BLUE RAVEN SOLAR, LLC.
Firm License No. D-0369
1403 North Research Way , Bldg. J
Orem, UT 84097

April 28, 2021

To: Blue Raven Solar
1220 S. 630 E. Ste. 430
American Fork, UT. 84003

Subject: Certification Letter
MacCormack Residence
112 Old Barn Way
Fuquay-Varina, NC. 27526

To Whom It May Concern,

A jobsite observation of the condition of the existing framing system was performed by an audit team of Blue Raven Solar. All attached structural calculations are based on these observations and the design criteria listed below.

On the above referenced project, the roof structural framing has been reviewed for additional loading due to the installation of the solar PV addition to the roof. The structural review, including the plans and calculations only apply to the section of the roof that is directly supporting the solar PV system and its supporting elements. The observed roof framing is described below.

The roof structure of (MP1,2&3) consists of composition shingle on roof plywood that is supported by pre-manufactured trusses that are spaced at @ 24"o.c.. The top chords, sloped at 31 degrees, are 2x4 sections, the bottom chords are 2x4 sections and the web members are 2x4 sections. The truss members are connected by steel gusset plates. The max unsupported projected horizontal top chord span is approximately 7'-0''.

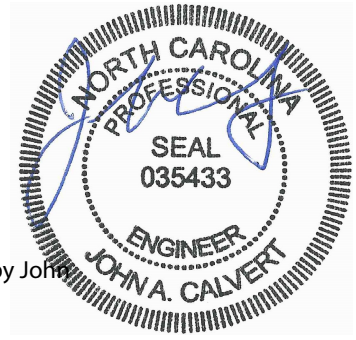
The existing roof framing system of (MP1,2&3) are judged to be adequate to withstand the loading imposed by the installation of the solar panels. No reinforcement is necessary. Where it is required for standoffs, install vertical 2x6 blocking between truss top chords. Attach block to adjacent trusses with Simpson A34 clips at each end. See attached detail for further specifications.

The spacing of the solar standoffs should be kept at 72" o.c. for landscape and 48" o.c. for portrait orientation, with a staggered pattern to ensure proper distribution of loads.

The scope of this report is strictly limited to an evaluation of the fastener attachment, underlying framing and supporting structure only. The attachment's to the existing structure are required to be in a staggered pattern to ensure proper distribution of loading. All panels, racking and hardware shall be installed per manufacturer specifications and within specified design limitations. All waterproofing shall be provided by the manufacturer.

Design Criteria:

- Applicable Codes = 2018 North Carolina State Building Code (NCSBC), ASCE7-10, and NDS-12
- Roof Dead Load = 7 psf (MP1,2&3)
- Roof Live Load = 20 psf
- Wind Speed = 115 mph, Exposure C
- Ground Snow Load = 15 psf - Roof Snow Load = 10.5 psf
- Attachments: (1) 5/16" dia lag screw with 2.5" min embedment depth, at spacing shown above.

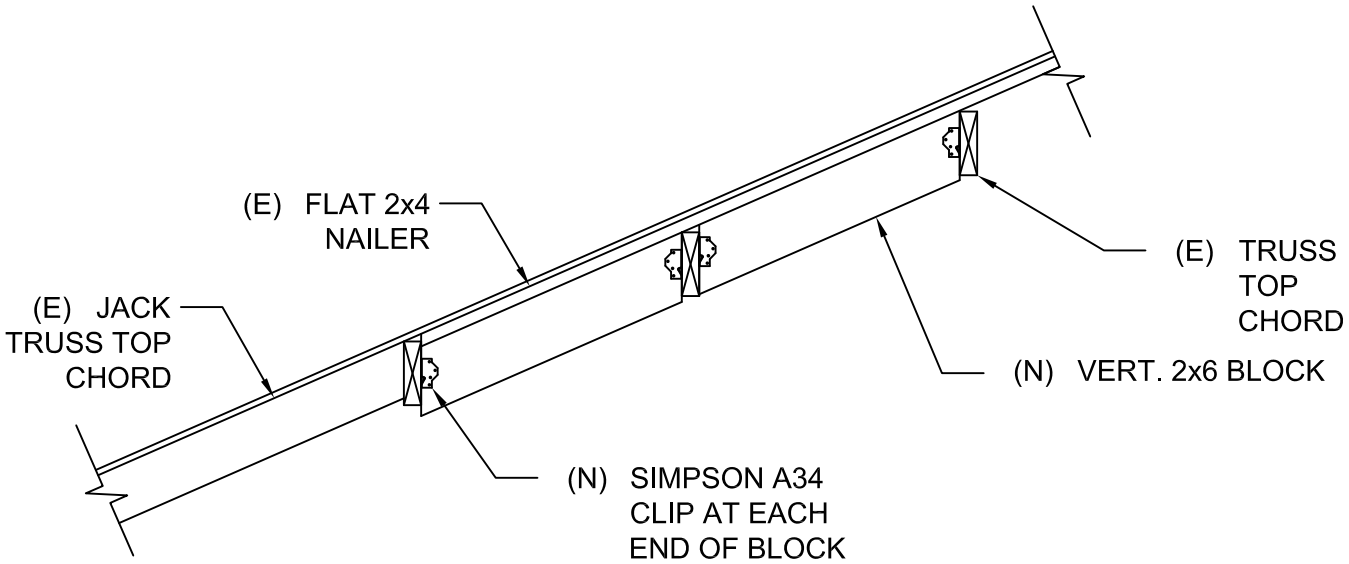


Please contact me with any further questions or concerns regarding this project.

Sincerely,

Digitally signed by John A. Calvert
Date: 2021.04.28 19:21:10 -06'00'

John Calvert, P.E.
Project Engineer



W1

TRUSS BLOCK INSTALL - ELEV.

4/28/2021

PROJECT NAME: Blocking Install		Scale: N.T.S.	
Domus Structural Engineering, LLC. 1210 Birch Street Broomfield, CO 80020 (303) 466- 3014 Domusstructural@gmail.com		Date: 9/20/16	
		Project Number: Solar PV	
	Project Description: Blocking for standoff attachment	Drawn By: JAC	Drawing Name: BLK1
		Revisions:	
		A	
		B	

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Wind Calculations

Per ASCE7-10 Components and Cladding

Input Variables	
Wind Speed	115 mph
Exposure Category	C
Roof Shape	Gable/Hip
Roof Slope	31 degrees
Mean Roof Height	20 ft
Effective Wind Area	19.3 ft

Design Wind Pressure Calculations		
Wind Pressure P = qh*G*Cn		
qh = 0.00256 * Kz * Kzt * Kd * V^2		(Eq. 30.3-1)
Kz (Exposure Coefficient) =	0.9	(Table 30.3-1)
Kzt (topographic factor) =	1	(Fig. 26.8-1)
Kd (Wind Directionality Factor) =	0.85	(Table 26.6-1)
V (Design Wind Speed) =	115 mph	(Fig. 26.5-1A)
Risk Category =	II	(Table 1.5-1)
qh =	25.90	
0.6 * qh =	15.54	

Standoff Uplift Calculations-Portrait					
	Zone 1	Zone 2	Zone 3	Positive	
GCp =	-0.94	-1.15	-1.15	0.84	(Fig. 30.4-1)
Uplift Pressure =	-14.67 psf	-17.91 psf	-17.91 psf	21.7 psf	
X Standoff Spacing =	4.00	4.00	2.67		
Y Standoff Spacing =	5.50	2.75	2.75		
Tributary Area =	22.00	11.00	7.33		
Dead Load on Attachment=	66.00	33.00	22.00		
Footing Uplift (0.6D+0.6W) =	**-283 lb**	**-177 lb**	**-118 lb**		

Standoff Uplift Calculations-Landscape					
	Zone 1	Zone 2	Zone 3	Positive	
GCp =	-0.94	-1.15	-1.15	0.84	(Fig. 30.4-1)
Uplift Pressure =	-14.67 psf	-17.91 psf	-17.91 psf	10.0 psf	(Minimum)
X Standoff Spacing =	6.00	6.00	4.00		
Y Standoff Spacing =	3.50	1.75	1.75		
Tributary Area =	21.00	10.50	7.00		
Dead Load on Attachment =	63.00	31.50	21.00		
Footing Uplift (0.6D+0.6W)=	**-270 lb**	**-169 lb**	**-113 lb**		

Standoff Uplift Check	
Maximum Design Uplift =	-283 lb
Standoff Uplift Capacity =	450 lb
450 lb capacity > 283 lb demand	**Therefore, OK**

Fastener Capacity Check	
Fastener =	1 - 5/16" dia Lag
Number of Fasteners =	1
Embedment Depth =	2.5
Pullout Capacity Per Inch =	250 lb
Fastener Capacity =	625 lb
w/ F.S. of 1.5 & DOL of 1.6=	667 lb
667.2 lb capacity > 283 lb demand	**Therefore, OK**

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Gravity Loading

Roof Snow Load Calculations		
p_g = Ground Snow Load =	15 psf	
$p_f = 0.7\ C_e\ C_t\ I\ p_g$		(ASCE7 - Eq 7-1)
C_e = Exposure Factor =	1	(ASCE7 - Table 7-2)
C_t = Thermal Factor =	1	(ASCE7 - Table 7-3)
I = Importance Factor =	1	
p_f = Flat Roof Snow Load =	10.5 psf	
$p_s = C_s p_f$		(ASCE7 - Eq 7-2)
Cs = Slope Factor =	1	
p_s = Sloped Roof Snow Load =	**10.5 psf**	

PV Dead Load = 3 psf (Per Blue Raven Solar)

PV System Weight	
Weight of PV System (Per Blue Raven Solar)	3.0 psf
X Standoff Spacing =	4.00 ft
Y Standoff Spacing =	5.50 ft
Standoff Tributary Area =	22.00 sft
Point Loads of Standoffs	**66 lb**

Note: PV standoffs are staggered to ensure proper distribution of loading

Roof Live Load = 20 psf

Note: Roof live load is removed in area's covered by PV array.

Roof Dead Load (MP1,2&3)		
Composition Shingle	4.00	
Roof Plywood	2.00	
2x4 Top Chords @ 24"o.c.	0.73	
Vaulted Ceiling	0.00	(Ceiling Not Vaulted)
Miscellaneous	0.27	
Total Roof DL (MP1,2&3)	**7.0 psf**	
DL Adjusted to 31 Degree Slope	8.2 psf	

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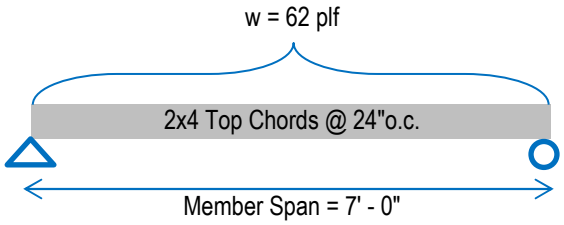
Framing Check

(MP1,2&3) **PASS**

Dead Load	8.2 psf
PV Load	3.0 psf
Live Load	20.0 psf

Governing Load Combo = DL + LL
Total Load **31.2 psf**



Member Properties

Member Size	S (in^3)	I (in^4)	Lumber Sp/Gr	Member Spacing
2x4	3.06	5.36	DF#2	@ 24"o.c.

Check Bending Stress

Fb (psi) =	f'b	x	Cd	x	Cf	x	Cr	(NDS Table 4.3.1)
	900	x	1.25	x	1.5	x	1.15	

Allowed Bending Stress = 1940.6 psi

Maximum Moment = (wL^2) / 8
= 381.7888 ft#
= 4581.466 in#

Actual Bending Stress = (Maximum Moment) / S
= 1496 psi

Allowed > Actual -- 77.1% Stressed -- Therefore, OK

Check Deflection

Allowed Deflection (Total Load) = L/180 (E = 1600000 psi Per NDS)
= 0.466 in
Deflection Criteria Based on = Continuous Span
Actual Deflection (Total Load) = (w*L^4) / (185*E*I)
= 0.164 in
= L/513 > L/180 **Therefore OK**

Allowed Deflection (Live Load) = L/240
0.35 in
Actual Deflection (Live Load) = (w*L^4) / (185*E*I)
0.105 in
L/800 > L/240 **Therefore OK**

Check Shear

Member Area = 5.3 in^2 Fv (psi) = 180 psi (NDS Table 4A)
Allowed Shear = Fv * A = 945 lb Max Shear (V) = w * L / 2 = 218 lb

Allowed > Actual -- 23.1% Stressed -- Therefore, OK