

# BARUN CORP

January 25, 2022

RE: CERTIFICATION LETTER

Project Address: Ruth Frame Residence  
1296 Young Rd  
Angier, NC 27501

## Design Criteria:

- Applicable Codes = 2018 NCBC, 2018 NCRC, ASCE 7-10, and 2015 NDS
- Risk Category = II
- Wind Speed = 120 mph, Exposure Category C, Partially/Fully Enclosed Method
- Ground Snow Load = 15 psf
- MP 1: 2x4 @ 16" OC, Roof DL = 7 psf, Roof LL/SL = 16 psf (Non-PV), Roof LL/SL = 6.9 psf (PV)
- MP 2: 2x8 @ 24" OC, Roof DL = 8 psf, Roof LL/SL = 15 psf (Non-PV), Roof LL/SL = 6.4 psf (PV)

To Whom It May Concern,

A jobsite survey of the existing framing system of the address indicated above was performed . All structural evaluation is based on the site inspection observations and the design criteria listed above.

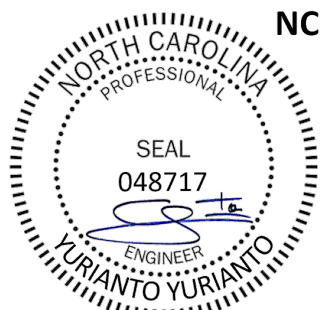
Existing roof structural framing has been reviewed for additional loading due to installation of PV Solar System on the roof. The structural review applies to the sections of roof that is directly supporting the solar PV system.

Based on this evaluation, I certify that the alteration to the existing structure by installation of the PV system meets the requirements of the applicable existing building and/or new building provisions adopted/referenced above.

Additionally, the PV module assembly including attachment hardware has been reviewed to be in accordance with the manufacturer's specifications and to meet and/or exceed the requirements set forth by the referenced codes.

Sincerely,

Yuri Yurianto, S.E., P.E.



By Yuri at 7:34:30 AM, 1/25/2022

# MP 1

PV System Dead Load (PV-DL)		
PV module weight		2.5 psf
Hardware assembly weight		0.5 psf
	<b>PV-DL</b>	<b>3 psf</b>

Roof Dead Load (R-DL)	Material	Panel Area
Existing Roofing Material	Comp Roof 1 layers	2.5 psf
Underlayment		0.5 psf
Plywood Sheathing		1.5 psf
Rafter Size and Spacing	2 x 4 @ 16 in. O.C.	1.09 psf
Vaulted ceiling	No	0 psf
Miscellaneous		1.5 psf
<b>Total Roof Dead Load</b>	<b>R-DL</b>	<b>7 psf</b>

Reduced Roof Live Load (Lr)	Expression	Value
Roof Live Load	$L_o$	20.0 psf
Member Tributary Area	$A_t$	< 200 sf
Roof 1 Roof Pitch		8.5/12 or 34°
Trubutary Area Reduction	$R_1$	1
Slope Roof Reduction	$R_2$	0.8
Reduced Roof Live Load	$L_r = L_o (R_1) (R_2)$	<b>16.0 psf</b>

Snow Load	Value
Ground Snow Load	$p_g$ 15
Effective Roof Slope	34°
Snow Importance Factor	$I_s$ 1.0
Snow Exposure Factor	$C_e$ 1.0
Snow Thermal Factor	$C_t$ 1.1
Minimum Flat Roof Snow Load	$p_{f-min}$ 15
Flat Roof Snow Load	$p_f$ <b>11.55</b>

Slope Roof Snow Load on Roof	(All other surfaces)
Roof Slope Factor	$C_{s-roof}$ 1.00
	<b><math>p_{s-roof}</math> 11.60</b>

Sloped Roof Snow Load on PV	(Unobstructed slippery surfaces)
Roof Slope Factor	$C_{s-pv}$ 0.60
	<b><math>p_{s-pv}</math> 6.90</b>



**WoodWorks**  
SOFTWARE FOR WOOD DESIGN

**COMPANY**  
  
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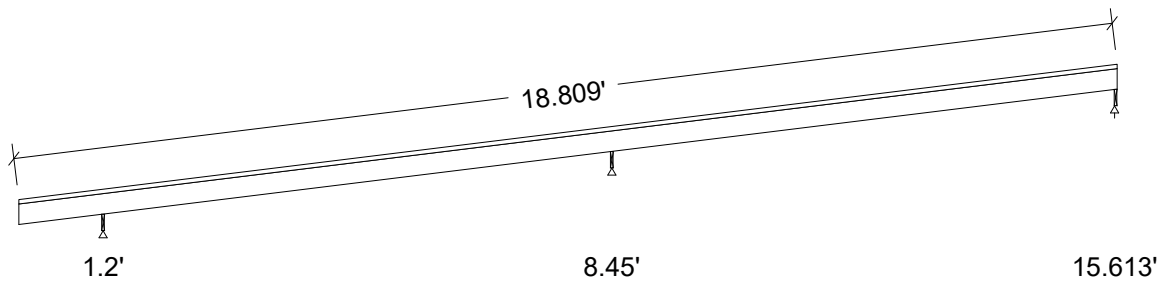
**PROJECT**  
  
MP 1

**Design Check Calculation Sheet**  
WoodWorks Sizer 2019 (Update 2)

**Loads:**

Load	Type	Distribution	Pat-tern	Location [ft]		Magnitude		Unit
				Start	End	Start	End	
DL	Dead	Full Area	No			7.00	(16.0")	psf
DL-PV	Dead	Partial Area	No	1.50	12.00	3.00	(16.0")	psf
SL-PV	Snow	Partial Area	No	1.50	12.00	6.90	(16.0")	psf
LL-RF1	Live	Partial Area	No	0.00	1.50	16.00	(16.0")	psf
LL-RF2	Live	Partial Area	No	12.00	15.65	16.00	(16.0")	psf

**Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :**



Unfactored:						
Dead		62		129		36
Live		31		23		56
Snow		26		67		4
Factored:						
Total		105		196		91
Bearing:						
F'theta		546		546		537
Capacity						
Joist		717		717		403
Support		586		586		469
Des ratio						
Joist		0.15		0.27		0.23
Support		0.18		0.33		0.20
Load comb		#3		#3		#2
Length		0.50*		0.50*		0.50*
Min req'd		0.09**		0.17**		0.11
Cb		1.75		1.75		1.00
Cb min		1.75		1.75		1.00
Cb support		1.25		1.25		1.00
Fcp sup		625		625		625

\*Minimum bearing length setting used: 1/2" for end supports and 1/2" for interior supports

\*\*Minimum bearing length governed by the required width of the supporting member.

**MP 1**

**Lumber-soft, S-P-F, No.1/No.2, 2x4 (1-1/2"x3-1/2")**

Supports: All - Timber-soft Beam, D.Fir-L No.2

Roof joist spaced at 16.0" c/c; Total length: 19.0'; Clear span(horz): 1.188', 7.188', 7.125'; Volume = 0.7 cu.ft.; Pitch: 8.5/12

Lateral support: top = continuous, bottom = at end supports; Repetitive factor: applied where permitted (refer to online help);

**This section PASSES the design code check.**

WARNING: Member length exceeds typical stock length of 18.0 ft

**Analysis vs. Allowable Stress and Deflection using NDS 2018 :**

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 25	Fv' = 155	psi	fv/Fv' = 0.16
Bending(+)	fb = 435	Fb' = 1509	psi	fb/Fb' = 0.29
Bending(-)	fb = 588	Fb' = 1155	psi	fb/Fb' = 0.51
Live Defl'n	0.10 = < L/999	0.43 = L/240	in	0.23
Total Defl'n	0.18 = L/571	0.57 = L/180	in	0.31

**Additional Data:**

FACTORS:	F/E (psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
Fv'	135	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	4
Fb'+	875	1.00	1.00	1.00	1.000	1.500	-	1.15	1.00	1.00	-	2
Fb'-	875	1.15	1.00	1.00	0.665	1.500	-	1.15	1.00	1.00	-	3
Fcp'	425	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
E'	1.4 million	1.00	1.00	-	-	-	-	-	1.00	1.00	-	2
Emin'	0.51 million	1.00	1.00	-	-	-	-	-	1.00	1.00	-	2

**CRITICAL LOAD COMBINATIONS:**

Shear : LC #4 = D + S  
 Bending(+): LC #2 = D + L  
 Bending(-): LC #3 = D + 0.75(L + S)  
 Deflection: LC #2 = D + L (live)  
               LC #2 = D + L (total)  
 Bearing : Support 1 - LC #3 = D + 0.75(L + S)  
               Support 2 - LC #3 = D + 0.75(L + S)  
               Support 3 - LC #2 = D + L

D=dead L=live S=snow

All LC's are listed in the Analysis output

Load combinations:

**CALCULATIONS:**

V max = 91, V design = 86 lbs; M(+) = 111 lbs-ft; M(-) = 150 lbs-ft

EIy = 7.50 lb-in<sup>2</sup>

"Live" deflection is due to all non-dead loads (live, wind, snow...)

Total deflection = 1.5 dead + "live"

Bearing: Allowable bearing at an angle F'theta calculated for each support as per NDS 3.10.3

Lateral stability(-): Lu = 17.31' Le = 25.81' RB = 22.0; Lu based on full span

**Design Notes:**

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2018) and the National Design Specification (NDS 2018), using Allowable Stress Design (ASD). Design values are from the NDS Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Continuous or Cantilevered Beams: NDS Clause 4.2.5.5 requires that normal grading provisions be extended to the middle 2/3 of 2 span beams and to the full length of cantilevers and other spans.
4. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.
5. SLOPED BEAMS: level bearing is required for all sloped beams.
6. The critical deflection value has been determined using maximum back-span deflection. Cantilever deflections do not govern design.

## MP 2

PV System Dead Load (PV-DL)		
PV module weight		2.5 psf
Hardware assembly weight		0.5 psf
	<b>PV-DL</b>	<b>3 psf</b>

Roof Dead Load (R-DL)	Material	Panel Area
Existing Roofing Material	Comp Roof 1 layers	2.5 psf
Underlayment		0.5 psf
Plywood Sheathing		1.5 psf
Rafter Size and Spacing	2 x 8 @ 24 in. O.C.	1.56 psf
Vaulted ceiling	No	0 psf
Miscellaneous		1.5 psf
<b>Total Roof Dead Load</b>	<b>R-DL</b>	<b>8 psf</b>

Reduced Roof Live Load (Lr)	Expression	Value
Roof Live Load	$L_o$	20.0 psf
Member Tributary Area	$A_t$	< 200 sf
Roof 2 Roof Pitch		9.5/12 or 37°
Trubutary Area Reduction	$R_1$	1
Slope Roof Reduction	$R_2$	0.75
Reduced Roof Live Load	<b><math>L_r = L_o (R_1) (R_2)</math></b>	<b>15.0 psf</b>

Snow Load	Value
Ground Snow Load	$p_g$ 15
Effective Roof Slope	37°
Snow Importance Factor	$I_s$ 1.0
Snow Exposure Factor	$C_e$ 1.0
Snow Thermal Factor	$C_t$ 1.1
Minimum Flat Roof Snow Load	$p_{f-min}$ 15
Flat Roof Snow Load	<b><math>p_f</math> 11.55</b>

Slope Roof Snow Load on Roof	(All other surfaces)
Roof Slope Factor	$C_{s-roof}$ 1.00
	<b><math>p_{s-roof}</math> 11.60</b>

Sloped Roof Snow Load on PV	(Unobstructed slippery surfaces)
Roof Slope Factor	$C_{s-pv}$ 0.55
	<b><math>p_{s-pv}</math> 6.40</b>

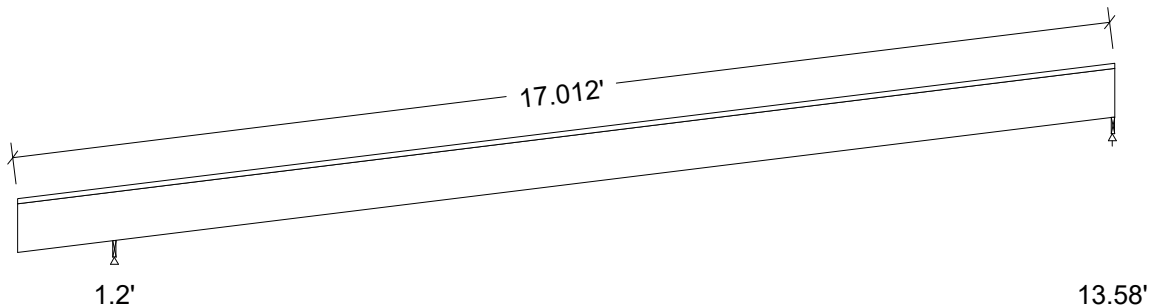


**Design Check Calculation Sheet**  
WoodWorks Sizer 2019 (Update 2)

**Loads:**

Load	Type	Distribution	Pat-tern	Location [ft]		Magnitude		Unit
				Start	End	Start	End	
DL	Dead	Full Area	No			8.00	(24.0")	psf
DL-PV	Dead	Partial Area	No	1.50	10.00	3.00	(24.0")	psf
SL-PV	Snow	Partial Area	No	1.50	10.00	6.40	(24.0")	psf
LL-RF1	Live	Partial Area	No	0.00	1.50	15.00	(24.0")	psf
LL-RF2	Live	Partial Area	No	10.00	13.61	15.00	(24.0")	psf

**Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :**



Unfactored:			
Dead		189	147
Live		62	92
Snow		69	40
Factored:		287	246
Bearing:			
F'theta		567	567
Capacity			
Joist		744	425
Support		586	469
Des ratio			
Joist		0.39	0.58
Support		0.49	0.52
Load comb		#3	#3
Length		0.50*	0.50*
Min req'd		0.24**	0.29
Cb		1.75	1.00
Cb min		1.75	1.00
Cb support		1.25	1.00
Fcp sup		625	625

\*Minimum bearing length setting used: 1/2" for end supports and 1/2" for interior supports

\*\*Minimum bearing length governed by the required width of the supporting member.

**MP 2**

**Lumber-soft, S-P-F, No.1/No.2, 2x8 (1-1/2"x7-1/4")**

Supports: All - Timber-soft Beam, D.Fir-L No.2

Roof joist spaced at 24.0" c/c; Total length: 17.44'; Clear span(horz): 1.188', 12.375'; Volume = 1.3 cu.ft.; Pitch: 9.5/12  
Lateral support: top = continuous, bottom = at supports; Repetitive factor: applied where permitted (refer to online help);

**This section PASSES the design code check.**

**Analysis vs. Allowable Stress and Deflection using NDS 2018 :**

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	$f_v = 23$	$F_v' = 135$	psi	$f_v/F_v' = 0.17$
Bending(+)	$f_b = 651$	$F_b' = 1389$	psi	$f_b/F_b' = 0.47$
Bending(-)	$f_b = 33$	$F_b' = 624$	psi	$f_b/F_b' = 0.05$
Live Defl'n	$0.14 = < L/999$	$0.77 = L/240$	in	0.18
Total Defl'n	$0.62 = L/299$	$1.03 = L/180$	in	0.60

**Additional Data:**

FACTORS:	F/E(ksi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	Cn	LC#
$F_v'$	135	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
$F_b'+$	875	1.15	1.00	1.00	1.000	1.200	-	1.15	1.00	1.00	-	3
$F_b'-$	875	1.00	1.00	1.00	0.516	1.200	-	1.15	1.00	1.00	-	2
$F_{cp}'$	425	-	1.00	1.00	-	-	-	-	1.00	1.00	-	-
$E'$	1.4 million	1.00	1.00	1.00	-	-	-	-	1.00	1.00	-	3
$E_{min}'$	0.51 million	1.00	1.00	1.00	-	-	-	-	1.00	1.00	-	3

**CRITICAL LOAD COMBINATIONS:**

Shear : LC #2 = D + L  
 Bending(+): LC #3 = D + 0.75(L + S)  
 Bending(-): LC #2 = D + L  
 Deflection: LC #3 = D + 0.75(L + S) (live)  
                   LC #3 = D + 0.75(L + S) (total)  
 Bearing : Support 1 - LC #3 = D + 0.75(L + S)  
                   Support 2 - LC #3 = D + 0.75(L + S)

D=dead L=live S=snow

All LC's are listed in the Analysis output

Load combinations:

**CALCULATIONS:**

$V_{max} = 189$ ,  $V_{design} = 169$  lbs;  $M(+)$  = 713 lbs-ft;  $M(-)$  = 36 lbs-ft

$EI_y = 66.69$  lb-in<sup>2</sup>

"Live" deflection is due to all non-dead loads (live, wind, snow...)

Total deflection = 1.5 dead + "live"

Bearing: Allowable bearing at an angle  $F'\theta$  calculated for each support as per NDS 3.10.3

Lateral stability(-):  $L_u = 15.50'$   $L_e = 24.13'$   $R_B = 30.5$ ;  $L_u$  based on full span

**Design Notes:**

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2018) and the National Design Specification (NDS 2018), using Allowable Stress Design (ASD). Design values are from the NDS Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
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