3/19/2020

Titan Solar Power
525 W Baseline Rd
Mesa, AZ 85210

Structural Calculations for Residential Rooftop PV Installation

Job: Amanda Preciado
Address: 242 Appleton Way
Sanford, NC 27332

Observation of the condition of the existing framing system was performed by an audit team of Titan Solar Power . After review of the field observation data and based on the accompanying structural capacity calculations, the existing roof framing has been determined to be adequate to support the proposed PV installation without structural upgrades.

Limits of Scope of Work and Liability

Existing structure is assumed to have been designed and constructed following appropriate codes at time of erection, and assumed to have appropriate permits. The calculations produced are only for the roof framing supporting the proposed PV installation referenced in the stamped planset and were completed according to generally recognized structural analysis standards and procedures, professional engineering and design experience, opinions and judgements. Existing deficiencies which are unknown or were not observable during time of inspection are not included in this scope of work. All PV modules, racking, and mounting equipment shall be designed and installed per manufacturer's approved installation specifications. The Engineer of Record and Current Renewables Engineering assume no responsibility for misuse or improper installation. This analysis is not stamped for water leakage. Framing was determined based on information in provided plans and/or photos, along with engineering judgement. Prior to commencement of work, the contractor shall verify the framing sizes, spacings, and spans noted in the stamped plans, calculations, and cert letter (where applicable) and notify the Engineer of Record of any discrepancies prior to starting construction. Contractor shall also verify that there is no damaged framing that was not addressed in stamped plans, calculations, and cert letter (where applicable) and notify the Engineer of Record of any concerns prior to starting construction.

Sincerely,

Current Renewables Engineering Inc.
Professional Engineer
info@currentrenewableseng.com

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Date: 2020.03.19 16:47:44 -07'00'

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Design Criteria:

Code:	2015 International Building Code				
	ASCE 7-10				
Risk Category:	II				
Wind, Vult:	117	mph	Ground Snow Load:	10	psf
Exposure Category:	B		PV Dead Load:	3	psf

Structure Dimensions

Building Width =	40	ft
Building Length =	40	ft
Mean Roof Height =	22	ft
Eave Height =	20	ft

Roof Structure 1

Framing

Attachment Span =	6	ft
Attachment Trib Width =	2.75	ft
Max Frame Span =	8	ft
Framing =	2 x 4 @ 24" OC Truss	
Lumber Species =	Spruce Pine Fir No. 1/No. Assumed	
Width, b =	1.5	in
Depth, d =	3.5	in
Cross Section Area, A =	5.25	in^2
Moment of Inertia, I_{xx} =	5.36	in^4
Section Modulus, S_{xx} =	3.06	in^3
Bending F_b =	875	psi
Shear F_v =	135	psi
Modulus of Elasticity, E =	1400000	psi
Modulus of Elasticity, E_{min} =	510000	psi
C_M =	1	
C_t =	1	
C_L =	1	
C_F =	1.5	
C_{fu} =	1	
C_i =	1	

NOTE: Attachments should be installed in a staggered configuration to properly distribute loading.

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Roof Structure 1 - Continued

C_r =	1.15				
C_{LSF} =	1.00				
$C_{D, Snow}$ =	1.15				
$C_{D, Wind}$ =	1.6				
$M_{all., wind}$ =	616.3	lb-ft	$V_{all., wind}$ =	759.8	lbs
$M_{all., snow}$ =	443.0	lb-ft	$V_{all., snow}$ =	546.1	lbs

Wind Load

Ultimate Wind Speed =	117	mph
Exposure Category =	B	
Risk Category =	II	
Adjustment Factor, λ =	1	
Topographic Factor, K_{zt} =	1	
Roof Pitch =	18	deg
Eff. Wind Area =	18.2	ft^2
Edge Zone Value, a =	4.0	ft

	Up Zone 1	Up Zone 2	Up Zone 3	Downward	
P_{net} =	-23	-38	-57.1	16	psf

Snow Load

Ground Snow Load, Pg =	10	psf
Ce =	0.9	
Ct =	1.2	
Is =	1	
pf =	7.6	psf
Ct =	1.2	
Roof Struc 1 Cs =	1.0	
Roof Struc 1 ps =	7.6	psf

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Roof Structure 1 - Continued

Dead Load

Roof			Wall		
Comp Shingle	3	psf	Stucco	10	psf
5/8 OSB Sheathing	2	psf	Gypsum	3	psf
2 x 4 @ 24" OC	1	psf	Studs	2	psf
Miscellaneous	1	psf	Misc.	2	psf
PV Components	3	psf			
Structure 1 Total DL (w/ PV)	10	psf			
Structure 1 Total DL (w/out PV)	7	psf			

Framing Capacity (ASD)

Load Combination:	D + S				
Uniform Dist Load, ωuni =	33.4	plf			
M_b =	231.7	lbs-ft	DCR M_b =	0.52	**OK**
V =	173.8	lbs	DCR V =	0.32	**OK**
Load Combination:	D + 0.6W				
Uniform Dist Load, ωuni =	38.2	plf			
M_b =	270.3	lbs-ft	DCR M_b =	0.44	**OK**
V =	202.7	lbs	DCR V =	0.27	**OK**
Load Combination:	D + 0.75(L + 0.6W + S)				
Uniform Dist Load, ωuni =	44.2	plf			
M_b =	318.1	lbs-ft	DCR M_b =	0.52	**OK**
V =	238.6	lbs	DCR V =	0.31	**OK**
Load Combination:	0.6D + 0.6W				
Uniform Dist Load, ωuni =	16.2	plf			
M_b =	150.8	lbs-ft	DCR M_b =	0.24	**OK**
V =	113.1	lbs	DCR V =	0.15	**OK**

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Seismic Check

Wall Area =	3200	ft^2	Roof Area =	1600	ft^2
Wall Weight =	54400	lbs	Roof Weight =	11200	lbs

Weight w/ PV =	67832.45	
Weight w/o PV =	65600	
% Weight Increase =	3%	**OK**

The increase in weight due to PV installation is less than 10% of the existing structure. Therefore, no further seismic analysis is required.