) \gamma_E \gamma_C \gamma_p$ (eq 29.4-6) p = 48.8 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 =	61.0	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) =	430.8	lbs	total uplift on anchor
Material =	SP	lumber	anchor material
Dia_{lag} =	#14	in.	diameter of screw
Penlag =	2.5	in.	min. penetration to existing framing
W_{lag} =	208	lb.	withdrawal load per ICC ESR3223
CD =	1.6		load duration factor for wind per NDS Table 2.3.2
Ct =	0.8		temperature factor per NDS Table 2.3.3
No_{screws} =	3		number of screws in withdrawal
Pallow = Wlag * Noscrews =	1996.8	lbs	total allowable withdrawal on anchor

$$\frac{P_{uplift}}{P_{allow}} = \mathbf{0.22} \quad \mathbf{< 1.00} \quad \mathbf{Anchor\ is\ OK!}$$

Anchorage = USE (3) #14 SCREW(S) AT 4FT. MAX. O.C. W/ 2.5IN. MIN. PENETRATION