July 16, 2018

Everest Solar Systems, LLC
3809 Ocean Ranch Blvd, Suite 111
Oceanside, CA 92056
Attn: Andy Neshat

RE: ***CrossRail PV Panel Mounting System Evaluation***

To whom it may concern:

Per your request, Moment Engineering + Design has performed a comprehensive structural analysis of the Everest Solar CrossRail Solar PV Mounting System for typical installations in the Territory of Guam. When installed per the conditions and design criteria described herein, the CrossRail Solar PV Mounting System is compliant with the sections of the design reference documents noted below.

Design Reference Documents

- *2009 International Building Code*
- *2009 International Residential Code*
- ASCE/SEI 7-05 – *Minimum Design Loads for Buildings and Other Structures*
- *2010 Aluminum Design* Manual, by the Aluminum Association
- Section and materials data provided by Everest Solar Systems
  - Rail section properties appear in the appendix to this report

Overview

The CrossRail PV-panel roof mounting system consists of extruded aluminum support rails spanning between points of attachment on an existing roof structure. This analysis is limited to capacity of the CrossRail only. Attachment of the CrossRail Mounting System to the existing roof structure shall be the responsibility of the installer, and should be analyzed by a registered design professional where required by the local authority having jurisdiction.

Methods & Design Parameters

Applicable combinations of dead, wind, snow, and seismic loads were evaluated in accordance with current code requirements to determine allowable rail span lengths, based on assumptions of single-span conditions and allowable deflection of L/60.

Design wind pressures were determined using Components and Cladding calculations in Chapter 6 of ASCE 7-05, using the loading parameters listed below. Configurations not conforming to these parameters will require additional analysis. Calculation of applicable roof snow load should be based upon ground snow load maps and equations and factors of ASCE 7-05, Chapter 7 and applicable sections of the 2009 IBC. For designated Case Study areas noted in the 2009 International Building Code, refer to local jurisdiction requirements for snow and wind load

determination. Seismic criteria were considered per provisions of ASCE 7-05 Chapter 13 with parameters specified below. While seismic effects did not appear to govern the capacity of this system, applicable seismic detailing requirements should be satisfied when installed per the manufacturer instructions and additional installation notes specified herein.

Loading Parameters:

- Ground snow load: Varies
- Design 3-second gust wind speed (V): 170 mph
- Building roof mean height: 30 ft. or less
- Roof wind pressure region: Zone 1 - Zone 3
- Structural occupancy category: II
- Wind exposure: B, C, D
- Seismic site class: D
- Seismic design category: A through E
- 0.2s MCE_R ground motion parameter (S_S): Not to exceed 2.000
- 1s MCE_R ground motion parameter (S_1): Not to exceed 1.250
- Component importance factor (I_p): 1.0
- Component acceleration factor, (a_p): 1.0
- Component response modification factor (R_p): 1.5
- Panel orientation: Portrait or Landscape
- Panel installation angle: Flush with roof slope
- Roof slope (θ): 0-7°, >7-27°, >27-45°

Design Results

The allowable span lengths of the system are principally controlled by applicable wind and snow loads to the structure. Refer to the CrossRail span tables in the appendix to this document for recommended rail configurations based on combinations of these loading parameters. Note that reaction loads provided in the attached tables are only applicable when used with the corresponding span length recommendations provided therein. These reactions may be scaled linearly when shorter spans are used.

Installation Notes

The following guidelines apply to all installations using the CrossRail product line:

- Tables assume two independent support rails per row with either panel orientation.
- Maximum end cantilever of aluminum support rail shall not exceed one-third (1/3) of allowable span in the roof wind pressure zone of the cantilever.
- Rails shall be continuous (not spliced) over a minimum of two supports unless using an approved Everest Solar structural splice.
- Installation over roof overhangs or within 10” of any roof edge is not advised.
- Observe all local jurisdictional requirements regarding roof setback requirements.
- Ensure that actual span length does not exceed capacity of roof attachment.

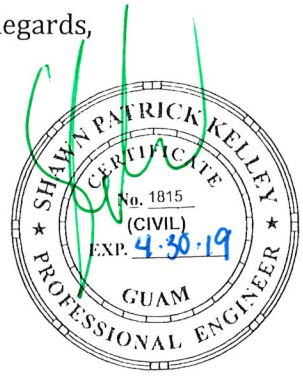
Summary

This assessment has provided design validation for code-compliant installations of the CrossRail PV Mounting System in the Territory of Guam. For the configurations and design loadings noted previously, the attached span tables represent maximum span lengths based on allowable stresses and deflection criteria. For all other configurations, refer to Everest Solar Systems for engineering support.

This report does not provide analysis of roof attachment hardware, nor of any existing structures, as may be required by the local authority having jurisdiction.

We appreciate the opportunity to have assisted you with this project. Should you have any further questions regarding this analysis, please feel free to contact us by phone or email.

Best Regards,



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ASCE 7-05 Design Wind Speed, V (mph)	Roof Slope θ (degrees)	Exposure -	Wind Pressure Zone -	Rail Type -	Allowable Span (in)	Wind Reaction Loads		
						Max. Uplift (lb)	Max. Dnforce (lb)	Max. Shear (lb)
170	0 to 7	B	1	X80	**76**	-878	417	5
				X48	**51**	-589	280	3
			2	X80	**63**	-1237	346	4
				X48	**43**	-845	236	3
			3	X80	**54**	-1607	296	4
				X48	**37**	-1101	203	3
		C	1	X80	**67**	-1094	498	5
				X48	**46**	-751	342	3
			2	X80	**56**	-1548	416	4
				X48	**38**	-1051	282	3
			3	X80	**46**	-1924	342	3
				X48	**31**	-1297	230	2
		D	1	X80	**64**	-1244	556	4
				X48	**43**	-836	374	3
			2	X80	**52**	-1709	452	4
				X48	**35**	-1150	304	2
			3	X80	**42**	-2086	365	3
				X80	**28**	-1391	243	2
170	>7 to 27	B	1	X80	**78**	-825	583	21
				X48	**53**	-561	396	14
			2	X80	**64**	-1194	478	17
				X48	**44**	-821	329	12
			3	X80	**56**	-1556	419	15
				X48	**38**	-1056	284	10
		C	1	X80	**69**	-1032	706	19
				X48	**47**	-703	481	13
			2	X80	**57**	-1497	583	16
				X48	**39**	-1025	399	11
			3	X80	**47**	-1835	481	13
				X48	**32**	-1249	327	9
		D	1	X80	**66**	-1174	794	18
				X48	**44**	-783	529	12
			2	X80	**53**	-1654	637	14
				X48	**36**	-1124	433	10
			3	X80	**43**	-1993	517	12
				X80	**29**	-1344	349	8
170	>27 to 45	B	1	X80	**76**	-884	871	29
				X48	**51**	-593	584	19
			2	X80	**72**	-983	825	27
				X48	**49**	-669	561	19
			3	X80	**72**	-983	825	27
				X48	**49**	-669	561	19
		C	1	X80	**67**	-1099	1060	25
				X48	**46**	-755	728	17
			2	X80	**64**	-1231	1013	24
				X48	**43**	-827	681	16
			3	X80	**64**	-1231	1013	24
				X48	**43**	-827	681	16
		D	1	X80	**64**	-1249	1195	24
				X48	**43**	-839	803	16
			2	X80	**60**	-1372	1120	23
				X48	**41**	-937	765	16
			3	X80	**60**	-1372	1120	23
				X80	**41**	-937	765	16

ASCE 7-05 Design Wind Speed, V (mph)	Roof Slope θ (degrees)	Exposure -	Wind Pressure Zone -	Rail Type -	Allowable Span (in)	Wind Reaction Loads		
						Max. Uplift (lb)	Max. Dnforce (lb)	Max. Shear (lb)
170	0 to 7	B	1	X80	**71**	-981	465	6
				X48	**48**	-663	314	4
			2	X80	**60**	-1408	393	5
				X48	**40**	-939	262	3
			3	X80	**50**	-1778	327	4
				X48	**34**	-1209	222	3
		C	1	X80	**64**	-1249	567	5
				X48	**43**	-839	381	3
			2	X80	**51**	-1685	452	4
				X48	**35**	-1156	310	3
			3	X80	**42**	-2099	372	3
				X48	**28**	-1399	248	2
		D	1	X80	**60**	-1394	622	5
				X48	**41**	-952	425	3
			2	X80	**47**	-1845	487	4
				X48	**32**	-1256	332	3
			3	X80	**38**	-2255	394	3
				X80	**26**	-1543	269	2
170	>7 to 27	B	1	X80	**73**	-923	651	23
				X48	**50**	-632	446	16
			2	X80	**61**	-1360	544	20
				X48	**41**	-914	366	13
			3	X80	**51**	-1693	455	16
				X48	**35**	-1162	312	11
		C	1	X80	**65**	-1161	794	21
				X48	**44**	-786	537	14
			2	X80	**52**	-1632	635	17
				X48	**36**	-1130	439	12
			3	X80	**43**	-2005	525	14
				X48	**29**	-1352	354	9
		D	1	X80	**62**	-1318	890	20
				X48	**42**	-893	603	13
			2	X80	**48**	-1790	689	15
				X48	**33**	-1231	473	11
			3	X80	**40**	-2215	574	13
				X80	**27**	-1495	387	9
170	>27 to 45	B	1	X80	**71**	-987	971	32
				X48	**48**	-667	656	21
			2	X80	**67**	-1093	916	30
				X48	**46**	-750	629	21
			3	X80	**67**	-1093	916	30
				X48	**46**	-750	629	21
		C	1	X80	**63**	-1235	1190	28
				X48	**43**	-843	812	19
			2	X80	**60**	-1379	1134	27
				X48	**41**	-942	775	18
			3	X80	**60**	-1379	1134	27
				X48	**41**	-942	775	18
		D	1	X80	**60**	-1399	1337	27
				X48	**41**	-956	914	18
			2	X80	**56**	-1530	1248	25
				X48	**38**	-1038	847	17
			3	X80	**56**	-1530	1248	25
				X80	**38**	-1038	847	17