PV LETTERS

Top Tier Solar Solutions
Contractor Address: 1530 Center Park Dr #2911, Charlotte, NC 28217

April 26, 2025

Subject: Proposed Solar Panel Installation
Nicholas Bazzelle Residence, 139 Woodbridge Dr, Spring Lake, NC
DC System Size: 4.860 kW
PV Letters Job #004-22105

To Whom it May Concern,

We have reviewed information, provided by our client, related to the proposed solar panel installation at the above-referenced address. The purpose of the review was to determine if the existing roof is structurally adequate for the proposed installation. Based on our review and analysis of the given information, and in accordance with governing building codes, I certify that the capacity of the structural roof framing that directly supports the additional gravity loading due to the solar panel supports and modules had been reviewed and determined to meet or exceed the requirements in accordance with the Design Criteria.

Design Parameter Summary

Governing Building Code: 2018 North Carolina Residential Code
Risk Category: II
Wind Exposure: B
Design Wind Speed: 120 mph
Ground Snow Load: 15 psf

Roof Information

Roof Structure: 2x4 Manufactured Trusses @ 24" O.C. (assumed)
Roofing Material: Asphalt Shingles (1 layer)
Roof Slope: 23 degrees

Roof Connection Details

Framing Mount Wood Screws: (2) #14 Self-Drilling Screw with a minimum penetration depth of 1.75" into roof truss top chord only, at 72" O.C. max

Engineering Analysis

The proposed installation - including weight of panels, racking, mounts, and inverters where applicable - will be approximately 3 psf. In the areas where panels are installed, roof live loads will not be present. The reduction of roof live load is adequate to fully or partially compensate for the addition of the panel installation. Because the member forces in the area of the solar panels are not increased by more than 5%, and so per provisions in the adopted building codes, the structure need not be altered for gravity loading.

The proposed installation will be 6" max. above the roof surface (flush mounted) and parallel to the roof surface. Therefore, any increase in wind loading on the building structure from the solar panel installation is expected to be negligible. Wind is the governing lateral load case. Because the increase in lateral loading is not increased by more than 10%, per provisions in the adopted building codes, the structure need not be altered for lateral loading.

Wind uplift on the panels has been calculated in accordance with the relevant provisions of ASCE 7-16. This loading has been used to verify the adequacy of the connection specified above. Connection locations should be in accordance with design drawings.

IronRidge XR10 rails will support the modules and will fasten to the roof structure with IronRidge QuickMount Halo Ultragrip along the rail.

Conclusion

The roof structure need not be altered for either gravity loading (including snow) or lateral loading (including wind). Therefore, the existing structure is permitted to remain unaltered. Connections to the roof must be made per the "Roof Connection Details" section above. Copies of all relevant calculations are enclosed.

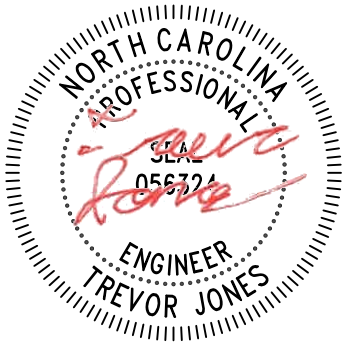
Limitations and Disclaimers

Electrical design is excluded from this analysis. Waterproofing is the sole responsibility of the installer and is also excluded from this analysis. Solar panels must be installed per manufacturer specifications. Structural design and analysis of the adequacy of solar panels, racks, mounts, and other components is performed by each component's respective manufacturer; the undersigned makes no statement of opinion regarding such components. This letter and the opinions expressed herein are rendered solely for the benefit of the permitting authority (city or county building department) and your office, and may not be utilized or relied on by any other party.

If you have any questions or concerns, please contact us at (208)-994-1680, or by email at Projects@pvletters.com.

Sincerely,

Trevor A. Jones, P.E.
4/26/2025



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Standard Loading Comparison

This calculation justifies the additional solar load by comparing existing to proposed gravity loads in the location of the solar panels.

	Without Solar	With Solar	
Dead Load			
Asphalt Shingles	3	3	psf
1/4" Plywood	1	1	psf
Framing	4	4	psf
Insulation	1	1	psf
1/2" Gypsum Ceiling	2	2	psf
M,E, & Misc	1.5	1.5	psf
Solar Panel	0	3	psf
Total Dead Load	12.5	15.5	psf
Snow Load			
Ground Snow Load, P_g	15		psf
Exposure Factor, C_e	0.90		
Thermal Factor, C_t	1.1		
Importance Factor, I_s	1		
Flat Roof Snow Load	10		ASCE 7 Eqn. 7.3-1 or jurisdiction min.
Slope	23		degrees
Unobstructed Slippery Surface?	No	No	
Slope Factor, C_s	1.00	1.00	
Sloped Roof Snow Load	10.4	10.4	psf
Live Load			
Roof Live Load	20	0	psf
Load Combination			
D + Lr	32.5	15.5	psf
D + S	22.9	25.9	psf
Max. Load	32.5	25.9	psf
% of original		**79.68%**	

Result: **Because the total forces are decreased, per the relevant code provisions stated in the body of the letter, the existing roof structure is permitted to remain unaltered.**

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Wood Screw Calculation (per ASCE 7-16)

This calculation justifies the connection of the solar panels to existing roof members, by showing the connection capacity is equal to or greater than the uplift force demands.

Connection Demand

Spacing perpendicular to rail, in	34	
Roof Angle, degrees	23	
Roof Layout	Gable	
Wind Speed, mph	120	
Exposure Coefficient, K_z	0.57	(Table 26.10-1)
Topographic Factor, K_{zt}	1.00	(Table 26.8.1)
Directionality Factor, K_d	0.85	(Table 26.6-1)
Elevation Factor, K_e	1.00	(Table 26.9-1)
Velocity Pressure q_z, psf	18.0	(Table26.10-1)

Zones:	1	2n, 2r, 2e	3r, 3e
Spacing parallel to rail, in	72	72	72
GC_p (max)(Figure 29.4-7)	1.50	2.25	2.57
Exposed Panels? (γ_E = 1.5) (Fig. 29.4-7)	No	No	No
Effective Wind Area on each con., ft^2	16.9	16.9	16.9
Pressure Equalization Factor, γ_a (Figure 29.4-8)	0.71	0.71	0.71
Uplift Force, psf (Equation 29.4-7)	19.1	28.6	32.8
Max. Uplift Force / Connection (0.6 WL), lbs	194.5	291.3	333.4
Solar Dead Load (0.6 DL). Lbs	30.5	30.5	30.5
Max. Uplift Force (0.6 WL - 0.6 DL), lbs	**164.0**	**260.8**	**302.9**

Connection Capacity

Attachment FTG	IronRidge QuickMount Halo Ultragrip	
Attachment location	Framing	
Fastener Type	Wood Screw	
Fastener Diameter, in	0.242	
Embedment Length, in	1.75	
Lumber Species & Grade	SPF #2 (Assumed)	
Nominal Withdrawal Capacity W, lbs	213	
# of Screws	2	
Load Duration Factor C_d	1.6	
Screw Adj. Withdrawal Cap. W', lbs	**681**	
Attachment FTG Strength with Cd, lbs	**1606**	

Max applied load, lbs	303
Max allowable load, lbs	681

Compare Adjusted Withdrawal Capacity to ASD Factored Demand

Zones:	1	2n, 2r, 2e	3r, 3e
	O.K.	O.K.	O.K.