PV LETTERS

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

May 03, 2025

Subject: Proposed Solar Panel Installation
Shirley Harrison Residence, 466 Woodwind Dr, Spring Lake, NC
DC System Size: 10.530 kW
PV Letters Job #004-22515

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: C
Design Wind Speed: 120 mph
Ground Snow Load: 15 psf

Roof Information

Roof Structure: 2x4 @ 24" O.C. (Assumed)
Roofing Material: Metal Roof
Roof Slope: 18, 36 degrees

Roof Connection Details

S-5! ProteaBracket to existing metal roof, at 45" O.C. max
Stagger attachments to avoid overloading any individual truss top chord.

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 7-10. 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 S-5! ProteaBracket 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.
5/3/2025

PV LETTERS

Standard Loading Comparison (Roof 1)

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			
Metal Roof	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	1.00		
Thermal Factor, C_t	1.1		
Importance Factor, I_s	1		
Flat Roof Snow Load	12		ASCE 7 Eqn. 7.3-1 or jurisdiction min.
Slope	36		degrees
Unobstructed Slippery Surface?	No	No	
Slope Factor, C_s	1.00	1.00	
Sloped Roof Snow Load	11.6	11.6	psf
Live Load			
Roof Live Load	20	0	psf
Load Combination			
D + Lr	32.5	15.5	psf
D + S	24.1	27.1	psf
Max. Load	32.5	27.1	psf
% of original		**83.23%**	

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.**

PV LETTERS

Bracket Connection Calculation (per ASCE 7-10) (Roof 1)

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	36
Roof Layout	Gable
Wind Speed, mph	120
Exposure Coefficient, K_z	0.85
Topographic Factor, K_{zt}	1.00
Directionality Factor, K_d	0.85
Elevation Factor, K_e	1.00
Velocity Pressure q_z, psf	26.5
Prying Coefficient	1

Zones:	1	2	3
Spacing parallel to rail, in	45	45	45
GC_p (max)	1.00	2.00	2.00
Exposed Panels? (γ_E = 1.5)	No	No	No
Effective Wind Area on each con., ft^2	10.6	10.6	10.6
Pressure Equalization Factor, γ_a	0.79	0.79	0.79
Uplift Force, psf	20.9	41.9	41.9
Max. Uplift Force / Connection (0.6 WL), lbs	133.1	266.1	266.1
Solar Dead Load (0.6 DL). Lbs	19.1	19.1	19.1
Max. Uplift Force (0.6 WL - 0.6 DL), lbs	**114.0**	**247.1**	**247.1**

Connection Capacity

Connection Type	S-5! ProteaBracket
Ultimate Capacity, lbs	817
Factor of Safety	2.50
Total Capacity, lbs	**326.8**

Compare ASD Factored Demand to Capacity

Demand, lbs	247.1
Capacity, lbs	326.8
Result	**Capacity exceeds demands. Therefore, connection passes.**

PV LETTERS

Standard Loading Comparison (Roof 2)

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			
Metal Roof	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	1.00		
Thermal Factor, C_t	1.1		
Importance Factor, I_s	1		
Flat Roof Snow Load	12		ASCE 7 Eqn. 7.3-1 or jurisdiction min.
Slope	18		degrees
Unobstructed Slippery Surface?	No	No	
Slope Factor, C_s	1.00	1.00	
Sloped Roof Snow Load	11.6	11.6	psf
Live Load			
Roof Live Load	20	0	psf
Load Combination			
D + Lr	32.5	15.5	psf
D + S	24.1	27.1	psf
Max. Load	32.5	27.1	psf
% of original		**83.23%**	

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.**

PV LETTERS

Bracket Connection Calculation (per ASCE 7-10) (Roof 2)

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	18
Roof Layout	Gable
Wind Speed, mph	120
Exposure Coefficient, K_z	0.85
Topographic Factor, K_{zt}	1.00
Directionality Factor, K_d	0.85
Elevation Factor, K_e	1.00
Velocity Pressure q_z, psf	26.5
Prying Coefficient	1

Zones:	1	2	3
Spacing parallel to rail, in	45	45	37.5
GC_p (max)	0.90	2.20	2.60
Exposed Panels? (γ_E = 1.5)	No	No	No
Effective Wind Area on each con., ft^2	10.6	10.6	8.8
Pressure Equalization Factor, γ_a	0.79	0.79	0.80
Uplift Force, psf	18.8	46.1	55.1
Max. Uplift Force / Connection (0.6 WL), lbs	119.8	292.7	292.0
Solar Dead Load (0.6 DL). Lbs	19.1	19.1	15.9
Max. Uplift Force (0.6 WL - 0.6 DL), lbs	**100.7**	**273.7**	**276.1**

Connection Capacity

Connection Type	S-5! ProteaBracket
Ultimate Capacity, lbs	817
Factor of Safety	2.50
Total Capacity, lbs	**326.8**

Compare ASD Factored Demand to Capacity

Demand, lbs	276.1
Capacity, lbs	326.8
Result	**Capacity exceeds demands. Therefore, connection passes.**