DANE COUNTY DEPT. OF PUBLIC WORKS, HIGHWAY & TRANSPORTATION

1919 Alliant Energy Center Way Madison, Wisconsin 53713 Office: 608/266-4018 ◊ Fax: 608/267-1533 Public Works Engineering Division Public Works Solid Waste Division

ADDENDUM

February 15, 2018

ATTENTION ALL REQUEST FOR BID (RFB) HOLDERS

RFB NO. 317031 - ADDENDUM NO. 1

JOB CENTER SOLAR ARRAY

BIDS DUE: TUESDAY, FEBRUARY 27, 2018, 2:00 PM. DUE DATE AND TIME ARE NOT CHANGED BY THIS ADDENDUM.

This Addendum is issued to modify, explain or clarify the original Request for Bid (RFB) and is hereby made a part of the RFB. Please attach this Addendum to the RFB.

If any additional information about this Addendum is needed, please call Eric Urtes at 608/266-4798, <u>urtes.eric@countyofdane.com</u> or Ryan Shore at 608/266-4475, shore@countyofdane.com.

Sincerely, *Ryan Shore* Project Manager

Enclosures:

Structural Analysis of Existing Roof Bidders Questions w/ Responses Pre-Bid Site Tour Attendees List



STRUCTURAL ANALYSIS OF EXISTING ROOF SYSTEM TO SUPPORT NEW PHOTOVOLTAIC CELL ARRAYS

DANE COUNTY HUMAN SERVICES BUILDING MADISON, WISCONSIN

> PREPARED FOR: STRANG, INC.

MP-SQUARED PROJECT NO. 1714147WI

December 1, 2017



Supervised by: Melissa A. Peyton, P.E.

Designed by: Justin Rademacher, E.I.T



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EXECUTIVE SUMMARY

MP-Squared Structural Engineers, LLC (MP-Squared) was retained by Strang, Inc. to determine the feasibility of installing photovoltaic (PV) arrays on the roof of the Dane County Human Services Building in Madison, Wisconsin.

The original roof framing plan by Klefstad Engineering Co, provided by Strang, shows the existing roof framing is composed of 22H7 joists spanning 40 ft., at 4 ft. on-center, framing into wide-flange girders at Lines B, C, D, and E. We estimate the building was constructed circa 1967; the allowable total safe load for joists from that era was determined using standard load tables printed in the *75-Year Steel Joist Manual* published by the Steel Joist Institute. The girders are assumed to be rolled with 36 ksi material.

Information regarding the roof type and the uniform dead load of each solar panel array was provided by Strang, Inc. MP-Squared made further assumptions regarding the weight of the roof deck, hanging MEP equipment, and other miscellaneous suspended items to estimate the total uniform dead weight of the roof. Existing RTU weights were also provided by the client for our use.

The uniform roof snow load was determined per the current Wisconsin Commercial Building Code (based on the 2009 International Building Code). The presence of solar panels makes an otherwise partially exposed roof, "sheltered." Sliding snow and snowdrift patterns, primarily north and south, were determined per the recommendations prescribed in *Snow Loads on Solar-Paneled Roofs* by the American Society of Civil Engineers.

We determined the sliding snow and snowdrift patterns produced by the solar panel configuration depicted on E201 and E401. Detail 1/E401 indicates the lower end of the array is about 21 inches above the existing roof. The snow load pattern created by this configuration will require strengthening of the existing roof joists and girders.

Reducing the gap to 14 inches revises the snow load pattern such that the existing roof joists and girders are adequate as-designed and do not require strengthening.

Please refer to the enclosed calculations for more in-depth analysis. If any of the assumptions used in the analysis of the existing roof system are incorrect, please contact MP-Squared to provide additional structural analysis.



LOADING INFORMATION





STANDARD LOAD TABLE **OPEN WEB STEEL JOISTS, H-SERIES**

Allowable Total Safe Loads in Pounds Per Linear Foot of H-SERIES Steel Joists - *For Joist Depths 8" to 14" inclusive.

The black figures in the following table give the TOTAL safe uniformly-distributed The figures shown in blue in this load table are the LIVE loads per linear foot of joist load-carrying capacities, in pounds per linear foot, of H-Series High Strength Steel Joists adopted by the Steel Joist Institute. The weight of DEAD loads, including the joists, must in all cases be deducted to determine the LIVE load-carrying capacities figures in blue by 1.5. In no case shall the total load capacity of the joist be exceeded.** of the joists.

which will produce an approximate deflection of 1/360 of the span. LIVE loads which will produce a deflection of 1/240 of the span may be obtained by multiplying the

*Depth in Inches Resisting Moment In Inch-Pounds Iaximum End Reaction In Pounds Approximate Weight in Pounds per Foot Span in Feet 8 9 10	8 73,000 2000 4.2 500 444 400 364	10 91,000 2200 4.2	10 116,000 2500 5.0	10 148,000 2800 6.1	12 111,000 2400 4.5	12 140,000 2800	12 180,000 3200	12 222,000 3600	12 260,000	14 165,000	14 212,000	14 259,000	14 307,000	14 369,00
Resisting Moment In Inch-Pounds Iaximum End Reaction In Pounds Approximate Weight in Pounds per Foot Span in Feet 8 9 10	73,000 2000 4.2 500 444 400 364	91,000 2200 4.2	116,000 2500 5.0	148,000 2800 6.1	111,000 2400 4.5	140,000 2800	180,000 3200	222,000	260,000	165,000	212,000	259,000	307,000	369,00
laximum End Reaction In Pounds Approximate Weight in Pounds per Foot Span in Feet 8 9 10	2000 4.2 500 444 400 364	2200 4.2	2500 5.0	2800 6.1	2400 4.5	2800	3200	3600	2000	1000000000	2022/2012	10000000000000000000000000000000000000		
Approximate Weight in Pounds per Foot Span in Feet 8 9 10	4.2 500 444 400 364	4.2	5.0	6.1	4.5			5000	3900	3200	3500	3800	4200	4600
Span in Feet 8 9 10	500 444 400 364	440				5.2	6.2	7.1	8.2	5.5	6.5	7.4	8.6	10.0
8 9 10	500 444 400 364	440												
9 10	444 400 364	440												
10	400	440												
	364	440	500	560										
11	319	400	455	509										
12	333	367	417	467	400	467	533	600	650					
13	288	338	385	431	369	431	492	554	600					
14	248	310	357	400	343	400	457	514	557	457	500	543	600	657
15	216	270	333	373	320	373	427	480	520	427	467	507	560	613
16	190	237	302	350	289	350	400	450	488	400	438	475	525	575
17	10.3	210	268	329	256	323	376	424	459	376	412	447	494	541
18		187	239	305	228	288	356	400	433	340	389	422	467	511
19		168	214	273	205	259	332	379	411	305	368	400	442	484
20		152	193	247	185	233	300	360	390	275	350	380	420	460
21		.02	105	120	168	212	272	336	371	249	320	362	400	438
22					153	193	248	306	355	227	292	345	382	418
23					140	176	227	280	328	208	267	326	365	400
24					128	162	208	257	301	191	245	300	350	383
25					69	89	108	130	155	176	226	276	327	368
26	*Indicates	Nominal De	pth of Steel	Joists only.	Joists only.	Accessories	and nailer s	trip not inclu	ded.	163	209	255	303	354
27	*tSee Manu	facturers' C	atalog for de	stailed inform	nation on sp	ecific joist ty	ypes.			96 151	117	237	281	337
										86	104	127	152	314

LOADS ABOVE COLORED LINES ARE GOVERNED BY SHEAR.

Tests on steel joists designed in accordance with the Steel Joist Institute Standard Specifications have demonstrated that the Steel Joist Institute Load Tables are applicable for concentrated top chord loadings (such as are developed in bulb-tee roof construction) when the sum of the equal concentrated top chord loadings does not exceed the allowable uniform loading for the joist type and span and the loads are placed at spacings not exceeding 33" along the top chord.

Adopted by the Steel Joist Institute May 31, 1961.

This Table in accordance with Simplified Practice Recommendation filed with the Commodity Standards Division, Office of Technical Services, U. S. Department of Commerce.

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Allowable Total Safe Loads in Pounds Per Linear Foot of H-SERIES Steel Joists - *For Joist Depths 16" to 24" inclusive.

Joist Designation	16H4	16H5	16H6	16H7	16H4	18H5	18H6	18H7	18H8	20H5	20H6	20H7	20H8	22H6	22H7	22H8	24H8	24H7	24H8
*Depth in Inches	16	16	16	16	16	18	18	18	18	20	20	20	20	22		22	24	24	24
Resisting Moment In Inch-Pounds	221,000	289,000	344,000	413,000	478,000	325,000	383,000	466,000	540,000	365,000	406,000	499,000	602,000	422,000	526,000	653,000	462,000	576,000	716,00
laximum End Reaction	3800	4300	4600	4900	5200	4500	4800	5200	5400	4800	5100	5400	5600	5400	5600	5800	5600	5800	6000
†Approximate Weight in Pounds per Foot	6.6	7.8	8.6	10.3	11.4	8.0	9.2	10.4	11.6	8.4	9.6	10.7	12.2	9.7	10.7	12.0	10.3	11.5	12.7
Span in Feet																			
16	475	538	575	613	650						5								
17	44/	506	541	5/6	612	500	600	670	600				-						
18	400	4/8	484	516	547	474	505	547	568										
20	368	430	460	490	520	450	480	520	540	480	510	540	560						
21	334	410	438	467	495	429	457	495	514	457	486	514	533						
22	304	391	418	445	473	409	436	473	491	436	464	491	509	491	509	527			
23	279	364	400	426	452	391	417	452	470	417	443	470	487	470	487	504			
24	256	334	383	408	433	375	400	433	450	400	425	450	467	450	467	483	467	483	500
25	236	308	367	392 295	416	347	384	416	432	384	408	432	448	432	448	464	448	464	480
26	218	285	339	377	400	321	369	400	415	360	392 360	415	431	415	431	446	431	446	462
27	202	264	315	363	385	297	350	385	400	334	371	400	415	386	415	430	415	430	444
28	188	246	293 181	350	371	276	326	371	386	310 239	345	386 336	400 385	359	400	414	393	414	429
29	175	229	273 162	327 189	359	258	304	359	372	289	322	372 307	386	335	386	400	366	400	414
30	164	214 122	255	306	347 195	241	284 18H	345 219	360	270	301	360	373	313 286	373	387 382	342	387	400
31	153 91	200	239 133	287 155	332	225 142	266 170	323 198	348 227	253 176	282 217	346	361 784	293 259	361	374	320	374	387
32	144	188	224	269	311 161	212 129	249	303 180	338 206	238 160	264 193	325	350 258	275	342	363	301 782	363	375
33						199 117	234 141	285 164	327 188	223 146	249	305 205	339 235	258 214	322	352	283	352	364
34				1		187 107	221 129	269 150	311 172	210 133	234 161	288 187	329 215	243 196	303 778	341 263	266	332	353
35						177 98	208 118	254 137	294 158	199 177	221	272	320 197	230 180	286 209	331	251	313	343 288
36						167 90	197 108	240 126	278 145	188 112	209 135	257 158	310 181	217 165	271 192	322 221	238 198	296 231	333
37										178 103	198 125	243 145	293 167	206 152	256	314 204	225 182	280 717	324
38										169 95	187 115	230 134	278 154	195 140	243 163	301 188	213 168	266	316 225
39										160 88	178 106	219 124	264 142	185 130	231	286 174	202 155	252 181	308 208
40										152	169 98	208	251 132	176 120	219 140	272 161	193 144	240 168	298 193
41				SAFE L	OAD C	ARRYI	NG							167 112	209 130	259 149	183 134	228 156	284 179
42			C	CAPAC	ITY OF	EXIST	ING F							159 104	199 121	247 139	175	218 145	271
43			2	2H7 J	JIST(S)								152 97	190 113	235 130	167 116	208 135	258
44														145 90	181 105	225 121	159 108	198 126	247
45	+Indic	ates Nom	ninal Dep	th of Stee	I Joists o	nly.				a a stalar ar	at in also de						152	190 118	236
46	*tSee M	Aanufact	urers' Ca	talog for o	letailed in	formatio	n on spe	cessories	types.	er strip n	ot include	id.					146	181 110	226
47										_							139 89	174 103	216
48																	134	167	207

LOADS ABOVE COLORED LINES ARE GOVERNED BY SHEAR.

Tests on steel joists designed in accordance with the Steel Joist Institute Standard Specifications have demonstrated that the Steel Joist Institute Load Tables are applicable for concentrated top chord loadings (such as are developed in bulb-tee roof construction) when the sum of the equal concentrated top chord loadings does not exceed the allowable uniform loading for the joist type and span and the loads are placed at spacings not exceeding 33" along the top chord.

Adopted by the Steel Joist Institute May 31, 1961.

This Table in accordance with Simplified Practice Recommendation filed with the Commodity Standards Division, Office of Technical Services, U. S. Department of Commerce.

WEIGHTS



AAON Inc. Unit Documents Viewer

DSO #: 476262 Shipped On: 09/24/2009 Site: Tulsa Ordered On: 07/20/2009 JobName: DANE CO.JOB CTR **Cutomer: MASTERS BUILDING SOLUTIONS** Shipped To: DANE CO. PARKS STORAGE C/O TOWER MECHANICAL, 4318 ROBERTSON RD., MADISON, WI USA 53714 Rep: 766 PO#: B96-0033-A Please select the Serial # to View

DSO Lines for 476262

TAG			DS	O Lines for 476262	WEIGHTS
	Serial #	DSO Line #	Part #	Description]
KTU-1	ANGT07112	001	99842	RN-030-8-0-EA09-344:CFGDK0ADELB00R0ACG0H0000000000B	3,255
RTU-2	BNGU07127	002	99843	RN-031-8-0-EA09-3C4:CEHQK0AGDFB00K0ACG0H000000000B	6,073
RTO-3	ANGT07113	003	99842	RN-030-8-0-EA09-344:CFGDK0ADELB00R0ACG0H0000000000B	3, 255
RTU-4	BNGW07128	004	99844	RN-050-8-0-EA09-3C4:CEHEK0AGDGB00K0ADG0H0000000000B	6,635
RTU-5	ANGT07114	005	99842	RN-030-8-0-EA09-344:CFGDK0ADELB00R0ACG0H0000000000B	3,255
RTU-6	ANGP07115	006	99846	RN-020-8-0-EA09-344:CEGDK0ADESB00R0ABG0H0000000000B	3,157
RTU-7	ANGR07116	007	99848	RN-025-8-0-EA09-344:CEGEK0ADESB00R0ACG0H0000000000B	3,233
		008	@FREIGHT		

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MP-Squared Structural Engineers

MP-Squared Structural Engineers Madison, WI 53719 608-821-4770 JOB TITLE Strang Dane County P.V.

ЈОВ NO . 1714147WI	SHEET NO.	
CALCULATED BY jtr	DATE	10/14/17
CHECKED BY MAP	DATE	

www.struware.com

Code Search

Code: International Building Code 2009

Occupancy:

Occupancy Group = B Business

Occupancy Category & Importance Factors:

Occupancy Category =					
Wind factor =	1.00				
Snow factor =	1.00				
Seismic factor =	1.00				

Type of Construction:

Fire Rating:

-	Roof =	0.0 hr
	Floor =	0.0 hr

Building Geometry:

Roof angle (θ)	0.25 / 12	1.2 deg -> SLIGHLTLY SLOPES TO DRAINS
Building length (L)	400.0 ft	
Least width (B)	200.0 ft	
Mean Roof Ht (h)	18.0 ft	-> ASSUMED
Parapet ht above grd	0.0 ft	
Minimum parapet ht	0.0 ft	

MP-Squared Structural Engineers MP-Squared Structural Engineers Madison, WI 53719 608-821-4770

JOB TITLE Strang Dane County P.V.

JOB NO.	1714147WI	SHEET NO.	
CALCULATED BY	jtr	DATE	10/14/17
CHECKED BY	MAP	DATE	

Snow Loads : ASCE 7-05

Nominal Snow Forces

Roof Horiz. eave to ridg Roof length parallel to	slope = e dist (W) = o ridge (L) =	1.2 deg 200.0 ft 400.0 ft	
Type of Roof Ground Snow Load Occupancy Category Importance Factor Thermal Factor Exposure Factor Pf = 0.7*Ce*Ct*I*Pg Unobstructed Slippery Sur Sloped-roof Factor	M Pg = I = <u>Ct =</u> <u>Ce =</u> face Cs =	onoslope 30.0 psf II 1.0 1.00 1.0 21.0 psf no 1.00	EXPOSURE B URBAN AREA
Balanced Snow Load	Ps =	21.0 psf	
Rain on Snow Surcharge Code Maximum Rain Surc Rain on Snow Surcharge Ps plus rain surcharge Minimum Snow Load Uniform Roof Design Sno	Angle charge = Pfmin = ow Load =	4.00 deg 5.0 psf 0.0 psf 21.0 psf 20.0 psf 21.0 psf	ORIGINAL DESIGN SNOW LOAD FOR GIVEN YEAR: 30 PSF
			DESIGN SNOW LOAD PER CURRENT WI BUILDING CODE WITHOUT P.V. CELL ARRAYS

MP-Squared Structural Engineers

MP-Squared Structural Engineers Madison, WI 53719 608-821-4770

JOB NO.	1714147WI	SHEET NO.	
CALCULATED BY	jtr	DATE	10/14/17
CHECKED BY	MAP	DATE	

Snow Loads : **ASCE 7-05**

Roof slope =	1.2 deg	
Horiz. eave to ridge dist (W) =	200.0 ft	
Roof length parallel to ridge (L) =	400.0 ft	
Type of Roof	Monoslope	
Ground Snow Load Pg =	30.0 psf	
Occupancy Category =	II	
Importance Factor I =	1.0	
Thermal Factor Ct =	1.00	
Exposure Factor Ce =	1.2	
Pf - 0.7*Ce*Ct*I*Pa -	25.2 nef	THE ASCE "SNOW LOADS ON
Unobstructed Slipperv Surface	20.2 psi	SOLAR-PANELED ROOFS" DESIGN GUIDE
eneberadica enppery eanabe	110	SUGGESTS THAT THE PRESENCE OF P.V.
Sloped-roof Factor Cs =	1 00	CELL ARRAYS MOVES AN OTHERWISE
Balanced Snow Load Ps =	25.2 psf	PARTIALLY-EXPOSED SECTION OF ROOF
Rain on Snow Surcharge Angle	4.00 dea	A INTO THE SHELLERED CATEGORT.
Code Maximum Rain Surcharge	5.0 psf	
Rain on Snow Surcharge =	0.0 psf	
Ps plus rain surcharge =	25.2 psf	
Minimum Snow Load Pfmin =	20.0 psf	
Uniform Roof Design Snow Load =	25.2 psf	
ennen zeelgit enen zeaa	_0 po.	
		>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
		CURRENT WI BUILDING
(and the second s		
AS ELUL ک	DED TO AB	OVE, THE ADDITION OF A P.V.
CELL AR ک		NGES THE SNOW LOAD
ک PATTER ک	N ON A RC	OF. THE CALCULATIONS THAT
FOLLOW	/ EXAMINE	THESE NEW PATTERNS
ک ACCORE	DING TO TH	HE ASCE "SNOW LOADS ON
SOLAR-		ROOFS" DESIGN GUIDE. THE
L PATTER	NS TO BE	EXAMINED ARE DRIFTED
SNOW A		
	SNUW UF	FINE HLIED PANEL INTO THE }

AISLE.

Nominal Snow Forces









** JEEWARD DISTRIBUTIONS MUST BE CALCULATED IF THERE IS NOT ENOUGH ROOM FOR AUDILABLE FOR THE INTER-ROW SNOW CHARGE (I.E. ALL AVAILABLE AJSLES FILL UP).

Snow Load Pattern for Elevated, Tilted-Open Solar Panel Array



Drift Load

Check requirements to avoid calculating drift patterns. $check_1a = if h_{p2} < 1.2 \cdot h_b$ = "DRIFT REQ'D, CHECK LOW-SIDE" "DRIFT NOT REQ'D, CHECK 2ND CONDITION" else "DRIFT REQ'D, CHECK LOW-SIDE" = "CHECK 2ND CONDITION" check_1b=if h_{p1}<h_b "DRIFT REQ'D" else "CHECK 2ND CONDITION" $check_2 := if h_{p1} < 2 ft + 2 h_b = "DRIFT REQ'D"$ "DRIFT REO'D" else "DRIFT NOT REO'D" Check if closely spaced. check_close=if l_aisle > 8 h_c = "YES" "NO else "YES" Wind out of the south $l_{u_south} = l_{south} \cdot \frac{1}{ft} = 57.25$ $h_{d} \coloneqq \left[0.43 \cdot l_{u_{south}} + \frac{1}{3} \cdot \left(p_{g} \cdot \frac{1}{p_{sf}} + 10 \right)^{\frac{1}{4}} - 1.5 \right] ft = 32.014 in \text{ Leeward drift depth}$ $A_{d_{expected}} = 2 \cdot h_{d}^{2} = 2049.767 in^{2}$ $h_{dw} = 0.75 \cdot h_{d} = 24.01 in$ Windward drift depth per ASCE7 $h_{s} = 0.707 \cdot h_{dw} = 16.975 in$ h := if h > h = 16.975 in Windward drift for wind blowing at low-side of panel s design s c h else h l drift_windard = if 4 h s_design horiz = 5 ft Horizontal extent for wind blowing at low-side of panel (multiply by 2) l horiz else 4∙h s design A = 0.5 h s_design (2.1 drift_windar) = 1018.519 in 2 Drift area at low-side of panel $h_{u} = \frac{A_{d} \text{ expected}}{l_{aisle}} = 48.804 \text{ in}$



Pd_leeward u_design Y= 38.7 *psf* Inter-row surcharge $n_{rows} = \frac{6 \cdot h_d^2 - A_{d_NW}}{h_u_{design}^1 aisle} = 4.369 \quad \text{Extent of inter-row surcharge (round up)}$ ASSUME 5 ROWS ARE FILLED BY INTER-ROW SURCHARGE

Snow Load Pattern for Elevated, Tilted-Open Solar Panel Array

		<u> </u>		
h _{p1} :=21 <i>in</i> Low side dimension			OF THE PANEL(S) FACES SOUTH. SWAP	
l = 60 in Length of horizontal projection		ntal projection	DIRECTIONS IN THE HEADINGS, IF DIFFERENT.	
$\theta := 20 deg$ Angle of tilt			DRIFT AREA 3 (SIMILAR TO DRIFT AREA 1)	
$l_{p} = \left(\frac{l_{horiz}}{\cos(\theta)}\right) = 63.8$	351 <i>in</i> Length	of panel		
$h_{p2} = h_{p1} + l_{p} \sin(e$	9)=42.838 <i>in</i>	High side dimensi	on	
l _{aisle} =42 <i>in</i> Wi	idth of aisle k	between rows		
Drift Fetch Dista	Inces:	for wind OUT OF	TUE NODTU	
north	Upwind fetch	for wind OUT OF		
south	opwind letch	for wind our of	THE SOUTH	
Balanced Snow LoaExposure Category $C_e \coloneqq 1.2$ $I_s \coloneqq 1$ $C_t \coloneqq 1.0$ $p_g \coloneqq 3$ $p_f \coloneqq 0.7 \cdot C_e \cdot C_t \cdot I_s \cdot p_s$	alanced Snow Loadxposure Category: Be=1.2I = 1.0f=0.7 C c C t I s p = 25.2 psff=0.7 C c C t I s p = 25.2 psf			
C _s ≔1.0 Obstr	ructed & monosl	lope roof		
$p_{s} = C_{s} p_{f} = 25.2 ps$	f			
$\gamma := 0.13 \cdot \frac{1}{ft} \cdot p_{g} + 14$	$\frac{lbf}{ft^3} = 17.9 \frac{lbf}{ft^3}$	3		
$h_{b} := \frac{p_{s}}{\gamma} = 16.894 in$	$h_c = h_{p2} - h_1$	= 25.944 in		
h exposed p2 h b	= 25.944 in An I m	mount of panel exp f positive, slidi ust be considered	posed above balanced snow load depth. ng snow surcharge from the solar panels d.	
Sliding Snow Load	nanels are evr	osed above balanc	red snow denth	
w = 1 = 60 in	paners are exp	The depth of th	he halanged snow load in an aisle is	
c horiz		shallower than sliding snow su projection of t	the height of the low edge of the panel. The archarge width is the whole horizontal he panel.	
wc_panel horiz	w _c =0 in	Horizontal proje	ection of panel covered by sliding snow	
w=w_−w_ aisle c c pa	nel ^{= 60 in}	Width of aisle c	overed by sliding snow	
		Note: For a open-back can slide under panel, the slidi the surcharge is	tilted panel, the slding snow the panel itself. For a closed-back ing snow stops at the panel back. 18" of under the adjacent panel.	
p _f +p _s =50.4 <i>psf</i>	Balanced snow (use balanced not covered b	load in aisle pl snow load only f y sliding snow)	us sliding surcharge or portion of aisle	

Drift Load

```
Check requirements to avoid calculating drift patterns.
                                                       = "DRIFT REQ'D, CHECK LOW-SIDE"
check_1a = if h_{p2} < 1.2 \cdot h_b
             "DRIFT NOT REQ'D, CHECK 2ND CONDITION"
           else
             "DRIFT REQ'D, CHECK LOW-SIDE"
                                     = "CHECK 2ND CONDITION"
check_1b=if h<sub>p1</sub><h<sub>b</sub>
             "DRIFT REQ'D"
           else
             "CHECK 2ND CONDITION"
check_2 := if h_{p1} < 2 ft + 2 h_b = "DRIFT REQ'D"
            "DRIFT REO'D"
          else
            "DRIFT NOT REO'D"
Check if closely spaced.
check_close=if l_aisle > 8 h_c = "YES"
                 "NO
              else
                 "YES"
Wind out of the south
l_{u_south} = l_{south} \cdot \frac{1}{ft} = 21.25
h_{d} \coloneqq \left[ 0.43 \cdot l_{u_{south}} \frac{1}{3} \cdot \left( p_{g} \cdot \frac{1}{p_{sf}} + 10 \right)^{\frac{1}{4}} - 1.5 \right] ft = 17.943 in \text{ Leeward drift depth}
A_{d_{expected}} = 2 \cdot h_{d}^{2} = 643.922 in^{2}
h_{dw} = 0.75 \cdot h_{d} = 13.457 in Windward drift depth per ASCE7
h<sub>s</sub>=0.707·h<sub>dw</sub>=9.514in
h := if h > h = 9.514 in Windward drift for wind blowing at low-side of panel
s_design s c
              h
            else
              h
l drift_windard s_design horiz = 3.171 ft Horizontal extent for wind blowing
at low-side of panel (multiply by 2)
                    l
horiz
                  else
                    4 h s design
h_{u} = \frac{A_{d} expected}{l_{aisle}} = 15.331 in
```





$(mn)^2$	Project Name:	STRANG DANE COUNTY P.V. PANELS
(IIIP)	Project No:	1714147 WI
STRUCTURAL ENGINEERS LLC	Designed By:	JTR Page No:
	Date:	11/20/2017
DRTFT ARFA 1.43		
OSLIDING SNOW (WORST CAS	ES ARE SPANS.	BETWEED CADJ (OK 65%)
10° x 60" x 60"	1 60" ×	+ 60" + +20" +
the state the	J J J J J	SL SL SL SL SL SAL = 100.8914
$\frac{161''}{16''} = \frac{51}{5'} + \frac{3}{3} \cdot \frac{5}{5'} + \frac{5}{5} \cdot \frac{5}{5} + \frac{3}{5} \cdot \frac{5}{5} + \frac{3}{5} \cdot \frac{5}{5} + \frac{5}{5} - \frac{5}$	2, 3.2,	5', 3.5', 5', 5''
DUIND OUT OF THE SOUTH	(NOTOK 75%	WIND
SLO= 101. JPLF	- INT	ER-ROW SL
S' S' ISH RPLE	(ISU, SPLE) SU	ISU, PAIF SL = ISU, PPLG
TITE TITE	VIII	
OL= SIPLE J QL= 75PLE J J	1	
A G'-10" , S' , 3.5'	S' 3.5' 5	1 3.51 51 3181
3 WIND OUT OF THE NORTH	(SHEAR NOT	0k > 5%)
1 WIND	139.8	PLF=SLD
		7.8131
$\frac{154.884F}{154.884F}$	le la	
SLOAL = 100. BALF J J J J J	* <u> </u>	
NL: 7SPIF JJJ.	DL= S	IPLF J J J ····
1-1 2 1 2:21 2:1 2:2	1	11-8

NOTE:

THE CALCULATIONS SHOW NS ROWS WILL BE FILLED BY INTER-ROW SURCHARGE. AT MOST, 2 ROWS BETWEEN CAD WILL BE FILLED, THIS CASE IS VERY UNLIKELY TO CONTROL.

Snow Load Pattern for Elevated, Tilted-Open Solar Panel Array

h _{p1} := 21 <i>in</i> Low s	de dimension		THIS SHEET ASSUMES THE LOW SIDE OF THE PANEL(S) FACES SOUTH SWAP	
l = 60 <i>in</i> Length of horizontal projection		DIRECTIONS IN THE HEAD	DINGS, IF DIFFERENT.	
$\theta \approx 20 \ deg$ Angle	e of tilt		DRIFT AREA A1, A2	
$l_{p} := \left(\frac{l_{horiz}}{\cos(\theta)}\right) = 63.8$	351 <i>in</i> Length	of panel		
h _{p2} := h _{p1} + 1 _p · sin (θ)=42.838 <i>in</i>	High side dimensi	ion	
laisle 42 <i>in</i> W:	idth of aisle b	between rows		
Drift Fetch Dista	ances:			
1 = 54.66/It north	Upwind fetch	for wind OU'L' OF	THE NORTH	
l := 63 ft south	Upwind fetch	for wind OUT OF	THE SOUTH	
Balanced Snow Loa	ad			
Exposure Category	у: В О	For Ct, ignore an	y thermal contributior	1
		from a solar panel array. For Ce, the presence		
C = 1.0 $p = 3$	30 <i>psi</i>	more severe state	e. For example, an othe	rwise
$p_f = 0.7 \cdot C_e \cdot C_t \cdot I_s$	p _g =25.2 <i>psf</i>	fully exposed roof would be considered partially exposed with the addition of solar panels.		
C _s ≔1.0 Obstr	ructed & monosl	lope roof		
$p_s = C_s p_f = 25.2 ps$	SÍ			
$\gamma \coloneqq 0.13 \cdot \frac{1}{ft} \cdot p_{g} + 14$	$\frac{lbf}{ft^3} = 17.9 \frac{lbf}{ft^3}$	<u>5</u> 3		
$h_{b} := \frac{p_{s}}{\gamma} = 16.894 in$	h_:= h_p2- h_1	= 25.944 <i>in</i>		
h == h p2 ^{-h} b	= 25.944 <i>in</i> An I	mount of panel ex f positive, slidi ust be considered	posed above balanced sund sound sound be above balanced sound by the second second second sound by the second seco	now load depth. the solar panels
Sliding Snow Load	1			
Consider only if	panels are exp	osed above baland	ced snow depth.	
w _c := 1 _{horiz} = 60 <i>in</i>		The depth of th shallower than sliding snow su projection of t	he balanced snow load i the height of the low urcharge width is the w the panel.	n an aisle is edge of the panel. The hole horizontal
wc_panel=lhoriz	$-w_{c} = 0$ in	Horizontal proje	ection of panel covered	by sliding snow
$w_{aisle} := w_{c} - w_{c} = 60 in$		Width of aisle covered by sliding snow		
		Note: For a open-back can slide under panel, the slidi the surcharge is	tilted panel, the sldi the panel itself. For ing snow stops at the p s under the adjacent pa	ng snow a closed-back anel back. 18" of nel.
p _f +p _s =50.4 <i>psf</i>	Balanced snow (use balanced not covered b	load in aisle pl snow load only f y sliding snow)	us sliding surcharge or portion of aisle	

Drift Load

Check requirements to avoid calculating drift patterns. $check_1a = if h_{p2} < 1.2 \cdot h_b$ = "DRIFT REQ'D, CHECK LOW-SIDE" "DRIFT NOT REQ'D, CHECK 2ND CONDITION" else "DRIFT REQ'D, CHECK LOW-SIDE" = "CHECK 2ND CONDITION" check_1b=if h_{p1}<h_b "DRIFT REQ'D" else "CHECK 2ND CONDITION" $check_2 := if h_{p1} < 2 ft + 2 h_b = "DRIFT REQ'D"$ "DRIFT REO'D" else "DRIFT NOT REO'D" Check if closely spaced. check_close=if l aisle > 8 h c = "YES" "NO else "YES" Wind out of the south $l_{u_south} = l_{south} \cdot \frac{1}{ft} = 63$ $h_{d} \coloneqq \left[0.43 \cdot l_{u_{south}} \frac{1}{3} \cdot \left(p_{g} \cdot \frac{1}{p_{sf}} + 10 \right)^{\frac{1}{4}} - 1.5 \right] ft = 33.635 in \text{ Leeward drift depth}$ $A_{d_expected} = 2 \cdot h_d^2 = 2262.638 in^2$ $h_{dw} = 0.75 \cdot h_{d} = 25.226 in$ Windward drift depth per ASCE7 $h_{s} = 0.707 \cdot h_{dw} = 17.835 in$ h := if h > h = 17.835 in Windward drift for wind blowing at low-side of panel s design s c h else h P _______ = h ______Y=26.604*psf* Drift surcharge for wind blowing at low-side of panel l ______ = if 4 h _____ > l ____ = 5 ft Horizontal extent for wind blowing drift_windard s_design horiz = 5 ft Horizontal extent for wind blowing at low-side of panel (multiply by 2) l horiz else 4 ⋅ h s design $A_{d_SW} = 0.5 \cdot h_{s_{design}} (2 \cdot l_{drift_{windar}}) = 1070.1 in^2$ Drift area at low-side of panel $h_{u} = \frac{A_{d} \text{ expected}}{l_{aisle}} = 53.872 \text{ in}$



Pd_leeward = hu_design Y= 38.7 psf Inter-row surcharge $n_{rows} = \frac{6 \cdot h_d^2 - A_d_{NW}}{h_u_{design}^{-1} aisle} = 4.369 \quad \text{Extent of inter-row surcharge (round up)}$ ASSUME 5 ROWS ARE FILLED BY INTER-ROW SURCHARG ASSUME 5 ROWS ARE FILLED BY INTER-ROW SURCHARGE ONLY 3 ROWS ARE AVAILABE. THEREFORE, CALCULATE LEEWARD DRIFT.



<pre>ldrift_leeward = if 4 h n_design > 1 horiz = 5 ft</pre>	<- HORIZONTAL EXTENT OF LEEWARD DRIFT SURCHARGE (MULTIPLY BY 2)
4 h n_design	
ANL = 0.5 hdesign (2 ldrift_leeward = 1325.62	5 <i>in</i> ²
A := n rows_available u_design aisle = 3268	3.944 <i>in</i> ²
6.h	Area of snow assumed to pass by aerodynamic shade region for lack of space available

(mp) ²	Project Name: Project No:	STANG BANE COUNTY PV PANELS	
STRUCTURAL ENGINEERS LLC	Designed By:	JTR Page No:	
	Date:	11/21/2017	
DRIFI ARFA 2 (A1) LOAD CA 2 SLIDING SNOW (OK 25	457-5 %)		
1 60" 60" 1 60" 60"	SLOUTE - 100. 3PLF	100 28 5 1 1 1	
DL=75PLF J J J	OL=SI	PLFVJJ	
3.5 , 3.5 , 3.5	· <u>5</u> 1	141-8m	
154,8PLF 154,8PLF 510=154.	BPLF T.		
31-31' SI 7.5' 3.5	1 gi	140811	
SLEEWARD DRJET FOR WIND WIND O	OUT OF THE J	= 1541,8PLF 14:5351	
154,812 - 154,00			
SLE 100, 8PLF I I I I	× × × ×		
DL= TSPLF J J	DL=51	PLFLL	

STAANG Project Name: NANE COUNTY OU PANELS $(mp)^2$ 1714147WI Project No: STRUCTURAL ENGINEERS, LLC Designed By: JTR Page No: 11/21/200 Date: OFIFT AREA 2 (A2) LOAD CASES O SLIDING SNOW (OULS%) 60" 1 36" SLSL DOE = 100. PPLF SLBAL- 100. BALE SLOAL = 100, 8PLF L 11, OL= 7SPLF DL=SIPLF de de seres 34'-10" SI WIND OUT OF THE SOUTH (OK LS'L) SLD=106.4PLF 101 WIND - SLo = 154, PPLF SLEAL = 100. SPLF J Jan 1 DL=SIPLF 1 1 DL: 75 AF JU 34-1011 5' 12" 3 LEEWARD OR JET FOR WIND OUT OF THE NORTH (OK 25%) - SLo= 131,8 PLF a WIND 101 SLD=154.814F SLBAL = 100.8PLF DL=S/PLF AL TSPLE 51 34.40"

Snow Load Pattern for Elevated, Tilted-Open Solar Panel Array

h _{p1} := 21 <i>in</i> Low side dimension		THIS SHEET ASSUMES THE LOW SIDE OF THE PANEL(S) FACES SOUTH. SWAP	
l := 60 <i>in</i> Length of horizor	ntal projection	DIRECTIONS IN THE HEADINGS, IF DIFFERE	NT.
$\theta \coloneqq 20 \ deg$ Angle of tilt		DRIFT AREA B1, B2	
$l_{p} = \left(\frac{l_{horiz}}{\cos(\theta)}\right) = 63.851 in \text{ Length}$	of panel		
$h_{p2} = h_{p1} + l_{p} \sin(\theta) = 42.838 in$	High side dimensi	ion	
l = 42 in Width of aisle b	etween rows		
Drift Fetch Distances:			
l := 63 ft Upwind fetch	for wind OUT OF	THE NORTH	
l := 40.25 ft Upwind fetch	for wind OUT OF	THE SOUTH	
Balanced Snow Load			
Exposure Category: B	For Ct, ignore an	y thermal contribution	
C = 1.2 I = 1.0	from a solar pane	al array. For Ce, the presence	
$C_t = 1.0$ $p_g = 30 psf$	of solar panels bumps the roof exposure into a more severe state. For example, an otherwise		
$p_f = 0.7 \cdot C_e \cdot C_f \cdot I_s p_g = 25.2 psf$	fully exposed roof would be considered partially exposed with the addition of solar panels.		
C _s := 1.0 Obstructed & monosl	ope roof		
$p_s = C_s p_f = 25.2 psf$			
$\gamma = 0.13 \cdot \frac{1}{ft} \cdot p_{g} + 14 \frac{lbf}{ft^{3}} = 17.9 \frac{lbf}{ft^{3}}$	3		
$h_{b} := \frac{p_{s}}{\gamma} = 16.894 in$ $h_{c} := h_{p2} - h_{b}$	= 25.944 <i>in</i>		
$h_{exposed} = h_{p2} - h_{b} = 25.944 in$ Ar II	mount of panel ex f positive, slidi ust be considered	posed above balanced snow load depth. .ng snow surcharge from the solar panels d.	3
Sliding Snow Load			
Consider only if panels are exp	osed above baland	ced snow depth.	
w _c :=1 _{horiz} =60 <i>in</i>	The depth of th shallower than sliding snow su projection of t	ne balanced snow load in an aisle is the height of the low edge of the panel urcharge width is the whole horizontal the panel.	L. The
<pre>wc_panel = l horiz - wc = 0 in</pre>	Horizontal proje	ection of panel covered by sliding snow	
waisle c c_panel 60 in	Width of aisle c	covered by sliding snow	
	Note: For a open-back can slide under panel, the slidi the surcharge is	tilted panel, the slding snow the panel itself. For a closed-back ing snow stops at the panel back. 18" of s under the adjacent panel.	= -
<pre>p + p = 50.4 psf Balanced snow (use balanced not covered by</pre>	load in aisle pl snow load only f y sliding snow)	us sliding surcharge for portion of aisle	
Drift Load

```
Check requirements to avoid calculating drift patterns.
check_la=if h_{p2} < 1.2 \cdot h_b
                                                     = "DRIFT REQ'D, CHECK LOW-SIDE"
            "DRIFT NOT REQ'D, CHECK 2ND CONDITION"
          else
             "DRIFT REQ'D, CHECK LOW-SIDE"
check_1b=if h<sub>p1</sub><h<sub>b</sub>
                                   = "CHECK 2ND CONDITION"
            "DRIFT REQ'D"
          else
             "CHECK 2ND CONDITION"
check_{2} = if h_{p1} < 2 ft + 2 h_{b} = "DRIFT REQ'D"
            "DRIFT REQ'D"
         else
           "DRIFT NOT REQ'D"
Check if closely spaced.
check_close=if l_aisle > 8 h c = "YES"
                "NO"
              else
                "YES"
```

Wind out of the south

1

$$\begin{split} l_{u_{s}} \operatorname{south}^{-1} \operatorname{south}^{-1} \frac{1}{ft} &= 40.25 \\ h_{d}^{-1} \left[0.43 \cdot l_{u_{s}} \operatorname{south}^{-1} \frac{1}{g_{s}} \left(p_{g} \cdot \frac{1}{pst} + 10 \right)^{\frac{1}{4}} - 1.5 \right] ft &= 26.472 \, in \text{ Leeward drift depth} \\ & A_{d_{e}} \operatorname{expected}^{=2 \cdot h_{d}}^{2} = 1401.534 \, in^{2} \\ & h_{dw}^{=0} \cdot 0.75 \cdot h_{d}^{=19.854 \, in \text{ Windward drift depth per ASCE7} \\ & h_{s}^{=0} \cdot 0.707 \cdot h_{dw}^{=14.037 \, in} \\ & h_{c}^{else} \\ & else \\ & h_{g}^{else} \\ \end{bmatrix} \\ P_{d_{w}indward}^{=h} s_{d} \operatorname{esign}^{+} Y^{=20.938 psf} \quad \text{Drift surcharge for wind blowing at low-side of panel} \\ & l \operatorname{drift_{windward}^{=if 4 \cdot h} s_{d} \operatorname{esign}^{+} horiz}^{=4.679 \, ft} \quad \text{Horizontal extent for wind blowing} \\ & l \operatorname{drift_{s}} \operatorname{else} \\ & 4 \cdot h_{s_{s}} \operatorname{design}^{-} \\ & else \\ & 4 \cdot h_{s_{s}} \operatorname{design}^{-} \\ & A_{d_{s}} \operatorname{sw}^{=0.5 \cdot h} s_{s} \operatorname{design}^{(2 \cdot 1)} \operatorname{drift_{windard}^{=}}^{-788.125 \, in^{2}} \quad \text{Drift area at low-side of panel} \\ & h_{u}^{=} \frac{A_{d} \operatorname{expected}_{1 a isle}}{33.37 \, in} \end{split}$$



P d_leeward u_design γ= 38.7 psf Inter-row surcharge $n_{rows} = \frac{6 \cdot h_d^2 - A_d_{NW}}{h_u_{design}^1 aisle} = 5.061$ Extent of inter-row surcharge (round up) ASSUME 6 ROWS ARE FILLED BY INTER-ROW SURCHARGE. ONLY 2 ROWS ARE AVAILABLE. CALCULATE LEEWARD DRIFT.

22 Nov 2017 09:10:16 - Drift Area 2 (B1, B2) Leeward Drifts.sm





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	Project Name:	STAR	WG F COUR	VIG AV PRAIEIC
$(mp)^2$	Project No:		714147	14/T
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ENGINEERS, LLC	Designed By:	JT	R Page	e No:
	Date:		11/21/0	2017
ORIFTAREA 2 (B1 + B) LOA	D CASES		XY FOR	B1
D B1: SLIDING SNOW (OK	< \$ %)		AOO	DN RTU GHT (CONSERVATUR)
PANELS FACE THIS WAY			CI III	71
GO" SUBLEDE = 100.61		35/160		357/%
SL BAL TOU.				
SLEAL FOO. SPLI	F + + + + ···			
$\frac{DL^2}{3L^4 \eta'} = \frac{1}{3L^5} + \frac{1}{5L} +$	V J V V ····			
				29 (Charge on Charge of Street of Charge of Ch
3 B1: WIND OUT OF THE NORT	TH lok 25%	b)		
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SLD= 15912 8.4091			5-41	1 271 A
		Solling		
SLBAL = 100.8PLF J J J J J J			1999 - 1997 -	
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		anterna de la construcción de la c	all na ann an an ann an ann an ann an ann an a	
(3) PALLEEL ADD DATET CAME LOT	a a	C 681	-10	
- NONE ROWS NOT FUE	6	1-3001-	77	
(4) ISJ: SLINDAG SNOW TOKES	10)	INCELS CAL	ETHIS	WAY
	4	114-64		
•		60"		GON GONTE MARIE
		X X J Y		VI VISION - INDEPIC
SLBAL = 100. PPLF			11-20-ALF	L BAL WOR VER
		enzennen en e	5'	31-011-811
				· · · · · · · · · · · · · · · · · · ·
583 D'Onofrio Drive, Suite 201, Madis	son, WI 53719 Phor www.mpsard.com	ne: 608-821-4	4770 Fax: 60	08-821-4780 39 of 119

		STA ANIS
()2	Project Name:	BANE COUNTY BU PANELS
(mp)-	Project No:	17141471017
	i Toject No.	
ENGINEERS, LLC	Designed By:	JTR Page No:
	Date:	11/21/2017
C DIVIDIO DUT ON THE	- Courte 101	
() ISD: WIND OUT OF THE	E SOUTH LOV	(2570)
		03.1312 - 360
		4.679 4.679
		IS& PLF
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DL SIPLF JJJJ		DE=75PLF& ++
29-10"		51 1 3-61 1-81
(D): 1 FEI AAD DATET FOR	ITUD DUT OF TH	IT ALLATH LOL (FOL)
6 DU. LEEWARD DRIFT FOR	WING DAI OF IF	1E NOVERA 102 23 70)
		- SLo= 141.9plf
		5' (5'
	<u> </u>	154,8925
STANZIAD 8 PIEWILL		The series of the second of the second s
DL= SIPLE L J J J		LALE TSELF & J.L.
29'-10''	an star men versen statistica strands statistica strands strands strands strands strands strands strands and s San strands stra San strands stra	5' 3.6" 1.8"
() BI: LEEWARD ORSFT FOR	VINO OUT OF 1	ME SOUTH (OK < STO)
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3:4" 3:6" 5:	27-211	
583 D'Onofrio Drive, Suite 201,	Madison, WI 53719 Phone www.mpsard.com	e: 608-821-4//0 Fax: 608-821-4780

Snow Load Pattern for Elevated, Tilted-Open Solar Panel Array

h := 21 in Low sid	de dimension		THIS SHEET ASSUMES THE LOW SIDE
pl 1, . := 60 <i>in</i> Leng	th of horizor	ntal projection	DIRECTIONS IN THE HEADINGS, IF DIFFERENT.
horiz $\theta \coloneqq 20 \ deg$ Angle of	of tilt	1 5	
$l_{p} \coloneqq \left(\frac{l_{horiz}}{\cos(\theta)}\right) = 63.852$	l <i>in</i> Length	of panel	
$h_{p2} = h_{p1} + l_{p} \sin(\theta)$	=42.838 <i>in</i> H	High side dimensi	lon
l _{aisle} =42 <i>in</i> Wid	th of aisle b	etween rows	
Drift Fetch Distand 1 := 131.25 <i>ft</i> north	ces: Upwind fetch	for wind OUT OF	THE NORTH
1 = 21.25 ft	Upwind fetch	for wind OUT OF	THE SOUTH
Balanced Snow Load Exposure Category: $C_e = 1.2$ $I_s = 1.0$ $C_t = 1.0$ $p_g = 30$ $p_f = 0.7 \cdot C_e \cdot C_t \cdot I_s \cdot p_g$ $C_s = 1.0$ Obstruct $p_s = C_s \cdot p_f = 25.2 psf$ $\gamma = 0.13 \cdot \frac{1}{ft} \cdot p_g + 14 \frac{1}{f}$ $h_b = \frac{p_s}{\gamma} = 16.894 in$ $h_exposed = h_2 - h_b = 2$ Sliding Snow Load	B psf f = 25.2 psf f = 25.2 psf cted & monosl $\frac{2bf}{t^3} = 17.9 \frac{1bf}{ft^3}$ $h_c \coloneqq h_{p2} - h_k$ 25.944 in Ar If	For Ct, ignore an from a solar panels b more severe state fully exposed roc exposed with the ope roof = 25.944 <i>in</i> mount of panel ex f positive, slidi ust be considered	posed above balanced snow load depth. ng snow surcharge from the solar panels
Consider only if pa	anels are exp	osed above baland	ced snow depth.
w = 1 horiz = 60 in		The depth of the shallower than sliding snow supprojection of t	he balanced snow load in an aisle is the height of the low edge of the panel. The archarge width is the whole horizontal the panel.
wc_panel horiz w	c=0 in	Horizontal proje	ection of panel covered by sliding snow
waisle c vc_pane	= 60 <i>in</i>	Width of aisle c	overed by sliding snow
		Note: For a open-back can slide under panel, the slidi the surcharge is	tilted panel, the slding snow the panel itself. For a closed-back ing snow stops at the panel back. 18" of under the adjacent panel.
p _f +p _s =50.4 <i>psf</i> B (n	alanced snow use balanced ot covered by	load in aisle pl snow load only f y sliding snow)	us sliding surcharge or portion of aisle

Drift Load

Check requirements to avoid calculating drift patterns. $check_1a = if h_{p2} < 1.2 \cdot h_b$ = "DRIFT REQ'D, CHECK LOW-SIDE" "DRIFT NOT REQ'D, CHECK 2ND CONDITION" else "DRIFT REQ'D, CHECK LOW-SIDE" = "CHECK 2ND CONDITION" check_1b=if h_{p1}<h_b "DRIFT REQ'D" else "CHECK 2ND CONDITION" $check_2 := if h_{p1} < 2 ft + 2 h_b = "DRIFT REQ'D"$ "DRIFT REO'D" else "DRIFT NOT REO'D" Check if closely spaced. check_close=if l aisle > 8 h c = "YES" "NO else "YES" Wind out of the south $l_{u_south} = l_{south} \cdot \frac{1}{ft} = 21.25$ $h_{d} \coloneqq \left[0.43 \cdot l_{u_{south}} \frac{1}{3} \cdot \left(p_{g} \cdot \frac{1}{p_{sf}} + 10 \right)^{\frac{1}{4}} - 1.5 \right] ft = 17.943 in \text{ Leeward drift depth}$ $A_{d_{expected}} = 2 \cdot h_{d}^{2} = 643.922 in^{2}$ $h_{dw} = 0.75 \cdot h_{d} = 13.457 in$ Windward drift depth per ASCE7 h_s=0.707·h_{dw}=9.514*in* h := if h > h = 9.514 in Windward drift for wind blowing at low-side of panel
s_design s c h else h l drift_windard s_design horiz = 3.171 ft Horizontal extent for wind blowing at low-side of panel (multiply by 2) l horiz else 4 h s design $h_{u} = \frac{A_{d} \text{ expected}}{l_{aisle}} = 15.331 \text{ in}$



Pd_leeward u_design Y= 38.7 *psf* Inter-row surcharge $n_{rows} = \frac{6 \cdot h_d^2 - A_d_{NW}}{h_u_{design}^1 aisle} = 10.285 \text{ Extent of inter-row surcharge (round up)}$ ASSUME 11 ROWS ARE FILLED BY INTER-ROW SURCHARGE. ONLY 2 ROWS ARE AVAILABLE. CALCULATE LEEWARD DRIFT.

21 Nov 2017 13:43:47 - Drift Area 4 Leeward Drifts.sm







Project Name:

STANG NANE COUNTY PV PANELS

Project No:

Designed By:

Page No:

1714147WI

Date:

JTR 11/21/2017

SLIDING SNOW (OK < S'10)





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ANALYSIS OF P.V. PANEL ARRAY (14" GAP)

The easiest, and perhaps the best, way to alleviate the issues encountered with the new snow drift load patterns is to lower the standoff height between the low-side of the photovoltaic cells and the roof. The following calculations will illustrate that reinforcing of existing framing can be avoided by simply lowering the low-side of the panel to a maximum height of 14" above the roof.



DRIFT AREA 1 & 3

Title Block Line 1 Project Title: Project ID: Engineer: You can change this area Project Descr: using the "Settings" menu item and then using the "Printing & Title Block" selection. Title Block Line 6 Printed: 22 NOV 2017, 9:29AM File = S:\Projects\2017PR~1\179604~1\01 CAL~1\88 ENE~1\JOISTC~1.EC6 **General Beam Analysis** ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Lic. # : KW-06006621 Licensee : MP-Squared Structural Engineers, LLC S Drift+Inter-Row+SL+DL Description : CONTROLLING LOAD CASE FOR DRIFT AREA 1 **General Beam Properties** 29,000.0 ksi Elastic Modulus Span Length = Span #1 40.0 ft Area = 10.0 in^2 Moment of Inertia = 100.0 in^4 D(0.024) S(0.1548) S(0.1548) S(0.1548) <u>S(0.1548)</u> S(0.1012,0) S(0,0.1012) D(0.051) S(0.1008) Span = 40.0 ft **Applied Loads** Service loads entered. Load Factors will be applied for calculations. Uniform Load : D = 0.0510, S = 0.1008 k/ft, Tributary Width = 1.0 ft, (Uniform DL & SL) Varying Uniform Load : S(S,E) = 0.0->0.1012 k/ft, Extent = 1.833 -->> 6.833 ft, Trib Width = 1.0 ft, (S-Drift) Varying Uniform Load : S(S,E) = 0.1012->0.0 k/ft, Extent = 6.833 -->> 11.833 ft, Trib Width = 1.0 ft, (S-Drift) Uniform Load : S = 0.1548 k/ft, Extent = 11.833 -->> 15.333 ft, Tributary Width = 1.0 ft, (Inter-Row) Uniform Load : S = 0.1548 k/ft, Extent = 20.333 -->> 23.833 ft, Tributary Width = 1.0 ft, (Inter-Row) Uniform Load : S = 0.1548 k/ft, Extent = 28.833 -->> 32.333 ft, Tributary Width = 1.0 ft, (Inter-Row) Uniform Load : S = 0.1548 k/ft, Extent = 37.333 -->> 40.0 ft, Tributary Width = 1.0 ft, (Inter-Row) Uniform Load : D = 0.0240 k/ft, Extent = 6.833 -->> 40.0 ft, Tributary Width = 1.0 ft, (PV Panel) **DESIGN SUMMARY** Maximum Bending = 48.008 k-ft Maximum Shear = 4.885 k Load Combination +D+S+H Load Combination +D+S+H Location of maximum on span 20.600ft Location of maximum on span 40.000 ft Span # where maximum occurs Span #1 Span # where maximum occurs Span #1 Maximum Deflection **BOTH SHEAR AND** Max Downward Transient Deflection 3.330 in 144 MOMENT ARE OVER THE Max Upward Transient Deflection 0.053 in 9074 Max Downward Total Deflection 4.799 in 100 5% THRESHOLD. Max Upward Total Deflection 34647 0.014 in

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stres	s Ratios	Summary of Moment Values						Summary of Shear Values			
Segment Length	Span #	М	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega Cb	Rm	Va Max	Vnx	Vnx/Omega	
Overall MAXimum Envelope													
Dsgn. L = 40.00 ft	1			48.01		48.01				4.88			
D Only													
Dsgn. L = 40.00 ft	1			14.72		14.72				1.49			
+D+L+H													
Dsgn. L = 40.00 ft	1			14.72		14.72				1.49			
+D+Lr+H													
Dsgn. L = 40.00 ft	1			14.72		14.72				1.49			
+D+S+H													
Dsgn. L = 40.00 ft	1			48.01		48.01				4.88			
+D+0.750Lr+0.750L+H													
Dsgn. L = 40.00 ft	1			14.72		14.72				1.49			
+D+0.750L+0.750S+H													
Dsgn. L = 40.00 ft	1			39.68		39.68				4.04			
+D+W+H						4.4 70							
Dsgn. L = 40.00 ft	1			14.72		14.72				1.49			
+D+0.70E+H													
Dsgn. L = 40.00 ft	1			14.72		14.72				1.49			
+D+0./50Lf+0./50L+0./50W+H				4470		4470				4.40			
$Dsgn. L = 40.00 \pi$	I			14.72		14.72				1.49			
+D+0./50L+0./50S+0./50W+H	1			20 / 0		20 / 0				4.04			
DSGN. L = 40.00 II				39.68		39.68				4.04			
+D+0.750L1+0.750L+0.5250E+1	1			1470		14 70				1 40			
DSUII. L = 40.00 II				14.72		14.72				1.49			
+D+0.750L+0.750S+0.5250E+F	1			20.40		20.40				4.04			
DSUIL = 40.00 IL	I			39.08		37.08				4.04 5	0 of 11	9	
+0.60D+W+H										-		•	

Title Block Line 6										Printe	d: 22 NOV 2	017, 9:29AM
General Beam A	nalv	sis					File = S	:\Projects\2017PR~1\17	79604~1\01_	_CAL~1\88_E	NE~1\JOIS	TC~1.EC6
	mary		_	_	_	_		ENERCALC, IN	IC. 1983-20	17, Build:10.1	7.9.25, Ver	:10.17.9.25
Lic. # : KW-06006621	or Down							Icensee . IVIP-3	quareu	Siruciura	i Engin	eers, LLC
Description: 3 Drift+int		FJL+DL										
Load Combination		Max Stre	ss Ratios			Summary of Mc	oment Val	ues		Summ	ary of Sh	ear Values
Segment Length S	Span #	Μ	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega Cb	Rm	Va Max	Vnx	Vnx/Omega
Dsgn. L = 40.00 ft +0.60D+0.70E+H	1			8.83		8.83				0.89		
Dsgn. L = 40.00 ft	1			8.83		8.83				0.89		
Overall Maximum Defle	ections	6										
Load Combination		Span	Max. "-" Defl	Locatior	in Span	Load Comb	oination		Max	. "+" Defl	Locatio	n in Span
+D+S+H		1	4.7985	2	0.200					0.0000		0.000
Vertical Reactions					Suppor	t notation : Far I	eft is #1		Values ir	n KIPS		
Load Combination		Support 1	Support 2									
Overall MAXimum		4.527	4.885									
Overall MINimum		0.810	0.892									
D Only		1.350	1.486									
+D+L+H		1.350	1.486									
+D+Lr+H		1.350	1.486									
+D+S+H		4.527	4.885									
+D+0.750Lr+0.750L+H		1.350	1.486									
+D+0.750L+0.750S+H		3.733	4.035									
+D+W+H		1.350	1.486									
+D+0.70E+H		1.350	1.486									
+D+0.750Lr+0.750L+0.750V	V+H	1.350	1.486									
+D+0.750L+0.750S+0.750W	/+H	3.733	4.035									
+D+0.750Lr+0.750L+0.5250	E+H	1.350	1.486									
+D+0.750I +0.750S+0.5250I	F+H	3,733	4.035									
+0.60D+W+H		0.810	0.892									
+0.60D+0.70E+H		0.810	0.892									
D Only		1 350	1 486									
Lr Only		1.550	1.400									
L Only												
S Only		3 177	3 300									
W Only		3.177	5.577									
F Only												
H Only												

Title Block Line 1 Project Title: Engineer: Project ID: You can change this area Project Descr: using the "Settings" menu item and then using the "Printing & Title Block" selection. Title Block Line 6 Printed: 22 NOV 2017, 9:32AM File = S:\Projects\2017PR~1\179604~1\01_CAL~1\88_ENE~1\JOISTC~1.EC6 General Beam Analysis ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Lic. # : KW-06006621 Licensee : MP-Squared Structural Engineers, LLC Description : N Drift+Inter-Row+SL+DL CONTROLLING LOAD CASE FOR DRIFT AREA 3 **General Beam Properties** Elastic Modulus 29,000.0 ksi Span Length = 40.0 ft Area = 10.0 in^2 Moment of Inertia = 100.0 in^4 Span #1 D(0.024) S(0.1398,0) <u>S(0.1548)</u> S(0.1548) S(0.1548) D(0.051) S(0.1008) Span = 40.0 ft Applied Loads Service loads entered. Load Factors will be applied for calculations. Uniform Load : D = 0.0510, S = 0.1008 k/ft, Tributary Width = 1.0 ft, (Uniform DL & SL) Uniform Load : S = 0.1548 k/ft, Extent = 8.333 -->> 11.833 ft, Tributary Width = 1.0 ft, (Inter-row) Uniform Load : S = 0.1548 k/ft, Extent = 0.0 -->> 3.333 ft, Tributary Width = 1.0 ft, (Inter-row) Uniform Load : S = 0.1548 k/ft, Extent = 16.833 -->> 20.333 ft, Tributary Width = 1.0 ft, (Inter-row) Varying Uniform Load : S(S,E) = 0.1398->0.0 k/ft, Extent = 25.333 -->> 33.143 ft, Trib Width = 1.0 ft, (N-Drift) Uniform Load : D = 0.0240 k/ft, Extent = 0.0 -->> 25.333 ft, Tributary Width = 1.0 ft, (PV Panel) **DESIGN SUMMARY** 45.450 k-ft Maximum Bending = Maximum Shear = 4.806 k Load Combination +D+S+H Load Combination +D+S+H Location of maximum on span 19.200ft Location of maximum on span 0.000 ft Span # where maximum occurs Span #1 Span # where maximum occurs Span # 1 Maximum Deflection SHEAR IS OVER THE 5% Max Downward Transient Deflection 152 3.143 in Max Upward Transient Deflection 0.050 in 9608 THRESHOLD. Max Downward Total Deflection 4.504 in 106 Max Upward Total Deflection 36996 0.013 in

Maximum Forces & Stresses for Load Combinations Max Stress Ratios Summary of Moment Values Summary of Shear Values Load Combination V Μ Ma - Max Vnx Vnx/Omega Span # Mmax + Mmax -Mnx Mnx/Omega Cb Rm Va Max Segment Length **Overall MAXimum Envelope** Dsgn. L = 40.00 ft 45.45 45.45 4.81 1 D Only Dsgn. L = 40.00 ft 13.74 13.74 1.44 1 +D+L+H Dsgn. L = 40.00 ft 1 13.74 13.74 1.44 +D+Lr+H Dsgn. L = 40.00 ft 1 13.74 13.74 1.44 +D+S+H Dsgn. L = 40.00 ft 1 45.45 45.45 4.81 +D+0.750Lr+0.750L+H 13.74 Dsgn. L = 40.00 ft1 13.74 1.44 +D+0.750L+0.750S+H Dsgn. L = 40.00 ft 37.52 37.52 3.96 1 +D+W+H Dsgn. L = 40.00 ft 1 13.74 13.74 1.44 +D+0.70E+H Dsgn. L = 40.00 ft 13.74 13.74 1.44 1 +D+0.750Lr+0.750L+0.750W+H Dsgn. L = 40.00 ft 13.74 13.74 1.44 1 +D+0.750L+0.750S+0.750W+H Dsqn. L = 40.00 ft37.52 37.52 3.96 +D+0.750Lr+0.750L+0.5250E+H Dsgn. L = 40.00 ft 13.74 13.74 1 1.44 +D+0.750L+0.750S+0.5250E+H Dsgn. L = 40.00 ft 37.52 37.52 3.96 1 +0.60D+W+H Dsgn. L = 40.00 ft 8.24 8.24 ^{0.86} 52 of 119 1 +0.60D+0.70E+H

8.24

0.86

8.24

Dsgn. L = 40.00 ft

1

Description : N Drift+Inter-Row+SL+DL

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	4.5037	20.000		0.0000	0.000
Vertical Reactions			Support	notation : Far left is #1	Values in KIPS	
Load Combination	Support 1	Support 2				
Overall MAXimum	4.806	4.020				
Overall MINimum	0.861	0.728				
D Only	1.435	1.213				
+D+L+H	1.435	1.213				
+D+Lr+H	1.435	1.213				
+D+S+H	4.806	4.020				
+D+0.750Lr+0.750L+H	1.435	1.213				
+D+0.750L+0.750S+H	3.963	3.318				
+D+W+H	1.435	1.213				
+D+0.70E+H	1.435	1.213				
+D+0.750Lr+0.750L+0.750W+H	1.435	1.213				
+D+0.750L+0.750S+0.750W+H	3.963	3.318				
+D+0.750Lr+0.750L+0.5250E+H	1.435	1.213				
+D+0.750L+0.750S+0.5250E+H	3.963	3.318				
+0.60D+W+H	0.861	0.728				
+0.60D+0.70E+H	0.861	0.728				
D Only	1.435	1.213				
Lr Only						
L Only						
S Only	3.370	2.807				
W Only						
E Only						
H Only						

Printed: 22 NOV 2017, 9:32AM File = S:\Projects\2017PR-1\179604-1\01_CAL-1\88_ENE-1\JOISTC-1.EC6 ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Licensee : MP-Squared Structural Engineers, LLC

Title Block Line 1 Project Title: Engineer: Project ID: You can change this area Project Descr: using the "Settings" menu item and then using the "Printing & Title Block" selection. Title Block Line 6 Printed: 22 NOV 2017, 9:36AM File = S:\Projects\2017PR~1\179604~1\01 CAL~1\88 ENE~1\JOISTC~1.EC6 General Beam Analysis ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Lic. # : KW-06006621 Licensee : MP-Squared Structural Engineers, LLC Description : Sliding Snow+SL+DL **General Beam Properties** Elastic Modulus 29,000.0 ksi Span Length = Span #1 40.0 ft Area = 10.0 in^2 Moment of Inertia = 100.0 in^4 S(0.1008) \$\$(0.1008) 1008) (0.1008) v 08) 1008) ° .1008) S(0.1008) S(0:1008) D(0.075) Span = 40.0 f Applied Loads Service loads entered. Load Factors will be applied for calculations. Uniform Load : D = 0.0750 k/ft, Tributary Width = 1.0 ft, (Uniform DL & SL) Uniform Load : S = 0.1008 k/ft, Extent = 0.0 -->> 0.8333 ft, Tributary Width = 1.0 ft, (Balanced Snow) Uniform Load : S = 0.1008 k/ft, Extent = 0.0 -->> 0.8333 ft, Tributary Width = 1.0 ft, (Sliding Snow) Uniform Load : S = 0.1008 k/ft, Extent = 5.833 -->> 9.333 ft, Tributary Width = 1.0 ft, (Balanced Snow) Uniform Load : S = 0.1008 k/ft, Extent = 4.333 -->> 9.333 ft, Tributary Width = 1.0 ft, (Sliding Snow) Uniform Load : S = 0.1008 k/ft, Extent = 14.333 -->> 17.833 ft, Tributary Width = 1.0 ft, (Balanced Snow) Uniform Load : S = 0.1008 k/ft, Extent = 12.833 -->> 17.833 ft, Tributary Width = 1.0 ft, (Sliding Snow) Uniform Load : S = 0.1008 k/ft, Extent = 22.833 -->> 26.333 ft, Tributary Width = 1.0 ft, (Balanced Snow) Uniform Load : S = 0.1008 k/ft, Extent = 21.333 -->> 26.333 ft, Tributary Width = 1.0 ft, (Sliding Snow) Uniform Load : S = 0.1008 k/ft, Extent = 31.333 -->> 34.833 ft, Tributary Width = 1.0 ft, (Balanced Snow) Uniform Load : S = 0.1008 k/ft, Extent = 29.833 -->> 34.833 ft, Tributary Width = 1.0 ft, (Sliding Snow) Uniform Load : S = 0.1008 k/ft, Extent = 39.833 -->> 40.0 ft, Tributary Width = 1.0 ft, (Balanced Snow) Uniform Load : S = 0.1008 k/ft, Extent = 38.333 -->> 40.0 ft, Tributary Width = 1.0 ft, (Sliding Snow) **DESIGN SUMMARY** 3.393 k Maximum Bending = 34.813 k-ft Maximum Shear = Load Combination +D+S+H Load Combination +D+S+H Location of maximum on span 20.200ft Location of maximum on span 0.000 ft Span # where maximum occurs Span # 1 Span # where maximum occurs Span # 1 Maximum Deflection Max Downward Transient Deflection 2.001 in 239 **BOTH SHEAR AND** Max Upward Transient Deflection 0.032 in 15150 **MOMENT ARE OK!** Max Downward Total Deflection 3.503 in 137 Max Upward Total Deflection 0.014 in 33564 Maximum Forces & Stresses for Load Combinations Max Stress Ratios Summary of Shear Values Summary of Moment Values Load Combination М V Vnx Vnx/Omega Segment Length Span # Mmax + Mmax -Ma - Max Mnx Mnx/Omega Cb Rm Va Max

Overall MAXimum Envelope				
Dsgn. L = 40.00 ft	1	34.81	34.81	3.39
D Only				
Dsgn. L = 40.00 ft	1	15.00	15.00	1.50
+D+L+H				
Dsgn. L = 40.00 ft	1	15.00	15.00	1.50
+D+Lr+H				
Dsgn. L = 40.00 ft	1	15.00	15.00	1.50
+D+S+H				
Dsgn. L = 40.00 ft	1	34.81	34.81	3.39
+D+0.750Lr+0.750L+H				
Dsgn. L = 40.00 ft	1	15.00	15.00	1.50
+D+0.750L+0.750S+H				
Dsgn. L = 40.00 ft	1	29.86	29.86	2.92
+D+W+H				
Dsgn. L = 40.00 ft	1	15.00	15.00	1.50
+D+0.70E+H				
Dsgn. L = 40.00 ft	1	15.00	15.00	1.50
+D+0.750Lr+0.750L+0.750W+H				
Dsgn. L = 40.00 ft	1	15.00	15.00	1.50
+D+0.750L+0.750S+0.750W+H				54 of 119
Dsgn. L = 40.00 ft	1	29.86	29.86	2.92

Printed: 22 NOV 2017, 9:36AM
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ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25
Licensee : MP-Squared Structural Engineers 11

Lic. # : KW-06006621 Description : Sliding Snow+SL+DL

200011-000													
Load Combination		Max Stre	ss Ratios			Summary of Mo	oment Val	ues			Sumn	nary of Sł	near Values
Segment Length S	pan #	Μ	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
+D+0.750Lr+0.750L+0.5250E+H													
Dsqn. L = 40.00 ft	1			15.00		15.00					1.50		
+D+0.750L+0.750S+0.5250E+H													
Dsgn. L = 40.00 ft	1			29.86		29.86					2.92		
+0.60D+W+H													
Dsgn. L = 40.00 ft	1			9.00		9.00					0.90		
+0.60D+0.70E+H				0.00		0.00					0.00		
Dsgn. L = 40.00 ft	1			9.00		9.00					0.90		
Overall Maximum Defle	ctions	5											
Load Combination		Span	Max. "-" Defl	Location in	Span	Load Comb	pination			Max	x. "+" Defl	Locatio	n in Span
+D+S+H		1	3.5031	20.2	200						0.0000		0.000
Vertical Reactions					Suppor	t notation : Far I	eft is #1			Values i	in KIPS		
Load Combination		Support 1	Support 2										
Overall MAXimum		3.393	3.387										
Overall MINimum		0.900	0.900										
D Only		1.500	1.500										
+D+L+H		1.500	1.500										
+D+Lr+H		1.500	1.500										
+D+S+H		3.393	3.387										
+D+0.750Lr+0.750L+H		1.500	1.500										
+D+0.750L+0.750S+H		2.919	2.916										
+D+W+H		1.500	1.500										
+D+0.70E+H		1.500	1.500										
+D+0.750Lr+0.750L+0.750W	+H	1.500	1.500										
+D+0.750L+0.750S+0.750W+	۰H	2.919	2.916										
+D+0.750Lr+0.750L+0.5250E	+H	1.500	1.500										
+D+0.750L+0.750S+0.5250E	+H	2.919	2.916										
+0.60D+W+H		0.900	0.900										
+0.60D+0.70E+H		0.900	0.900										
D Only		1.500	1.500										
Lr Only													
L Only													
S Only		1.893	1.887										
W Only													
E Only													
H Only													



DRIFT AREA 2 (A1)

Title Block Line 1 Project Title: Engineer: Project ID: You can change this area Project Descr: using the "Settings" menu item and then using the "Printing & Title Block" selection. Title Block Line 6 Printed: 22 NOV 2017, 9:40AM File = S:\Projects\2017PR~1\179604~1\01_CAL~1\88_ENE~1\JOISTC~1.EC6 General Beam Analysis ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Lic. # : KW-06006621 Licensee : MP-Squared Structural Engineers, LLC Description : N-drift+Inter-row+SL+DL **General Beam Properties** Elastic Modulus 29,000.0 ksi Span Length = Span #1 40.0 ft Area = 10.0 in^2 Moment of Inertia = 100.0 in^4 D(0.024) [☆] S(0.1548) S(0.1548) S(0.1548) S(0.1398,0) Ď(0.051) Š(0.1008) Span = 40.0 ft **Applied Loads** Service loads entered. Load Factors will be applied for calculations. Uniform Load : D = 0.0510, S = 0.1008 k/ft, Tributary Width = 1.0 ft, (Uniform DL & SL) Varying Uniform Load : S(S,E) = 0.1398->0.0 k/ft, Extent = 25.250 -->> 33.063 ft, Trib Width = 1.0 ft, (N-Drift) Uniform Load : S = 0.1548 k/ft, Extent = 16.750 -->> 20.250 ft, Tributary Width = 1.0 ft, (Inter-row) Uniform Load : S = 0.1548 k/ft, Extent = 8.250 -->> 11.750 ft, Tributary Width = 1.0 ft, (Inter-row) Uniform Load : S = 0.1548 k/ft, Extent = 0.0 -->> 3.250 ft, Tributary Width = 1.0 ft, (Inter-row) Uniform Load : D = 0.0240 k/ft, Extent = 0.0 -->> 25.250 ft, Tributary Width = 1.0 ft, (Uniform DL & SL) **DESIGN SUMMARY** 45.404 k-ft Maximum Bending = Maximum Shear = 4.797 k Load Combination +D+S+H Load Combination +D+S+H Location of maximum on span 19.200ft 0.000 ft Location of maximum on span Span # where maximum occurs Span #1 Span # where maximum occurs Span # 1 Maximum Deflection Max Downward Transient Deflection 3.140 in 152 SHEAR IS OVER THE 5%

Maximum Forces & Stresses for Load Combinations

Max Upward Transient Deflection

Max Downward Total Deflection

Max Upward Total Deflection

Load Combination		Summary of Moment Values							Summary of Shear Values				
Segment Length	Span #	Μ	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
Overall MAXimum Envelope													
Dsan. L = 40.00 ft	1			45.40		45.40					4.80		
D Only													
Dsgn. L = 40.00 ft	1			13.72		13.72					1.43		
+D+L+H													
Dsgn. L = 40.00 ft	1			13.72		13.72					1.43		
+D+Lr+H													
Dsgn. L = 40.00 ft	1			13.72		13.72					1.43		
+D+S+H													
Dsgn. L = 40.00 ft	1			45.40		45.40					4.80		
+D+0.750Lr+0.750L+H													
Dsgn. L = 40.00 ft	1			13.72		13.72					1.43		
+D+0.750L+0.750S+H													
Dsgn. L = 40.00 ft	1			37.48		37.48					3.96		
+D+W+H				40.70		40.70					4.40		
Dsgn. L = 40.00 ft	1			13.72		13.72					1.43		
+D+0.70E+H				40.70		40.70					4.40		
Dsgn. L = 40.00 ft	1			13.72		13.72					1.43		
+D+0./50LF+0./50L+0./50W+F	1			10 70		10 70					1 40		
$DSgn. L = 40.00 \pi$	I			13.72		13.72					1.43		
+D+0./50L+0./50S+0./50W+H	1			27.40		27.40					2.07		
DSGII. L = 40.00 II	1			37.48		37.48					3.90		
+D+0.750LI+0.750L+0.5250E+I	1			12 72		12 72					1 / 2		
$D_{10} = 40.00 \text{ II}$				13.72		13.72					1.45		
$+D+0.750\pm0.7505\pm0.5250\pm1$	1			27 10		27 10					2.06		
$+0.60D_{\pm}W_{\pm}H$	1			57.40		57.40					5.70		
$D_{san} I = 40.00 \text{ ft}$	1			8 23		8 23					0.86		
+0.60D+0.70F+H				0.20		0.23					0.00 5	7 of 11	9
Dsan. $L = 40.00 \text{ ft}$	1			8.23		8.23					0.86		

9619

37034

106

THRESHOLD.

0.050 in

4.499 in

0.013 in

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	4.4991	20.000		0.0000	0.000
Vertical Reactions			Support	notation : Far left is #1	Values in KIPS	
Load Combination	Support 1	Support 2				
Overall MAXimum	4.797	4.014				
Overall MINimum	0.861	0.727				
D Only	1.435	1.211				
+D+L+H	1.435	1.211				
+D+Lr+H	1.435	1.211				
+D+S+H	4.797	4.014				
+D+0.750Lr+0.750L+H	1.435	1.211				
+D+0.750L+0.750S+H	3.956	3.313				
+D+W+H	1.435	1.211				
+D+0.70E+H	1.435	1.211				
+D+0.750Lr+0.750L+0.750W+H	1.435	1.211				
+D+0.750L+0.750S+0.750W+H	3.956	3.313				
+D+0.750Lr+0.750L+0.5250E+H	1.435	1.211				
+D+0.750L+0.750S+0.5250E+H	3.956	3.313				
+0.60D+W+H	0.861	0.727				
+0.60D+0.70E+H	0.861	0.727				
D Only	1.435	1.211				
Lr Only						
L Only						
S Only	3.362	2.803				
W Only						
E Only						
H Only						

Printed: 22 NOV 2017, 9:40AM File = S:\Projects\2017PR-1\179604-1\01_CAL-1\88_ENE-1\JOISTC-1.EC6 ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Licensee : MP-Squared Structural Engineers, LLC

_Title Block Line 6				Printed: 22 NOV 2017, 9:41AM
General Beam Analysis		File = S:\Proj	ects\2017PR~1\179604~1\01_CAL~1\ ENERCALC_INC_1983-2017_Build	88_ENE~1\JOISTC~1.EC6
Lic. # : KW-06006621		Lice	nsee : MP-Squared Struct	tural Engineers, LLC
Description : Leeward S-drift+Inter-row+SL+DL				
General Beam Properties	CONTROLLI	NG LOAD	CASE FOR DRIF	AREA 2 (A1)
Elastic Modulus 29,000.0 ksi				
Span #1 Span Length = 40.0 ft	Area =	10.0 in^2	Moment of Inertia =	100.0 in^4
D(0.024)	-tr			
$\begin{array}{c} \stackrel{\vee}{\overset{\vee}{\overset{\vee}{\overset{\vee}{\overset{\vee}{\overset{\vee}{\overset{\vee}{\overset{\vee}{$	×	Ŷ		
	Ď(0.051) Š(0.1008)	ţ	<u>\$(0.1548,0)</u>	
×		•		×
×				×
	Span = 40.0 ft			
•				
Applied Loads	Ser	vice loads enter	ed. Load Factors will be ap	plied for calculations.
Uniform Load : D = 0.0510, S = 0.1008 k/ft, Tributary Wid	lth = 1.0 ft, (Uniform DL 8	، SL)		
Varying Uniform Load : S(S,E) = 0.1548->0.0 k/ft, Extent =	: 25.250>> 39.785 ft, T	rib Width = 1.0 ft	, (Leeward S-drift)	
$Uniform Load \cdot S = 0.1346 \text{ k/ft} \text{Extent} = 10.730 \text{>>} 20.23$	on, moulary width = 1. Iff Tributary Width = 1.0	ft (Inter-row)		

 $\begin{array}{l} \text{Uniform Load}: S = 0.1548 \text{ k/ft, Extent} = 0.0 \dashrightarrow 3.250 \text{ ft, Tributary Width} = 1.0 \text{ ft, (Inter-row)} \\ \text{Uniform Load}: D = 0.0240 \text{ k/ft, Extent} = 0.0 \dashrightarrow 25.250 \text{ ft, Tributary Width} = 1.0 \text{ ft, (Solar Panels)} \\ \end{array}$

DESIGN SUMMARY

Maximum Bending = Load Combination	47.586 k-ft +D+S+H	Maximum Shear = Load Combir	= nation	4.910 k +D+S+H
Location of maximum on span	19.600ft	Location of n	naximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # when	e maximum occurs	Span # 1
Maximum Deflection Max Downward Transient Deflection Max Upward Transient Deflection Max Downward Total Deflection Max Upward Total Deflection	3.389 in 0.054 in 4.749 in 0.013 in	141 8964 101 37034	BOTH SHEAR A MOMENT ARE 0 5% THRESHOLI	ND OVER THE D.

Maximum Forces & Sti	resses	for Load C	ombinati	ions								
Load Combination		Max Stress	s Ratios		:	Summary of Mo	ment Valu	Jes		Summa	ary of Sh	ear Values
Segment Length	Span #	М	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega Cb	Rm	Va Max	Vnx	Vnx/Omega
Overall MAXimum Envelope												
Dsgn. L = 40.00 ft	1			47.59		47.59				4.91		
D Only												
Dsgn. L = 40.00 ft	1			13.72		13.72				1.43		
+D+L+H												
Dsgn. L = 40.00 ft	1			13.72		13.72				1.43		
+D+Lr+H												
Dsgn. L = 40.00 ft	1			13.72		13.72				1.43		
+D+S+H												
Dsgn. L = 40.00 ft	1			47.59		47.59				4.91		
+D+0.750Lr+0.750L+H												
Dsgn. L = 40.00 ft	1			13.72		13.72				1.43		
+D+0.750L+0.750S+H												
Dsgn. L = 40.00 ft	1			39.12		39.12				4.04		
+D+W+H												
Dsgn. L = 40.00 ft	1			13.72		13.72				1.43		
+D+0.70E+H												
Dsgn. L = 40.00 ft	1			13.72		13.72				1.43		
+D+0.750Lr+0.750L+0.750W+H	1											
Dsgn. L = 40.00 ft	1			13.72		13.72				1.43		
+D+0.750L+0.750S+0.750W+H												
Dsgn. L = 40.00 ft	1			39.12		39.12				4.04		
+D+0.750Lr+0.750L+0.5250E+I	H											
Dsgn. L = 40.00 ft	1			13.72		13.72				1.43		
+D+0.750L+0.750S+0.5250E+H	ł											
Dsgn. L = 40.00 ft	1			39.12		39.12				4.04		
+0.60D+W+H												
Dsgn. L = 40.00 ft	1			8.23		8.23				0.86 –	0 of 11	0
+0.60D+0.70E+H										5		3
Dsgn. L = 40.00 ft	1			8.23		8.23				0.86		

Description : Leeward S-drift+Inter-row+SL+DL

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	4.7486	20.000		0.0000	0.000
Vertical Reactions			Support	notation : Far left is #1	Values in KIPS	
Load Combination	Support 1	Support 2				
Overall MAXimum	4.910	4.480				
Overall MINimum	0.861	0.727				
D Only	1.435	1.211				
+D+L+H	1.435	1.211				
+D+Lr+H	1.435	1.211				
+D+S+H	4.910	4.480				
+D+0.750Lr+0.750L+H	1.435	1.211				
+D+0.750L+0.750S+H	4.041	3.663				
+D+W+H	1.435	1.211				
+D+0.70E+H	1.435	1.211				
+D+0.750Lr+0.750L+0.750W+H	1.435	1.211				
+D+0.750L+0.750S+0.750W+H	4.041	3.663				
+D+0.750Lr+0.750L+0.5250E+H	1.435	1.211				
+D+0.750L+0.750S+0.5250E+H	4.041	3.663				
+0.60D+W+H	0.861	0.727				
+0.60D+0.70E+H	0.861	0.727				
D Only	1.435	1.211				
Lr Only						
L Only						
S Only	3.475	3.269				
W Only						
E Only						
H Only						

Project Title: Engineer: Project Descr:

Prinled: 22 NOV 2017, 9:41AM File = S:\Projects\2017PR-1\179604~1\01_CAL-1\88_ENE~1\JOISTC-1.EC6 ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Licensee : MP-Squared Structural Engineers, LLC Title Block Line 1 Project Title: Engineer: Project ID: You can change this area Project Descr: using the "Settings" menu item and then using the "Printing & Title Block" selection. Title Block Line 6 Printed: 22 NOV 2017, 9:41AM File = S:\Projects\2017PR~1\179604~1\01 CAL~1\88 ENE~1\JOISTC~1.EC6 **General Beam Analysis** ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Lic. # : KW-06006621 Licensee : MP-Squared Structural Engineers, LLC Description : Sliding Snow+SL+DL **General Beam Properties** Elastic Modulus 29,000.0 ksi Span Length = 40.0 ft 10.0 in^2 Span #1 Area = Moment of Inertia = 100.0 in^4 S(0.1008) (0.1008) S(0.1008) * S(0.1008) ∑_____S(0.1008) ∛ D(0.024) D(0.051) Span = 40.0 ft **Applied Loads** Service loads entered. Load Factors will be applied for calculations. Uniform Load : D = 0.0510 k/ft, Tributary Width = 1.0 ft, (Uniform DL & SL) Uniform Load : D = 0.0240 k/ft, Extent = 0.0 -->> 25.250 ft, Tributary Width = 1.0 ft, (P.V. Panels) Uniform Load : S = 0.1008 k/ft, Extent = 0.0 -->> 3.250 ft, Tributary Width = 1.0 ft, (Balanced Snow) Uniform Load : S = 0.1008 k/ft, Extent = 0.0 -->> 3.250 ft, Tributary Width = 1.0 ft, (Sliding Snow) Uniform Load : S = 0.1008 k/ft, Extent = 15.250 -->> 20.250 ft, Tributary Width = 1.0 ft, (Sliding Snow) Uniform Load : S = 0.1008 k/ft, Extent = 25.250 -->> 40.0 ft, Tributary Width = 1.0 ft, (Balanced Snow) **DESIGN SUMMARY** Maximum Bending = 31.766 k-ft Maximum Shear = 3.459 k Load Combination +D+S+H Load Combination +D+S+H 18.800ft Location of maximum on span Location of maximum on span 0.000 ft Span # where maximum occurs Span #1 Span # where maximum occurs Span # 1 Maximum Deflection Max Downward Transient Deflection 1.788 in 268 **BOTH SHEAR AND** Max Upward Transient Deflection 0.029 in 16744 **MOMENT ARE OK!** Max Downward Total Deflection 3.147 in 152 0.013 in Max Upward Total Deflection 37034 Maximum Forces & Stresses for Load Combinations Max Stress Ratios Summary of Moment Values Summary of Shear Values Load Combination Vnx Vnx/Omega М V Mnx/Omega Cb Va Max Ma - Max Mnx Rm Seament Length Span # Mmax + Mmax -

<u>j</u>	1		5	J
Overall MAXimum Envelope				
Dsgn. L = 40.00 ft	1	31.77	31.77	3.46
D Only				
Dsgn. L = 40.00 ft	1	13.72	13.72	1.43
+D+L+H				
Dsgn. L = 40.00 ft	1	13.72	13.72	1.43
+D+Lr+H				
Dsgn. L = 40.00 ft	1	13.72	13.72	1.43
+D+S+H				
Dsgn. L = 40.00 ft	1	31.77	31.77	3.46
+D+0.750Lr+0.750L+H				
Dsgn. L = 40.00 ft	1	13.72	13.72	1.43
+D+0.750L+0.750S+H				
Dsgn. L = 40.00 ft	1	27.25	27.25	2.95
+D+W+H				
Dsgn. L = 40.00 ft	1	13.72	13.72	1.43
+D+0.70E+H				
Dsgn. L = 40.00 ft	1	13.72	13.72	1.43
+D+0.750Lr+0.750L+0.750W+H				
Dsgn. L = 40.00 ft	1	13.72	13.72	1.43
+D+0.750L+0.750S+0.750W+H				
Dsgn. L = 40.00 ft	1	27.25	27.25	2.95
+D+0.750Lr+0.750L+0.5250E+H				
Dsgn. L = 40.00 ft	1	13.72	13.72	1.43
+D+0.750L+0.750S+0.5250E+H				61 of 119
Dsgn. L = 40.00 ft	1	27.25	27.25	2.95

Title Block Line 6									Printe	d: 22 NOV 2	017, 9:41AM
General Ream Ana	lvsis					File = S	:\Projects\2017PR~1\17	79604~1\01	_CAL~1\88_E	NE~1\JOIS	TC~1.EC6
	19313		_	_		_	ENERCALC, IN	IC. 1983-20	017, Build:10.1	7.9.25, Ver	:10.17.9.25
LIC. # : KW-0600621						Ľ	licensee : MP-5	quared	Structura	i Engin	eers, LLC
Description : Sliding Show+3	SL+DL										
Load Combination	Max Stre	ess Ratios			Summary of Mo	oment Val	ues		Summ	ary of Sh	ear Values
Segment Length Span	# M	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega Cb	Rm	Va Max	Vnx	Vnx/Omega
+0.60D+W+H Dsgn. L = 40.00 ft 1			8.23		8.23				0.86		
Dsgn. L = 40.00 ft 1			8.23		8.23				0.86		
Overall Maximum Deflection	ons										
Load Combination	Span	Max. "-" Defl	Locatior	n in Span	Load Comb	oination		Мах	(. "+" Defl	Locatio	n in Span
+D+S+H	1	3.1472	1	19.800					0.0000		0.000
Vertical Reactions				Suppor	t notation : Far I	eft is #1		Values in	n KIPS		
Load Combination	Support 1	Support 2								-	
Overall MAXimum	3.459	3.042									
Overall MINimum	0.861	0.727									
D Only	1.435	1.211									
+D+L+H	1.435	1.211									
+D+Lr+H	1.435	1.211									
+D+S+H	3.459	3.042									
+D+0.750Lr+0.750L+H	1.435	1.211									
+D+0.750L+0.750S+H	2.953	2.584									
+D+W+H	1.435	1.211									
+D+0 70F+H	1 435	1 211									
+D+0 7501 r+0 7501 +0 750W+H	1 435	1 211									
+D+0 750I +0 750S+0 750W+H	2 953	2 584									
+D+0 7501 r+0 7501 +0 5250F+H	1 435	1 211									
+D+0 750I +0 750S+0 5250E+H	2 953	2 584									
+0.60D+W+H	0.861	0 727									
+0.60D+0.70E+H	0.861	0.727									
D Only	1 435	1 211									
Lr Only	1.100	1.211									
L Only											
S Only	2 025	1 831									
W Only	2.025	1.001									
F Only											
H Only											



DRIFT AREA 2 (A2)

You can change this area using the "Settings" menu and then using the "Printi	ı u item ng &		Project Title: Engineer: F Project Descr:							Proj	Project ID:		
Title Block" selection. Title Block Line 6										Printec	I: 22 NOV 2	017, 9:49AM	
General Beam	Analysi	s					File = S:	Projects\2017PR~1\179	0604~1\01_C	AL~1\88_EN	IE~1\JOIS	TC~1.EC6	
Lic. # : KW-06006621 Description : S-drift	+Inter-row+SL+I	DL	-		-		L	icensee : MP-Sc	uared S	tructural	Engin	eers, LLC	
General Beam Prop	erties												
Elastic Modulus	29,000.0	ksi											
Span #1	Span Lengt	ih =	40.0	ft	Area =	10).0 in^2	Moment of	Inertia =		100.0	in^4	
×		\$		D(0	.051) S(0. ∲	.1008)		S(0,0).1064) ↓ ↓	⊅ ∲ \$(0.1 Ĵ	.024) 064,Q)((
×												×	
											ŕ		
				S	Span = 40.	.0 ft							
												•	
Applied Loads						Service	loads er	ntered. Load Fact	ors will b	e applied	l for cal	culations.	
Uniform Load : Varying Uniform Uniform Load : Varying Uniform Uniform Load :	D = 0.0510, S = 0.1548 k/f a Load : S(S,E b Load : S(S,E b Load : S(S,E D = 0.0240 \text{ k/f}	S = 0.1008) = 0.0->0. t, Extent =) = 0.1064 t, Extent =	k/ft, Tribu 1064 k/ft, 39.833 ->0.0 k/ft, 34.833	utary Width = 1 Extent = 29.8: >> 40.0 ft, Tril Extent = 34.8: >> 40.0 ft, Tril	I.0 ft, (Unif 33>> 34 butary Wic 33>> 39 butary Wic	form DL & SL) .833 ft, Trib \ ith = 1.0 ft, (Ir .833 ft, Trib \ ith = 1.0 ft, (P) Nidth = 1. nter-row) Nidth = 1. VV Panel)	0 ft, (S-Drift) 0 ft, (N-Drift)					
Maximum Bending	3 =			31.914 k-	ft Ma	ximum She	ear =				3.64	1 k	
Load Combination				+D+S+H		Load Co	ombinatio	1			+D+S+	H	
Location of maximu	m on span			20.600ft Span # 1		Locatioi Snan #	n of maxir where ma	num on span ximum occurs			40.0 Span #	00 ft 1	
Maximum Deflecti Max Downward Tr Max Lloward Tran	on ransient Defle	ection		2.178 in		220					opun "		
Max Opward Train Max Downward To Max Upward Tota	sient Deflection	on N		0.034 in 3.218 in 0.010 in		14049 149 48603		BOTH SH MOMEN	HEAR T ARE	OK!			
Max Downward To Max Upward Total	sient Deflection	on n	mhinati	0.034 in 3.218 in 0.010 in		14049 149 48603		BOTH SH MOMEN	T ARE	OK!			
Max Opward Train Max Downward To Max Upward Tota Maximum Forces & Load Combination	sient Deflection otal Deflection I Deflection Stresses for	on n r Load Co Max Stress	ombinati s Ratios	0.034 in 3.218 in 0.010 in ions		14049 149 48603 Summary of Mo	oment Valu	BOTH SE MOMEN		Summa	ary of Sh	ear Values	
Max Downward To Max Upward Tota Maximum Forces & Load Combination Segment Length	sient Deflection I Deflection Stresses for Span #	on n r Load Co <u>Max Stress</u> M	ombinati Ratios V	0.034 in 3.218 in 0.010 in ions Mmax +	Mmax -	14049 149 48603 Summary of Me Ma - Max	oment Valu Mnx	es Mnx/Omega Cb	TARE	Summa Va Max	ary of Sh Vnx	ear Values Vnx/Omega	
Max Downward To Max Upward Tota Max Upward Tota Maximum Forces & Load Combination Segment Length Overall MAXimum Envelope Dsgn. L = 40.00 ft	sient Deflection tal Deflection I Deflection Stresses for Span #	on n r Load Co <u>Max Stress</u> M	ombinati Ratios V	0.034 in 3.218 in 0.010 in ions Mmax + 31.91	Mmax -	14049 149 48603 Summary of Ma Ma - Max 31.91	oment Valu Mnx	es Mnx/Omega Cb		Summa Va Max 3.64	ary of Sh Vnx	ear Values Vnx/Omega	
Max Downward Tota Max Upward Tota Max Upward Tota Maximum Forces & Load Combination Segment Length Overall MAXimum Envelope Dsgn. L = 40.00 ft D Only Dsgn. L = 40.00 ft	sient Deflection tal Deflection Deflection Stresses for Span # 1 1	on n r Load Co <u>Max Stress</u> M	ombinati Ratios V	0.034 in 3.218 in 0.010 in ions <u>Mmax +</u> 31.91 10.36	Mmax -	14049 149 48603 Summary of Ma Ma - Max 31.91 10.36	oment Valu Mnx	BOTH SH MOMEN ⁻ les Mnx/Omega Cb		Summa Va Max 3.64 1.14	ary of Sh Vnx	ear Values Vnx/Omega	
Max Downward To Max Upward Tota Max Upward Tota Maximum Forces & Load Combination Segment Length Overall MAXimum Envelope Dsgn. L = 40.00 ft D Only Dsgn. L = 40.00 ft +D+L+H Dsgn. L = 40.00 ft	sient Deflection tal Deflection Deflection Stresses for Span # 1 1 1	on n <u>Max Stress</u> <u>M</u>	v Ratios V	0.034 in 3.218 in 0.010 in ions Mmax + 31.91 10.36 10.36	Mmax -	14049 149 48603 Summary of Mo Ma - Max 31.91 10.36 10.36	oment Valu Mnx	BOTH SE MOMENT	TARE	Summa Va Max 3.64 1.14 1.14	ary of Sh Vnx	ear Values Vnx/Omega	
Max Downward Tota Max Upward Tota Max Upward Tota Maximum Forces & Load Combination Segment Length Overall MAXimum Envelope Dsgn. L = 40.00 ft +D+L+H Dsgn. L = 40.00 ft +D+Lr+H Dsgn. L = 40.00 ft	sient Deflection tal Deflection Deflection Stresses for Span # 1 1 1 1	on n <u>Max Stress</u> M	ombinati s Ratios V	0.034 in 3.218 in 0.010 in ions Mmax + 31.91 10.36 10.36	Mmax -	14049 149 48603 Summary of Me Ma - Max 31.91 10.36 10.36 10.36	oment Valu Mnx	es Mnx/Omega Cb	Rm	Summa Va Max 3.64 1.14 1.14 1.14	ary of Sh Vnx	ear Values Vnx/Omega	
Max Downward Tot Max Upward Tota Max Upward Tota Max Upward Tota Maximum Forces & Load Combination Segment Length Overall MAXimum Envelope Dsgn. L = 40.00 ft D Only Dsgn. L = 40.00 ft +D+L+H Dsgn. L = 40.00 ft +D+Lr+H Dsgn. L = 40.00 ft +D+S+H Dsgn. L = 40.00 ft	sient Deflection total Deflection Stresses for Span # 1 1 1 1 1 1	on n <u>Max Stress</u> M	ombinati s Ratios V	0.034 in 3.218 in 0.010 in ions Mmax + 31.91 10.36 10.36 10.36 31.91	Mmax -	14049 149 48603 Summary of Ma Ma - Max 31.91 10.36 10.36 10.36 31.91	oment Valu Mnx	Ies Mnx/Omega Cb	Rm	Summa Va Max 3.64 1.14 1.14 1.14 3.64	ary of Sh Vnx	ear Values Vnx/Omega	
Max Downward Tot Max Upward Total Max Upward Total Max Upward Total Segment Length Overall MAXimum Envelope Dsgn. L = 40.00 ft +D+L+H Dsgn. L = 40.00 ft +D+Lr+H Dsgn. L = 40.00 ft +D+S+H Dsgn. L = 40.00 ft +D+S+H Dsgn. L = 40.00 ft +D+0.750Lr+0.750L+H Dsgn L = 40.00 ft	sient Deflection total Deflection Stresses for Span # 1 1 1 1 1 1 1	on n <u>Max Stress</u> <u>M</u>	ombinati s Ratios V	0.034 in 3.218 in 0.010 in ions Mmax + 31.91 10.36 10.36 31.91 10.36	Mmax -	14049 149 48603 Summary of Mo Ma - Max 31.91 10.36 10.36 10.36 31.91 10.36	oment Valu Mnx	es Mnx/Omega Cb	Rm	Summa Va Max 3.64 1.14 1.14 1.14 3.64 1.14	ary of Sh Vnx	ear Values Vnx/Omega	
Max Downward Tot Max Upward Tota Max Upward Tota Max Upward Tota Max Upward Tota Segment Length Overall MAXimum Envelope Dsgn. L = 40.00 ft +D+L+H Dsgn. L = 40.00 ft +D+Lr+H Dsgn. L = 40.00 ft +D+S+H Dsgn. L = 40.00 ft +D+0.750Lr+0.750L+H Dsgn. L = 40.00 ft +D+0.750Lr+0.750S+H	sient Deflection tal Deflection I Deflection Stresses for Span # 1 1 1 1 1 1 1 1	n r Load Co <u>Max Stress</u> M	ombinati s Ratios V	0.034 in 3.218 in 0.010 in ions Mmax + 31.91 10.36 10.36 31.91 10.36 31.91 10.36	Mmax -	14049 149 48603 Summary of Me Ma - Max 31.91 10.36 10.36 31.91 10.36 31.91 10.36	oment Valu Mnx	BOTH SE MOMENT	Rm	Summa Va Max 3.64 1.14 1.14 1.14 3.64 1.14 2.01	ary of Sh Vnx	ear Values Vnx/Omega	
Max Downward Tot Max Upward Total Max Upward Total Max Upward Total Segment Length Overall MAXimum Envelope Dsgn. L = 40.00 ft +D+L+H Dsgn. L = 40.00 ft +D+Lr+H Dsgn. L = 40.00 ft +D+Lr+H Dsgn. L = 40.00 ft +D+S+H Dsgn. L = 40.00 ft +D+0.750Lr+0.750L+H Dsgn. L = 40.00 ft +D+0.750L+0.750S+H Dsgn. L = 40.00 ft +D+W+H	sient Deflection total Deflection Stresses for Span # 1 1 1 1 1 1 1 1 1 1	n <u>Max Stress</u> M	ombinati Ratios V	0.034 in 3.218 in 0.010 in ions Mmax + 31.91 10.36 10.36 10.36 31.91 10.36 26.53	Mmax -	14049 149 48603 Summary of Mo Ma - Max 31.91 10.36 10.36 10.36 31.91 10.36 26.53	oment Valu Mnx	Ies Mnx/Omega Cb	Rm	Summa Va Max 3.64 1.14 1.14 1.14 3.64 1.14 3.01	ary of Sh Vnx	ear Values Vnx/Omega	
Max Downward Tota Max Upward Tota Max Upward Tota Max Upward Tota Max Upward Tota Maximum Forces & Load Combination Segment Length Overall MAXimum Envelope Dsgn. L = 40.00 ft +D+L+H Dsgn. L = 40.00 ft +D+Lr+H Dsgn. L = 40.00 ft +D+0.750L+0.750L+H Dsgn. L = 40.00 ft +D+0.750L+0.750S+H Dsgn. L = 40.00 ft +D+W+H Dsgn. L = 40.00 ft +D+W+H Dsgn. L = 40.00 ft +D+0.76L+H	sient Deflection total Deflection Deflection Stresses for Span # 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	on n <u>Max Stress</u> <u>M</u>	ombinati s <u>Ratios</u> V	0.034 in 3.218 in 0.010 in ions Mmax + 31.91 10.36 10.36 31.91 10.36 26.53 10.36	Mmax -	14049 149 48603 Summary of Me Ma - Max 31.91 10.36 10.36 31.91 10.36 26.53 10.36	oment Valu Mnx	es Mnx/Omega Cb	Rm	Summa Va Max 3.64 1.14 1.14 1.14 3.64 1.14 3.01 1.14	ary of Sh Vnx	ear Values Vnx/Omega	
Max Downward Tota Max Upward Tota Max Upward Tota Max Upward Tota Max Upward Tota Maximum Forces & Load Combination Segment Length Overall MAXimum Envelope Dsgn. L = 40.00 ft +D+L+H Dsgn. L = 40.00 ft +D+Lr+H Dsgn. L = 40.00 ft +D+C50Lr+0.750L+H Dsgn. L = 40.00 ft +D+0.750Lr+0.750S+H Dsgn. L = 40.00 ft +D+0.76L+0.750S+H Dsgn. L = 40.00 ft +D+0.750L+0.750S+H Dsgn. L = 40.00 ft +D+0.750Lr+0.750L+0.750V	sient Deflection total Deflection Stresses for Span # 1 1 1 1 1 1 1 1 1 1 1 1 1	n <u>Max Stress</u> M	ombinati s Ratios V	0.034 in 3.218 in 0.010 in ions Mmax + 31.91 10.36 10.36 31.91 10.36 26.53 10.36 10.36	Mmax -	14049 149 48603 Summary of Me Ma - Max 31.91 10.36 10.36 31.91 10.36 26.53 10.36 10.36	oment Valu Mnx	Ies Mnx/Omega Cb	Rm	Summa Va Max 3.64 1.14 1.14 1.14 3.64 1.14 3.01 1.14 1.14	ary of Sh Vnx	ear Values Vnx/Omega	
Max Downward Total Max Downward Total Max Upward Total Max Upward Total Max Upward Total Maximum Forces & Load Combination Segment Length Overall MAXimum Envelope Dsgn. L = 40.00 ft +D+L+H Dsgn. L = 40.00 ft +D+Lr+H Dsgn. L = 40.00 ft +D+S+H Dsgn. L = 40.00 ft +D+0.750Lr+0.750L+H Dsgn. L = 40.00 ft +D+0.750L+0.750S+H Dsgn. L = 40.00 ft +D+0.750L+0.750S+H Dsgn. L = 40.00 ft +D+0.750Lr+0.750L+0.750V Dsgn. L = 40.00 ft +D+0.750Lr+0.750L+0.750V Dsgn. L = 40.00 ft +D+0.750Lr+0.750S+0.750V	sient Deflection total Deflection Stresses for Span # 1 1 1 1 1 1 1 1 1 1 1 1 1	on n <u>Max Stress</u> <u>M</u>	ombinati s Ratios V	0.034 in 3.218 in 0.010 in ions Mmax + 31.91 10.36 10.36 10.36 31.91 10.36 26.53 10.36 10.36 10.36	Mmax -	14049 149 48603 Summary of Mi Ma - Max 31.91 10.36 10.36 10.36 31.91 10.36 26.53 10.36 10.36 10.36	oment Valu Mnx	es Mnx/Omega Cb	Rm	Summa Va Max 3.64 1.14 1.14 1.14 3.64 1.14 3.01 1.14 1.14 1.14 1.14	ary of Sh Vnx	ear Values Vnx/Omega	
Max Downward Tot Max Downward Tot Max Upward Tota Max Upward Tota Max Upward Tota Max Upward Tota Segment Length Overall MAXimum Envelope Dsgn. L = 40.00 ft D Only Dsgn. L = 40.00 ft +D+L+H Dsgn. L = 40.00 ft +D+Lr+H Dsgn. L = 40.00 ft +D+0.750Lr+0.750L+H Dsgn. L = 40.00 ft +D+0.750Lr+0.750S+H Dsgn. L = 40.00 ft +D+0.750Lr+0.750L+0.750V Dsgn. L = 40.00 ft +D+0.750Lr+0.750L+0.750V Dsgn. L = 40.00 ft +D+0.750Lr+0.750L+0.750V Dsgn. L = 40.00 ft +D+0.750Lr+0.750L+0.750V Dsgn. L = 40.00 ft	stent Deflection total Deflection Stresses for Span # 1 1 1 1 1 1 1 1 1 1 1 1 1	on n <u>Max Stress</u> M	ombinati s Ratios V	0.034 in 3.218 in 0.010 in ions Mmax + 31.91 10.36 10.36 10.36 31.91 10.36 26.53 10.36 10.36 10.36 10.36 26.53	Mmax -	14049 149 48603 Summary of Me Ma - Max 31.91 10.36 10.36 31.91 10.36 26.53 10.36 10.36 10.36 10.36 26.53	oment Valu Mnx	es Mnx/Omega Cb	Rm	Summa Va Max 3.64 1.14 1.14 1.14 3.64 1.14 3.01 1.14 1.14 1.14 1.14 3.01	ary of Sh Vnx	ear Values Vnx/Omega	
Max Downward Total Max Upward Total Maximum Forces & Load Combination Segment Length Overall MAXimum Envelope Dsgn. L = 40.00 ft D Only Dsgn. L = 40.00 ft +D+L+H Dsgn. L = 40.00 ft +D+Lr+H Dsgn. L = 40.00 ft +D+0.750L+0.750L+H Dsgn. L = 40.00 ft +D+0.750L+0.750S+H Dsgn. L = 40.00 ft +D+W+H Dsgn. L = 40.00 ft +D+0.750L+0.750L+0.750V+0.750V Dsgn. L = 40.00 ft +D+0.750L+0.750S+0.750W Dsgn. L = 40.00 ft +D+0.750L+0.750L+0.750L+0.5250 Dsgn. L = 40.00 ft	sient Deflection total Deflection Stresses for Span # 1 1 1 1 1 1 1 1 1 1 1 1 1	on n <u>Max Stress</u> <u>M</u>	ombinati s Ratios V	0.034 in 3.218 in 0.010 in ions Mmax + 31.91 10.36 10.36 10.36 31.91 10.36 26.53 10.36 10.36 10.36 10.36 26.53 10.36	Mmax -	14049 149 48603 Summary of Mi Ma - Max 31.91 10.36 10.36 10.36 26.53 10.36 10.36 10.36 10.36 26.53 10.36	oment Valu Mnx	es Mnx/Omega Cb	Rm	Summa Va Max 3.64 1.14 1.14 1.14 3.64 1.14 3.01 1.14 1.14 1.14 3.01 1.14	ary of Sh Vnx	ear Values Vnx/Omega	
Max Downward Total Max Upward Total Use Up (1997) Dsgn L = 40.00 ft +D+L+H Dsgn. L = 40.00 ft +D+Lr+H Dsgn. L = 40.00 ft +D+0.750L+0.750L+0.750L+H Dsgn. L = 40.00 ft +D+0.750L+0.750L+0.750L+0.750L Dsgn. L = 40.00 ft +D+0.750L+0.750L+0.750L+0.750V Dsgn. L = 40.00 ft +D+0.750L+0.750L+0.5250 Dsgn. L = 40.00 ft +D+0.750L+0.750L+0.5250 Dsgn. L = 40.00 ft +D+0.750L+0.750S+0.5250 Dsgn. L = 40.00 ft	sient Deflection total Deflection Stresses for Span # 1 1 1 1 1 1 1 1 1 1 1 1 1	on n <u>Max Stress</u> <u>M</u>	ombinati s Ratios V	0.034 in 3.218 in 0.010 in ions Mmax + 31.91 10.36 10.36 10.36 31.91 10.36 26.53 10.36 10.36 10.36 26.53 10.36 26.53	Mmax -	14049 149 48603 Summary of Mi Ma - Max 31.91 10.36 10.36 10.36 26.53 10.36 10.36 10.36 10.36 10.36 26.53 10.36 26.53	oment Valu Mnx	es Mnx/Omega Cb	Rm	Summa Va Max 3.64 1.14 1.14 1.14 3.64 1.14 3.01 1.14 1.14 1.14 3.01 1.14 3.01 1.14 3.01	ary of Sh Vnx	ear Values Vnx/Omega	
$\begin{array}{r} \mbox{Max Downward Total} \\ \mbox{Max Upward Total} \\ Max$	sient Deflection total Deflection Stresses for Span # 1 1 1 1 1 1 1 1 1 1 1 1 1	on n <u>Max Stress</u> <u>M</u>	ombinati s Ratios V	0.034 in 3.218 in 0.010 in ions Mmax + 31.91 10.36 10.36 10.36 31.91 10.36 26.53 10.36 10.36 10.36 10.36 10.36 26.53 10.36 26.53 10.36 26.53 26.53	Mmax -	14049 149 48603 Summary of Mi Ma - Max 31.91 10.36 10.36 10.36 31.91 10.36 26.53 10.36 10.36 10.36 10.36 26.53 10.36 26.53 10.36 26.53 10.36	oment Valu Mnx	es Mnx/Omega Cb	Rm	Summa Va Max 3.64 1.14 1.14 1.14 3.64 1.14 3.01 1.14 1.14 1.14 3.01 1.14 3.01 1.14 3.01 0.68	ary of Sh Vnx	ear Values Vnx/Omega	

Description : S-drift+Inter-row+SL+DL

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	3.2181	20.200		0.0000	0.000
Vertical Reactions			Support	notation : Far left is #1	Values in KIPS	
Load Combination	Support 1	Support 2				
Overall MAXimum	3.113	3.641				
Overall MINimum	0.617	0.682				
D Only	1.028	1.136				
+D+L+H	1.028	1.136				
+D+Lr+H	1.028	1.136				
+D+S+H	3.113	3.641				
+D+0.750Lr+0.750L+H	1.028	1.136				
+D+0.750L+0.750S+H	2.592	3.015				
+D+W+H	1.028	1.136				
+D+0.70E+H	1.028	1.136				
+D+0.750Lr+0.750L+0.750W+H	1.028	1.136				
+D+0.750L+0.750S+0.750W+H	2.592	3.015				
+D+0.750Lr+0.750L+0.5250E+H	1.028	1.136				
+D+0.750L+0.750S+0.5250E+H	2.592	3.015				
+0.60D+W+H	0.617	0.682				
+0.60D+0.70E+H	0.617	0.682				
D Only	1.028	1.136				
Lr Only						
L Only						
S Only	2.085	2.505				
W Only						
E Only						
H Only						

Prinled: 22 NOV 2017, 9:49AM File = S:\Projects\2017PR-1\179604~1\01_CAL-1\88_ENE~1\JOISTC-1.EC6 ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Licensee : MP-Squared Structural Engineers, LLC

Title Block Line 1 You can change this are using the "Settings" mer and then using the "Prin Title Block" selection. Title Block Line 6	ea nu item tting &				Project Title: Engineer: Project Descr:							oject ID:		
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Lic. # : KW-0600662	1							Lice	ensee : MP-S	c. 1983-20 quared 3	Structural	9.25, ver: Engine	eers, LLC	
Description : Leev	ward N-drift+Inte	r-row+SL+DL												
General Beam Pro	perties				CON	IIROLL			CASE F			REA	Z (AZ)	
Elastic Modulus	29,000.0	ksi												
Span #1	Span Leng	gth =	40.0 f	t	Are	a =	10.0 in^2	2	Moment of	f Inertia	=	100.0	in^4	
											D/0	024)		
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×		¢		[D(0.051)	S(0.1008) ∛			<u>S(0,</u>	0.1310)	_ĵ		ž	
) X													Ž	
					-	10.0 %						4		
					Span =	= 40.0 π							•	
Applied Loads						Se	rvice loads	ente	red. Load Fac	tors will	be applied	for cale	culations.	
Uniform Load Varying Unifor Uniform Load Varying Unifor Uniform Load	: D = 0.0510, m Load : S(S, : S = 0.1548 k m Load : S(S, : D = 0.0240 k	S = 0.1008 F E) = 0.0->0.1/ft, Extent = E) = 0.1318- /ft, Extent =	<pre></pre>	Extent = 29 > 40.0 ft, Extent = 34 > 40.0 ft,	= 1.0 π, (9.833>> Tributary 4.833>> Tributary	 > 34.833 ft, > Width = 1.0 > 39.833 ft, > Width = 1.0 	& SL) Trib Width = ft, (Inter-row Trib Width = ft. (PV Pane	⊧ 1.0 ft v) ⊧ 1.0 ft el)	;, (leeward N-D ;, (leeward N-D	rift) rift)				
DESIGN SUMMAR	Y		0 11000		, no utat y			.,						
Maximum Bendin	1g =			32.252	k-ft	Maximum	Shear =					3.75	2 k	
Load Combination	1			+D+S+F		Lo	ad Combina	ition				+D+S+	·H	
Location of maxim	num on span			20.600	Oft	Lo	cation of ma	iximur	n on span			40.00	DO ft	
Span # where max	ximum occurs			Span # 1		Sp	an # where i	maxin	num occurs			Span #	1	
Maximum Deflect Max Downward Max Upward Tra Max Downward Max Upward Tot	tion Transient Defl nsient Deflec Total Deflection al Deflection	lection tion on		2.216 0.035 3.256 0.010	in in in in	2 138 1 486	16 43 47 03		BOTH S MOMEN	HEAF IT AR	R AND E OK!			
Maximum Forces &	& Stresses fo	or Load Co	mbinatio	ons										
Load Combination		Max Stress	Ratios			Summary	of Moment V	/alues			Summa	ary of She	ear Values	
Segment Length	Span #	М	V	Mmax +	Mma	ax - Ma - N	ax Mn	ix M	Inx/Omega Cb	Rm	Va Max	Vnx	Vnx/Omega	
Overall MAXimum Envelop Dsgn. L = 40.00 ft	e 1			32.25		32.	25				3.75			
D Only Dsgn. L = 40.00 ft	1			10.36		10.	36				1.14			
+D+L+H Dsgn. L = 40.00 ft	1			10.36		10.	36				1.14			
+D+Lr+H Dsgn. L = 40.00 ft	1			10.36		10.	36				1.14			
$+\nu+S+H$ Dsgn. L = 40.00 ft	1			32.25		32.	25				3.75			
+D+0.750Lr+0.750L+H Dsgn. L = 40.00 ft	1			10.36		10.	36				1.14			
+D+0./50L+0./50S+H Dsgn. L = 40.00 ft	1			26.78		26.	78				3.10			
+D+W+H Dsgn. L = 40.00 ft	1			10.36		10.	36				1.14			

10.36

10.36

26.78

10.36

26.78

6.22

6.22

10.36

10.36

26.78

10.36

26.78

6.22

6.22

1.14

1.14

3.10

1.14

3.10

0.68

0.68 66 of 119

+D+0.70E+H Dsgn. L = 40.00 ft

+0.60D+W+H Dsgn. L = 40.00 ft +0.60D+0.70E+H

+D+0.750Lr+0.750L+0.750W+H Dsgn. L = 40.00 ft +D+0.750L+0.750S+0.750W+H

Dsgn. L = 40.00 ft +D+0.750Lr+0.750L+0.5250E+H

Dsgn. L = 40.00 ft +D+0.750L+0.750S+0.5250E+H Dsgn. L = 40.00 ft

Dsgn. L = 40.00 ft

1

1

1

1

1

1

1

Description : Leeward N-drift+Inter-row+SL+DL

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	3.2562	20.200		0.0000	0.000
Vertical Reactions			Support	notation : Far left is #1	Values in KIPS	
Load Combination	Support 1	Support 2				
Overall MAXimum	3.129	3.752				
Overall MINimum	0.617	0.682				
D Only	1.028	1.136				
+D+L+H	1.028	1.136				
+D+Lr+H	1.028	1.136				
+D+S+H	3.129	3.752				
+D+0.750Lr+0.750L+H	1.028	1.136				
+D+0.750L+0.750S+H	2.604	3.098				
+D+W+H	1.028	1.136				
+D+0.70E+H	1.028	1.136				
+D+0.750Lr+0.750L+0.750W+H	1.028	1.136				
+D+0.750L+0.750S+0.750W+H	2.604	3.098				
+D+0.750Lr+0.750L+0.5250E+H	1.028	1.136				
+D+0.750L+0.750S+0.5250E+H	2.604	3.098				
+0.60D+W+H	0.617	0.682				
+0.60D+0.70E+H	0.617	0.682				
D Only	1.028	1.136				
Lr Only						
L Only						
S Only	2.101	2.616				
W Only						
E Only						
H Only						

Printed: 22 NOV 2017, 9:50AM File = S:\Projects\2017PR-1\179604-1\01_CAL-1\88_ENE-1\JOISTC-1.EC6 ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Licensee : MP-Squared Structural Engineers, LLC

Title Block Line 1 You can change this area using the "Settings" menu and then using the "Printi	ı ı item ng &					Project Tit Engineer Project De		Project ID:			
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	Analys	5	_	_	_	_	Lice	ENERCALC, INC	2. 1983-2017, Juared St	Build:10.17.9	9.25, Ver:10.17.9.25 Engineers, LLC
Description : Sliding	g Snow+SL+Dl	-									
General Beam Prope	erties										
Elastic Modulus	29,000.0	ksi			_						
Span #1	Span Leng	jth =	40.0 ft		Area =	10).0 in^2	Moment of	Inertia =		100.0 in^4
								<u>S(0.1</u> ♦ ♦ ₹	008)	:	S(0.1008)
\$		\$		S(0.1008)			\$		\$	D(0.02	24)
×		¢			D(0.051) ∲			\$	~	~ ~	×
*											—×
				Spa	an = 40.0 f	ît .					
Applied Loads						Service	e loads ente	red. Load Fact	ors will be	applied	for calculations.
Uniform Load : Uniform Load : Uniform Load : Uniform Load : Uniform Load : Uniform Load : DESIGN SUMMARY	$\begin{array}{l} D = 0.0510 \text{ k}, \\ D = 0.0240 \text{ k}, \\ S = 0.1008 \text{ k}, \\ \end{array}$	/ft, Tributary /ft, Extent = 3 /ft, Extent = 0 /ft, Extent = 3 /ft, Extent = 3 /ft, Extent = 2	Width = 1.0 ft 4.833>> 40 .0>> 34.833 9.833>> 40 8.333>> 40 9.833>> 34	, (Uniform I .0 ft, Tribut 3 ft, Tributa .0 ft, Tribut .0 ft, Tribu .833 ft, Tribu	DL & SL) tary Width ary Width = tary Width tary Width butary Wid	= 1.0 ft, (P = 1.0 ft, (Ba = 1.0 ft, (B = 1.0 ft, (S = 1.0 ft, (S th = 1.0 ft,	P.V. Panels) Ilanced Snow Ilanced Sno Iliding Snow) (Sliding Sno	/) w) w)			
Maximum Bending	g =		31	.868 k-ft	Maxii	mum She	ear =				3.254 k
Load Combination	m on snan		+D	+S+H 20.400ft		Load Co	ombination n of maximur	n on snan			+D+S+H 40.000 ft
Span # where maxing	mum occurs		Spa	an # 1		Span #	where maxin	num occurs			Span # 1
Maximum Deflection Max Downward Tr Max Upward Tran Max Downward To Max Upward Total	on ransient Defl sient Deflect otal Deflection	ection tion on	2 0 3 0	.166 in .034 in .206 in .010 in		221 14104 149 48603		BOTH S MOMEN	HEAR T ARE	AND OK!]
Maximum Forces &	Stresses fo	or Load Cor	nbinations								
Load Combination	C m an "	Max Stress F	Ratios		Sur	mmary of Mo	oment Values		Der	Summa	ry of Shear Values
Segment Length	Span #	IVI	V IVI	max + I	ivimax - IN	via - Max	IVINX IV	inx/Omega Cb	RM	va Max	vnx vnx/Omega
Dsgn. L = 40.00 ft	1			31.87		31.87				3.25	
Dsgn. L = 40.00 ft	1			10.36		10.36				1.14	
Dsgn. L = 40.00 ft	1			10.36		10.36				1.14	
+D+Lr+H Dsgn. L = 40.00 ft	1			10.36		10.36				1.14	
Dsgn. L = 40.00 ft	1			31.87		31.87				3.25	
Dsgn. L = 40.00 ft	1			10.36		10.36				1.14	
+D+0.750L+0.750S+H Dsgn. L = 40.00 ft	1			26.49		26.49				2.72	
+D+W+H Dsgn. L = 40.00 ft	1			10.36		10.36				1.14	
+D+0.70E+H Dsan L = 40.00 ft	1			10 36		10 36				1 14	
+D+0.750Lr+0.750L+0.750V	V+H 1			10.34		10.24				1 1 /	
+D+0.750L+0.750S+0.750W	/+H			10.30		10.30				1.14	
Dsgn. L = 40.00 ft +D+0.750Lr+0.750L+0.5250	1)E+H			26.49		26.49				2.72	
Dsgn. L = 40.00 ft +D+0.750L+0.750S+0.5250I	1 E+H			10.36		10.36				1.14	
Dsgn. L = 40.00 ft +0.60D+W+H	1			26.49		26.49				2.72	
Dsgn. L = 40.00 ft	1			6.22		6.22				^{0.68} 68	3 of 119
Dsgn. L = 40.00 ft	1			6.22		6.22				0.68	

Description : Sliding Snow+SL+DL

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	3.2063	20.200		0.0000	0.000
Vertical Reactions			Support	notation : Far left is #1	Values in KIPS	
Load Combination	Support 1	Support 2				
Overall MAXimum	3.111	3.254				
Overall MINimum	0.617	0.682				
D Only	1.028	1.136				
+D+L+H	1.028	1.136				
+D+Lr+H	1.028	1.136				
+D+S+H	3.111	3.254				
+D+0.750Lr+0.750L+H	1.028	1.136				
+D+0.750L+0.750S+H	2.590	2.724				
+D+W+H	1.028	1.136				
+D+0.70E+H	1.028	1.136				
+D+0.750Lr+0.750L+0.750W+H	1.028	1.136				
+D+0.750L+0.750S+0.750W+H	2.590	2.724				
+D+0.750Lr+0.750L+0.5250E+H	1.028	1.136				
+D+0.750L+0.750S+0.5250E+H	2.590	2.724				
+0.60D+W+H	0.617	0.682				
+0.60D+0.70E+H	0.617	0.682				
D Only	1.028	1.136				
Lr Only						
L Only						
S Only	2.083	2.118				
W Only						
E Only						
H Only						

Project ID:

Printed: 22 NOV 2017, 9:53AM File = S:\Projects\2017PR-1\179604-1\01_CAL-1\88_ENE-1\JOISTC-1.EC6 ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Licensee : MP-Squared Structural Engineers, LLC


DRIFT AREA 2 (B1)

Title Block Line 1 Project Title: Project ID: Engineer: You can change this area Project Descr: using the "Settings" menu item and then using the "Printing & Title Block" selection. Title Block Line 6 Printed: 29 NOV 2017, 5:05PM File = S:\Projects\2017PR~1\179604~1\01_CAL~1\88_ENE~1\JOISTC~1.EC6 General Beam Analysis ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Lic. # : KW-06006621 Licensee : MP-Squared Structural Engineers, LLC B1: N Drift+Inter-row+SL+DL+RTU Description : **General Beam Properties** Elastic Modulus 29,000.0 ksi Span Length = Span #1 40.0 ft Area = 10.0 in^2 Moment of Inertia = 100.0 in^4 S(0,0.1505) S(0.1548) D(0.024) [†] D(0.351) D(0.351) D(0.051) S(0.1008) Span = 40.0 ft Applied Loads Service loads entered. Load Factors will be applied for calculations.

Uniform Load : D = 0.0510, S = 0.1008 k/ft, Tributary Width = 1.0 ft, (Uniform DL & SL) Uniform Load : D = 0.0240 k/ft, Extent = 28.167 -->> 40.0 ft, Tributary Width = 1.0 ft, (P.V. Panels) Point Load : D = 0.3510 k @ 7.0 ft, (RTU DL) Uniform Load : S = 0.1548 k/ft, Extent = 33.167 -->> 36.667 ft, Tributary Width = 1.0 ft, (Inter-Row) Varying Uniform Load : S(S,E) = 0.0->0.1505 k/ft, Extent = 19.757 -->> 28.167 ft, Trib Width = 1.0 ft, (N-Drift) Point Load : D = 0.3510 k @ 12.330 ft, (RTU DL)

+0.60D+0.70E+H Dsgn. L = 40.00 ft

1

DESIGN SUMMARY 40.692 k-ft 4.322 k Maximum Bending = Maximum Shear = +D+S+H Load Combination Load Combination +D+S+H Location of maximum on span 21.000ft Location of maximum on span 40.000 ft Span # where maximum occurs Span # 1 Span # where maximum occurs Span # 1 Maximum Deflection Max Downward Transient Deflection 182 2.632 in **BOTH SHEAR AND** Max Upward Transient Deflection 0.041 in 11851 MOMENT ARE OK! Max Downward Total Deflection 4.116 in 116 Max Upward Total Deflection 33460 0.014 in

Maximum Forces & Stresses for Load Combinations Summary of Moment Values Max Stress Ratios Summary of Shear Values Load Combination V Μ Mmax -Span # Mmax + Ma - Max Mnx Mnx/Omega Cb Rm Va Max Vnx Vnx/Omega Segment Length **Overall MAXimum Envelope** 40.69 40.69 4.32 Dsan. L = 40.00 ft1 D Only Dsgn. L = 40.00 ft 14.59 14.59 1.59 1 +D+L+H Dsgn. L = 40.00 ft 1 14.59 14.59 1.59 +D+Lr+H Dsgn. L = 40.00 ft 1 14.59 14.59 1.59 +D+S+H Dsgn. L = 40.00 ft 1 40.69 40.69 4.32 +D+0.750Lr+0.750L+H 14.59 Dsgn. L = 40.00 ft 1 14.59 1.59 +D+0.750L+0.750S+H 34.09 Dsqn. L = 40.00 ft1 34.09 3.60 +D+W+H Dsgn. L = 40.00 ft 1 14.59 14.59 1.59 +D+0.70E+H Dsgn. L = 40.00 ft 14.59 14.59 1.59 1 +D+0.750Lr+0.750L+0.750W+H Dsgn. L = 40.00 ft 14.59 1.59 1 14.59 +D+0.750L+0.750S+0.750W+H Dsqn. L = 40.00 ft34.09 34.09 3.60 +D+0.750Lr+0.750L+0.5250E+H Dsgn. L = 40.00 ft 14.59 1.59 1 14.59 +D+0.750L+0.750S+0.5250E+H 34.09 Dsgn. L = 40.00 ft 1 34.09 3.60 +0.60D+W+H Dsan. L = 40.00 ft8.76 8.76 1 0.96 71 of 119

8.76

0.96

8.76

General Beam Analysis

Description : B1: N Drift+Inter-row+SL+DL+RTU

Overall Maximum Deflections

+D+S+H 1 4.1157 20.200 0.0000 0.000 Vertical Reactions Support 1 Support 1	Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
Vertical Reactions Support 1 Support 2 Overall MAXimum 3.911 4.322 Overall MINimum 0.957 0.859 D Only 1.594 1.432 +D+L+H 1.594 1.432 +D+L+H 1.594 1.432 +D+S-H 3.911 4.322 +D+S-H 3.911 4.322 +D+0.750L+0.750L+H 1.594 1.432 +D+0.750L+0.750S+H 3.332 3.599 +D+0.750L+0.750S+H 1.594 1.432 +D+0.750L+0.750L+H 3.332 3.599 +D+0.750L+0.750L+H 3.332 3.599 +D+0.750L+0.750L+H 0.957 0.859 DOnly 1.594 1.432 +D+0.750L+0.750L+H 0.957 0.859	+D+S+H	1	4.1157	20.200		0.0000	0.000
Load Combination Support 1 Support 2 Overall MAXimum 3.911 4.322 Overall MINimum 0.957 0.859 D Only 1.594 1.432 +D+L+H 1.594 1.432 +D+Lr+H 1.594 1.432 +D+Lr+H 1.594 1.432 +D+Cr50L+0.750L+H 1.594 1.432 +D+0.750L+0.750L+H 1.594 1.432 +D+0.750L+0.750S+H 3.332 3.599 +D+0.750L+0.750S+H 1.594 1.432 +D+0.750L+0.750L+0.750W+H 1.594 1.432 +D+0.750L+0.750L+0.750W+H 3.332 3.599 +D+0.750L+0.750L+0.750L+H 1.594 1.432 +D+0.750L+0.750L+0.5250E+H 3.332 3.599 +0.60D+0.70E+H 0.957 0.859 +0.60D+0.70E+H 0.957 0.859 +0.60D+0.70E+H 0.957 0.859 Donly 1.594 1.432 L Only Sonly 2.316 2.890 W Only E	Vertical Reactions			Support	notation : Far left is #1	Values in KIPS	
Overall MAXimum 3.911 4.322 Overall MINimum 0.957 0.859 D Only 1.594 1.432 +D+L+H 1.594 1.432 +D+Lr+H 1.594 1.432 +D+Cr+H 3.911 4.322 +D+O.750L+0.750L+H 1.594 1.432 +D+O.750L+0.750L+H 1.594 1.432 +D+0.750L+0.750S+H 3.332 3.599 +D-0.70E+H 1.594 1.432 +D+0.70E+H 1.594 1.432 +D+0.750L+0.750W+H 1.594 1.432 +D+0.750L+0.750S+0.10.750W+H 3.332 3.599 +D+0.750L+0.750S+0.40.5250E+H 1.594 1.432 +D+0.750L+0.750S+0.5250E+H 3.332 3.599 +0.60D+W+H 0.957 0.859 +0.60D+W+H 0.957 0.859 +0.60D+W+H 0.957 0.859 D Only 1.594 1.432 L Only Sonly 2.316 2.890 W Only E 2.316 2	Load Combination	Support 1	Support 2				
Overall MINimum 0.957 0.859 D Only 1.594 1.432 +D+L+H 1.594 1.432 +D+L+H 1.594 1.432 +D+L+H 3.911 4.322 +D+0.750L+0.750L+H 1.594 1.432 +D+0.750L+0.750S+H 3.32 3.599 +D+0.750L+0.750L+0.750W+H 1.594 1.432 +D+0.750L+0.750L+0.750W+H 3.32 3.599 +D+0.750L+0.750L+0.750W+H 3.332 3.599 +D+0.750L+0.750L+0.5250E+H 3.332 3.599 +D.0.750L+0.750L+0.5250E+H 3.332 3.599 +0.60D+W+H 0.957 0.859 +0.60D+W+H 0.957 0.859 Donly 1.594 1.432 L Only 1.594 1.432 L Conly 1.594 1.432 B Only 1.594 1.432 +D-0.750L+0.750L+0.5250E+H 3.32 3.599 +0.60D+0.70E+H 0.957 0.859 D Only 1.594 1.432	Overall MAXimum	3.911	4.322				
D Only 1.594 1.432 +D+L+H 1.594 1.432 +D+Lr+H 1.594 1.432 +D+S+H 3.911 4.322 +D+0.750L+0.750L+H 1.594 1.432 +D+0.750L+0.750S+H 3.332 3.599 +D+W+H 1.594 1.432 +D-0.70E+H 1.594 1.432 +D-0.750L+0.750S+H 3.332 3.599 +D+0.750L+0.750S+0.750W+H 1.594 1.432 +D+0.750L+0.750S+0.750W+H 1.594 1.432 +D+0.750L+0.750S+0.750W+H 3.332 3.599 +D+0.750L+0.750S+0.5250E+H 1.594 1.432 +D+0.750L+0.750S+0.5250E+H 3.332 3.599 +D-0.750L+0.750S+0.5250E+H 3.332 3.599 +0.60D+W+H 0.957 0.859 Donly 1.594 1.432 L Only 1.594 1.432 L Only 1.594 1.432 B Only 2.316 2.890 W Only 2.316 2.890	Overall MINimum	0.957	0.859				
+D+L+H1.5941.432+D+L+H1.5941.432+D+S+H3.9114.322+D-0.750L+0.750L+H1.5941.432+D+0.750L+0.750S+H3.3323.599+D+0.750L+0.750L+11.5941.432+D+0.750L+0.750L+11.5941.432+D+0.750L+0.750L+11.5941.432+D+0.750L+0.750L+11.5941.432+D+0.750L+0.750S+0.750W+H3.3323.599+D+0.750L+0.750S+0.5250E+H1.5941.432+D+0.750L+0.750S+0.5250E+H3.3323.599+0.60D+W+H0.9570.859+0.60D+W+H0.9570.859+0.60D+W+H0.9570.859+0.60D+W+H0.9570.859+0.60D+W+H0.9570.859+0.60D+W+H0.9570.859+0.60D+W+H0.9570.859+0.60D+W+H0.9570.859+Donly1.5941.432+Donly1.5941.432+Donly1.5941.432+Donly1.5941.432+Donly1.5941.432+Donly1.5941.432+Donly1.5941.432+Donly1.5941.432+Donly1.5941.432+Donly1.5941.432+Donly1.5941.432+Donly1.5941.432+Donly1.5941.432+Donly1.5941.432+Donly1.5941.432+Donly1.5941.432 <tr< td=""><td>D Only</td><td>1.594</td><td>1.432</td><td></td><td></td><td></td><td></td></tr<>	D Only	1.594	1.432				
+D+Lr+H 1.594 1.432 +D+S+H 3.911 4.322 +D+0.750Lr0.750L+H 1.594 1.432 +D+0.750L+0.750S+H 3.332 3.599 +D+0.750Lr0.750L+0.750V+H 1.594 1.432 +D+0.750Lr0.750L+0.750W+H 1.594 1.432 +D+0.750Lr0.750L+0.750W+H 1.594 1.432 +D+0.750Lr0.750L+0.750V+H 3.332 3.599 +D+0.750Lr0.750L+0.5250E+H 1.594 1.432 +D+0.750L+0.750L+0.5250E+H 1.594 1.432 +D+0.750L+0.750S+0.5250E+H 3.332 3.599 +0.60D+W+H 0.957 0.859 +0.60D+W+H 0.957 0.859 DOnly 1.594 1.432 Lr Only 1.594 1.432 L Only 2.316 2.890 W Only 2.316 2.890 W Only E Only H Only	+D+L+H	1.594	1.432				
+D+S+H 3.911 4.322 +D+0.750L+0.750L+H 1.594 1.432 +D+0.750L+0.750S+H 3.332 3.599 +D+W+H 1.594 1.432 +D+0.750L+0.750L+1 1.594 1.432 +D+0.750L+0.750L+0.750W+H 1.594 1.432 +D+0.750L+0.750L+0.750W+H 3.332 3.599 +D+0.750L+0.750L+0.5250E+H 1.594 1.432 +D+0.750L+0.750S+0.5250E+H 3.332 3.599 +D+0.750L+0.750S+0.5250E+H 3.332 3.599 +0.60D+W+H 0.957 0.859 P0.01V 1.594 1.432 LONIV 1.594 1.432 LONIV 1.594 1.432 HONIV 0.957 0.859 DONIV 1.594 1.432 LONIV 1.594 1.432 LONIV 2.316 2.890 WONIV E E E ONIV H 9.859	+D+Lr+H	1.594	1.432				
+D+0.750L+0.750L+H 1.594 1.432 +D+0.750L+0.750S+H 3.332 3.599 +D+W+H 1.594 1.432 +D+0.70E+H 1.594 1.432 +D+0.750Lr0.750L+0.750W+H 1.594 1.432 +D+0.750Lr0.750S+0.750W+H 3.32 3.599 +D+0.750Lr0.750S+0.750W+H 3.32 3.599 +D+0.750Lr0.750S+0.5250E+H 1.594 1.432 +D+0.750L+0.750S+0.5250E+H 3.332 3.599 +0.60D+W+H 0.957 0.859 +0.60D+0.70E+H 0.957 0.859 D Only 1.594 1.432 Lr Only 1.594 1.432 Lr Only 2.316 2.890 W Only E Only H Only	+D+S+H	3.911	4.322				
+D+0.750L+0.750S+H 3.332 3.599 +D+W+H 1.594 1.432 +D+0.70E+H 1.594 1.432 +D+0.750L+0.750L+0.750W+H 1.594 1.432 +D+0.750L+0.750L+0.750W+H 3.32 3.599 +D+0.750L+0.750L+0.5250E+H 1.594 1.432 +D+0.750L+0.750S+0.5250E+H 3.332 3.599 +0.60D+W+H 0.957 0.859 +0.60D+W+H 0.957 0.859 D Only 1.594 1.432 Lr Only 1.594 1.432 Lr Only 2.316 2.890 W Only E Only 1.916 F Only H Only 1.916	+D+0.750Lr+0.750L+H	1.594	1.432				
+D+W+H 1.594 1.432 +D+0.70E+H 1.594 1.432 +D+0.750L+0.750L+0.750W+H 1.594 1.432 +D+0.750L+0.750L+0.5250E+H 3.332 3.599 +D+0.750L+0.750S+0.5250E+H 3.332 3.599 +0.60D+W+H 0.957 0.859 +0.60D+W+H 0.957 0.859 D Only 1.594 1.432 Lr Only 1.594 1.432 L Only 2.316 2.890 W Only 2.316 2.890 W Only E Only 4.10 2.316 2.890	+D+0.750L+0.750S+H	3.332	3.599				
+D+0.70E+H 1.594 1.432 +D+0.750L+0.750L+0.750W+H 1.594 1.432 +D+0.750L+0.750S+0.750W+H 3.332 3.599 +D+0.750L+0.750L+0.5250E+H 1.594 1.432 +D+0.750L+0.750S+0.5250E+H 3.332 3.599 +0.60D+W+H 0.957 0.859 +0.60D+0.70E+H 0.957 0.859 D Only 1.594 1.432 L Only 1.594 1.432 S Only 2.316 2.890 W Only E Only 1.432 H Only 1.594 1.432	+D+W+H	1.594	1.432				
+D+0.750L+0.750W+0.750W+H 1.594 1.432 +D+0.750L+0.750S+0.750W+H 3.332 3.599 +D+0.750L+0.5250E+H 1.594 1.432 +D+0.750L+0.5250E+H 3.332 3.599 +0.60D+W+H 0.957 0.859 +0.60D+0.70E+H 0.957 0.859 D Only 1.594 1.432 Lr Only 1.594 1.432 B Only 2.316 2.890 W Only E Only H Only	+D+0.70E+H	1.594	1.432				
+D+0.750L+0.750S+0.750W+H 3.332 3.599 +D+0.750L+0.5250E+H 1.594 1.432 +D+0.750L+0.750S+0.5250E+H 3.332 3.599 +0.60D+W+H 0.957 0.859 +0.60D+0.70E+H 0.957 0.859 D Only 1.594 1.432 Lr Only 1.594 1.432 L Only 2.316 2.890 W Only 1.01/2 1.432 H Only 1.594 1.432	+D+0.750Lr+0.750L+0.750W+H	1.594	1.432				
+D+0.750L+0.750L+0.5250E+H 1.594 1.432 +D+0.750L+0.750S+0.5250E+H 3.332 3.599 +0.60D+W+H 0.957 0.859 +0.60D+0.70E+H 0.957 0.859 D Only 1.594 1.432 Lr Only 1.594 1.432 S Only 2.316 2.890 W Only E Only H Only	+D+0.750L+0.750S+0.750W+H	3.332	3.599				
+D+0.750L+0.750S+0.5250E+H 3.332 3.599 +0.60D+W+H 0.957 0.859 +0.60D+0.70E+H 0.957 0.859 D Only 1.594 1.432 Lr Only LOnly 2.316 2.890 W Only 2.316 2.890 W Only E Only H Only	+D+0.750Lr+0.750L+0.5250E+H	1.594	1.432				
+0.60D+W+H 0.957 0.859 +0.60D+0.70E+H 0.957 0.859 D Only 1.594 1.432 Lr Only 2.316 2.890 W Only 2.316 2.890 W Only E Only H Only	+D+0.750L+0.750S+0.5250E+H	3.332	3.599				
+0.60D+0.70E+H 0.957 0.859 D Only 1.594 1.432 Lr Only 2.316 2.890 W Only E Only E Only H Only	+0.60D+W+H	0.957	0.859				
D Only 1.594 1.432 Lr Only L Only S Only 2.316 2.890 W Only E Only H Only	+0.60D+0.70E+H	0.957	0.859				
Lr Only L Only S Only 2.316 2.890 W Only E Only H Only	D Only	1.594	1.432				
L Only S Only 2.316 2.890 W Only E Only H Only	Lr Only						
S Only 2.316 2.890 W Only E Only H Only	L Only						
W Only E Only H Only	S Only	2.316	2.890				
E Only H Only	W Only						
H Only	E Only						
	H Only						

Project Title: Engineer: Project Descr:

Project ID:

Printed: 29 NOV 2017, 5:05PM File = S:\Projects\2017PR-1\179604-1\01_CAL-1\88_ENE-1\JOISTC-1.EC6 ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Licensee : MP-Squared Structural Engineers, LLC

Title Block" selection	n.					Drinked: 20 NOV 2017 E.12DM				
General Be	am Analvsis			File = S:\Pro	pjects\2017PR~1\179604~1\01_CAL~1\	38_ENE~1\JOISTC~1.EC6				
Lic. # : KW-0600	6621	_		Lice	ensee : MP-Squared Struct	tural Engineers, LLC				
Description :	B1: Leeward S-Drft+Inter-row+	SL+DL+RTU	CONTROLLING LOAD CASE FOR DRIFT AREA 2							
General Beam	Properties									
Elastic Modulus Span #1	29,000.0 ksi Span Length =	40.0 ft	Area	a = 10.0 in^2	Moment of Inertia =	100.0 in^4				
×	D(0.351)	D(0.351)	D(0.05,1)	_S(0,1098)	D(0.024)	52) * * *				
			Span	= 40.0 ft						
•						 				
Applied Loads				Service loads ente	red. Load Factors will be ap	plied for calculations.				
Uniform Lo Varying Ur Uniform Lo Uniform Lo Point Load Point Load	bad : D = 0.0510, S = 0.100 hiform Load : S(S,E) = 0.0-> bad : S = 0.1520 k/ft, Extent bad : D = 0.0240 k/ft, Extent d : D = 0.3510 k @ 7.0 ft, (R d : D = 0.3510 k @ 12.333 ft	8 k/ft, Tributary W 0.1548 k/ft, Extent = 33.208>> 36.7 = 28.208>> 40.0 TU) , (RTU)	/idth = 1.0 ft, (I = 19.163>> 708 ft, Tributa 3 ft, Tributary	Jniform DL & SL) 28.167 ft, Trib Width = 1.0 f ry Width = 1.0 ft, (Inter-row) Width = 1.0 ft, (PV Panel)	t, (Leeward S Drift)					
DESIGN SUMM	ARY									
Maximum Ber Load Combina	nding = ation	41. +D+	201 k-ft S+H	Maximum Shear = Load Combination		4.350 k +D+S+H				
Location of ma	aximum on span	21	.000ft	Location of maximum	m on span	40.000 ft				

Location of maximum on span	21.0001	LUCATION OF	Location of maximum on span				
Span # where maximum occurs	Span # 1	Span # when	Span # 1				
Maximum Deflection Max Downward Transient Deflection Max Upward Transient Deflection Max Downward Total Deflection Max Upward Total Deflection	2.676 in 0.041 in 4.159 in 0.014 in	179 11667 115 33474	BOTH SHEAR AND MOMENT ARE OK!				

Maximum Forces & Str	esses f	for Load Co	ombinati	ions									
Load Combination		Max Stress	s Ratios			Summary of Mo	oment Valu	Jes			Summa	ary of Sł	ear Values
Segment Length S	Span #	М	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omeg	a Cb	Rm	Va Max	Vnx	Vnx/Omega
Overall MAXimum Envelope													
Dsgn. L = 40.00 ft	1			41.20		41.20					4.35		
D Only													
Dsgn. L = 40.00 ft	1			14.59		14.59					1.59		
+D+L+H													
Dsgn. L = 40.00 ft	1			14.59		14.59					1.59		
+D+Lr+H													
Dsgn. L = 40.00 ft	1			14.59		14.59					1.59		
+D+S+H													
Dsgn. L = 40.00 ft	1			41.20		41.20					4.35		
+D+0.750Lr+0.750L+H													
Dsgn. L = 40.00 ft	1			14.59		14.59					1.59		
+D+0.750L+0.750S+H													
Dsgn. L = 40.00 ft	1			34.47		34.47					3.62		
+D+W+H													
Dsgn. L = 40.00 ft	1			14.59		14.59					1.59		
+D+0.70E+H													
Dsgn. L = 40.00 ft	1			14.59		14.59					1.59		
+D+0.750Lr+0.750L+0.750W+H													
Dsgn. L = 40.00 ft	1			14.59		14.59					1.59		
+D+0.750L+0.750S+0.750W+H													
Dsgn. L = 40.00 ft	1			34.47		34.47					3.62		
+D+0.750Lr+0.750L+0.5250E+H	4												
Dsgn. L = 40.00 ft	1			14.59		14.59					1.59		
+D+0.750L+0.750S+0.5250E+H													
Dsgn. L = 40.00 ft	1			34.47		34.47					3.62		
+0.60D+W+H													
Dsgn. L = 40.00 ft	1			8.75		8.75					0.96 -	2 of 14	0
+0.60D+0.70E+H											1	3 01 1	9
Dsgn. L = 40.00 ft	1			8.75		8.75					0.96		

General Beam Analysis

Printed: 29 NOV 2017. 5:13PM

THREA. 27 NOV 2017, 5.101 M
File = S:\Projects\2017PR~1\179604~1\01_CAL~1\88_ENE~1\JOISTC~1.EC6
ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25
Licensee : MP-Squared Structural Engineers, LLC

Description : B1: Leeward S-Drft+Inter-row+SL+DL+RTU

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	4.1595	20.200		0.0000	0.000
Vertical Reactions			Support	notation : Far left is #1	Values in KIPS	
Load Combination	Support 1	Support 2				
Overall MAXimum	3.936	4.350				
Overall MINimum	0.956	0.859				
D Only	1.594	1.431				
+D+L+H	1.594	1.431				
+D+Lr+H	1.594	1.431				
+D+S+H	3.936	4.350				
+D+0.750Lr+0.750L+H	1.594	1.431				
+D+0.750L+0.750S+H	3.350	3.620				
+D+W+H	1.594	1.431				
+D+0.70E+H	1.594	1.431				
+D+0.750Lr+0.750L+0.750W+H	1.594	1.431				
+D+0.750L+0.750S+0.750W+H	3.350	3.620				
+D+0.750Lr+0.750L+0.5250E+H	1.594	1.431				
+D+0.750L+0.750S+0.5250E+H	3.350	3.620				
+0.60D+W+H	0.956	0.859				
+0.60D+0.70E+H	0.956	0.859				
D Only	1.594	1.431				
Lr Only						
L Only						
S Only	2.342	2.919				
W Only						
E Only						
H Only						

Title Block Line 1 You can change this area using the "Settings" ment and then using the "Printi Title Block" selection	a u item ing &			Proje Eng Proje	ect Title: ineer: ect Descr:		Project ID:		
Title Block Line 6							Printed: 29 NOV 2017, 5:14PM		
General Beam	Analysis	;			File = S:\Pi	rojects\2017PR~1\179604~1\01 ENERCALC, INC. 1983-20	_CAL~1\88_ENE~1\JOISTC~1.EC6 017, Build:10.17.9.25, Ver:10.17.9.25		
Lic. # : KW-06006621 Description : B1: S	liding Snow+SL+[DL+RTU			Lic	ensee : MP-Squared	Structural Engineers, LLC		
General Beam Prop	erties								
Elastic Modulus Span #1	29,000.0 k Span Length	si = 40.0 ft		Area =	10.0 in^2	Moment of Inertia	= 100.0 in^4		
							S(0.1008)		
\$	D(0.351)	D(0.3\$(9.10	08)	\$		÷ D	<u>(0.024)</u>		
×	±	÷		D(0.051)			* * *		
*							×		
L			S	pan = 40.0 ft			J		
			_				1		
Applied Loads	or 1			Se	rvice loads ente	ered. Load Factors wil	l be applied for calculations.		
Uniform Load : Uniform Load : Point Load : D Uniform Load : Uniform Load : Uniform Load : Point Load : D	$D = 0.0510 \text{ k/ft}, D = 0.0240 \text{ k/ft}, = 0.3510 \text{ k} @ 7. S = 0.1008 \text{ k/ft}, S = 0.1008 \text{ k/ft}, S = 0.1008 \text{ k/ft}, S = 0.3510 \text{ k} @ 12. \\= 0.3510 \text{ k} @ 12$	Extent = 0.0>> 40 Extent = 28.208>> 0 ft, (RTU) Extent = 0.0>> 28 Extent = 33.167>> Extent = 33.167>> 2.333 ft, (RTU)	9.0 ft, Tributan > 40.0 ft, Tribut - 167 ft, Tribut > 36.667 ft, Tr > 38.167 ft, Tr	y Width = 1.0 ft, utary Width = 1.0 ary Width = 1.0 ibutary Width = ibutary Width =	(Uniform DL & SL) ft, (PV Panel) it, (SL Balanced) 1.0 ft, (Balanced = 1.0 ft, (Sliding sno	_) snow) ow)			
DESIGN SUMMARY	,								
Maximum Bending	g =		33.185 k-ft +D+S+H	Maximun	1 Shear =		3.533 k +D+S+H		
Location of maximu	ım on span		18.600ft	Lo	cation of maximu	um on span	0.000 ft		
Span # where maxi	mum occurs		Span # 1	SI	oan # where maxi	imum occurs	Span # 1		
Maximum Deflecti Max Downward T Max Upward Tran	on ransient Deflectionsient Deflection	tion n	1.853 in 0.030 in	2 162	59 27	BOTH SHE			
Max Downward To Max Upward Tota	otal Deflection		3.338 in 0.014 in	1 334	43 74				
Maximum Forces &	Stresses for	Load Combinatio	ns						
Load Combination	<u>Nic3303 101</u>	Max Stress Ratios		Summar	y of Moment Value	S	Summary of Shear Values		
Segment Length	Span #	M V	Mmax +	Mmax - Ma - N	lax Mnx	Mnx/Omega Cb Rm	Va Max Vnx Vnx/Omega		
Dsgn. L = 40.00 ft	1		33.19	33	19		3.53		
Donly Dsgn. L = 40.00 ft	1		14.59	14	59		1.59		
Dsgn. L = 40.00 ft	1		14.59	14	59		1.59		
+D+Lr+H Dsgn. L = 40.00 ft	1		14.59	14	59		1.59		
+D+S+H Dsgn. L = 40.00 ft	1		33.19	33	.19		3.53		
+D+0.750Lr+0.750L+H Dsgn. L = 40.00 ft	1		14.59	14	59		1.59		
+D+0.750L+0.750S+H	1		28 53	28	53		3.05		
+D+W+H	1		14 50	20	55		1.60		
+D+0.70E+H	1		14.07	14	57		1.07		
Dsgn. L = 40.00 ft +D+0.750Lr+0.750L+0.750V	N+H		14.59	14	27		1.59		
Dsgn. L = 40.00 ft +D+0.750L+0.750S+0.750W	1 V+H		14.59	14	59		1.59		
Dsgn. L = 40.00 ft +D+0.750Lr+0.750L+0.5250	1)E+H		28.53	28	53		3.05		
Dsgn. L = 40.00 ft +D+0.750L+0.750S+0.5250	1 F+H		14.59	14	59		1.59		
Dsgn. L = 40.00 ft +0.60D+W+H	1		28.53	28	53		^{3.05} 75 of 119		

	Title Block Line 6										Printe	d: 29 NOV 2	017, 5:14PM
Description: B1: Stiding Snow-SL+DL+RTU Licensee': MP-Squared Structural Engineers, LLC Description: B1: Stiding Snow-SL+DL+RTU Load Combination Max Stress Ratios Summary of Moment Values Summary of Shear Values Segment Length Span # M V Mmax + Ma - Max Mnx Mn	General Beam An	alvs	sis					File = S	:\Projects\2017PR~1\17	9604~1\01_	_CAL~1\88_E	VE~1/JOIS	TC~1.EC6
Lick = NRLP0000021 Bit: Stiding Snow+SL+DL+RTU Eternster: MIP-Squared Snot-Gthar Etg/meers LECe Load Combination Sagn # M V Mmax + Mmax / Ma - Max Mnx Mnx / Mnx/Omega Cb Rm Va Max Vnx Vnx/Omega Dsgn. L = 40.00 ft 1 8.75 8.75 0.96 0.96 0.0000-07.05 H1 Bsgn. Max.** Deft Location in Span Load Combination Max. *** Deft Location in Span toad Combination Span Max.*** Deft Location in Span Load Combination Max.*** Deft Location in Span toad Combination Support notation : Far left is #1 Values in KIPS Load Combination Max.**** Load Combination Support notation : Far left is #1 Values in KIPS Load Combination Max.**** Load Combination Support notation : Far left is #1 Values in KIPS Load Combination Max.**** Load Combination Support notation : Far left is #1 Values in KIPS Load Combination Max.*** Load Combination Support notation : Far left is #1 Values in KIPS		larye		_	_	_	_		ENERCALC, IN	C. 1983-20	17, Build:10.1	7.9.25, Ver:	:10.17.9.25
Description i OF status storestruction Load combination Max Stress Ratios M Summary of Moment Values Summary of Shear Values Segment Length Span # Minx + Minax - Ma - Max Minx Minx/Omega Cb Rm Va Max Vinx Vinx/Omega Dsgn, L = 4000 ft 1 8.75 8.75 0.96 Overall Maximum Deflections	LIC. # : KW-0600621	Spow						L	ICENSEE . MIF-3	quareu	Structura	i Engin	eers, LLC
Load Combination Max Stress Ratios Summary of Moment Values Summary of Shear Values Dsgn.L = 40.00 ft 1 8.75 8.75 0.96 0.6000-076 +H 0.96 0.96 0.96 Dsgn.L = 40.00 ft 1 8.75 8.75 0.96 Overall Maximum Deflections 8.75 8.75 0.96 Load Combination Span Max. *- Defl Location in Span Load Combination Max. *-* Defl Location in Span +0+5+H 1 3.3381 19.800 0.000 0.000 0.000 Vertical Reactions Support 1 Support 1 Support 1 Values in KIPS 0.000 0.000 Vertical Reactions Support 1 Support 1 Values in KIPS Values in KIPS Values in KIPS Load Combination Support 1 Support 2 Support 1 Values in KIPS Values in KIPS Load Combination Support 1 Support 2 Support 1 Values in KIPS Values in KIPS Load Combination Support 1 Support 2 Values i	Description : B1. Silding	3110W+3	DL+DL+KIU										
Segment Length Span # M V Mmax + Mmax - Ma - Max Mmx Mmx / Mmx/Omega Cb Va Max Vnx Vnv/Omega Dsgn. L = 40.00 ft 1 8.75 8.75 0.96 Overall Maximum Deflections	Load Combination		Max Stre	ss Ratios			Summary of Mo	ment Val	ues		Summ	ary of Shear Values	
Dsgn L = 40.00 ft 1 8.75 8.75 0.96 bugn L = 40.00 ft 1 8.75 8.75 0.96 Overall Maximum Deflections Load Combination Span Max. ** Defl Location in Span Load Combination Max. ** Defl Location in Span vertical Reactions 0.0000 0.0000 0.0000 0.0000 Vertical Reactions Support 1 Support 2 Support notation : Far left is #1 Values in KIPS Load Combination Support 1 Support 1 Support 1 Values in KIPS Load Combination Support 1 Support 1 Values in KIPS Values in KIPS Donly 1.594 1.431 +Detrice 1 +Detrice 1 +Detrice 1 0b Only 1.594 1.431 +Detrice 1 +Detrice 1 +Detrice 1 0b-0.70L+0.750L+0.750L+1 1.594 1.431 +Detrice 1 +Detrice 1 0b-0.70L+0.750L+0.750L+1 1.594 1.431 +Detrice 1 +Detrice 1 <	Segment Length Sp	an #	М	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega Cb	Rm	Va Max	Vnx	Vnx/Omega
Dsgn. L = 40.00 ft 1 8.75 8.75 0.96 Overall Maximum Deflections Load Combination Span Max. "-" Defl Location in Span Load Combination Max. "+" Defl Location in Span +D+S+H 1 3.3381 19.800 0.0000 0.0000 0.0000 Vertical Reactions Support 1 Support 1 Support notation : Far left is #1 Values in KIPS Overall MAXimum 3.533 3.188 Overall MAXimum 5.54 0.96 Overall MINimum 0.956 0.859 0.01 Values in KIPS Values in KIPS Overall MINimum 0.956 0.859 0.01 Values in KIPS Values in KIPS Overall MINimum 0.956 0.859 0.01 Values in KIPS Values in KIPS D only 1.594 1.431 Values in KIPS Values in KIPS D only 1.594 1.431 Values in KIPS Values in KIPS D only 1.594 1.431 Values in KIPS Values in KIPS D onfolt=0.750L+0.750L+1 <	Dsgn. L = 40.00 ft +0.60D+0.70F+H	1			8.75		8.75				0.96		
Overall Maximum Deflections Load Combination Span Max. "+" Defl Location in Span Load Combination Max. "+" Defl Location in Span +D-S+H 1 3.381 19.800 0.0000 0.000 Vertical Reactions Support 1 Support notation : Far left is #1 Values in KIPS Load Combination Support 1 Support 1 Support notation : Far left is #1 Values in KIPS Load Combination Support 1 Support 1 Support notation : Far left is #1 Values in KIPS Doverall MAXimum 0.956 0.859 Orverall MAXimum 0.956 0.859 Donly 1.594 1.431 +D+Lr+H 1.594 1.431 +D-U.750L+0.750L+1 1.594 1.431 +D+D-750L+0.750L+0.750H 1.594 1.431 +D-0.750L+0.750L+0.750L+0.750H 1.594 1.431 +D+D-750L+0.750L+0.750L+0.750H 1.694 1.431 +D-0.750L+0.750L+0.750L+1 1.594 1.431 +D+D-750L+0.750L+0.750L+0.750L+1 1.594 1.431 +D+0.750L+0.750L+0.750L+0.750L+1 1.594 1.431 <td>Dsgn. L = 40.00 ft</td> <td>1</td> <td></td> <td></td> <td>8.75</td> <td></td> <td>8.75</td> <td></td> <td></td> <td></td> <td>0.96</td> <td></td> <td></td>	Dsgn. L = 40.00 ft	1			8.75		8.75				0.96		
Load Combination Span Max. *." Defl Location in Span Load Combination Max. *." Defl Location in Span +D+S+H 1 3.3381 19.800 0.0000 0.000 Vertical Reactions Support 1 Support notation : Far left is #1 Values in KIPS Load Combination Support 1 Support 1 Support notation : Far left is #1 Values in KIPS Overall MAXimum 0.956 0.859 Only 1.594 1.431 +D+L+H 1.594 1.431 - - - +D+L+H 1.594 1.431 - - - +D+L+H 1.594 1.431 - - - +D+L+H 1.594 1.431 - - - - +D+0.750L+0.750S+H 3.048 2.749 - </td <td>Overall Maximum Deflect</td> <td>ctions</td> <td></td>	Overall Maximum Deflect	ctions											
+D+S+H 1 3.3381 19.800 0.0000 0.000 Vertical Reactions Support 1 Support 2 Overall MAXimum 3.533 3.188 Values in KIPS Overall MIMimum 0.956 0.859 Values in KIPS D only 1.594 1.431 Values in KIPS +D+L+H 1.594 1.431 Values in KIPS +D-t7SUL+0.750L+1 1.594 1.431 +D-t7SUL+0.750L+1 1.594 1.431 +D-0.750L+0.750S+H 3.048 2.749 +D+0.750L+0.750S+H 3.048 2.749 +D-0.750L+0.750L+0.750W+H 1.594 1.431 +D-0.750L+0.750L+0.750W+H 3.048 2.749 +D-0.750L+0.750S+D-0.520E+H 1.594 1.431 +D-0.750L+0.750S+0.520E+H 3.048 2.749 +D-0.750L+0.750S+0.520E+H 3.048 2.749 +D-0.750L+0.750S+0.520E+H 3.048 2.749 +0.60D+W+H 0.956 0.859 0.60D+W+H 0.956 0.859 D ofly 1.594	Load Combination		Span	Max. "-" Defl	Location	in Span	Load Comb	ination		Max	. "+" Defl	Locatio	n in Span
Vertical Reactions Support 1 Support 2 Overall MAXimum 3.533 3.188 Overall MINimum 0.956 0.859 D Only 1.594 1.431 +D+L+H 1.594 1.431 +D+LFH 3.533 3.188 +D-0.750Lr+0.750L+H 1.594 1.431 +D+0.750Lr+0.750L+H 1.594 1.431 +D-0.750L+0.750L+H 1.594 1.431 +D-0.750L+0.750L+H 1.594 1.431 +D-0.750L+0.750L+H 1.594 1.431 +D-0.750L+0.750S+H 3.048 2.749 +D+0.750L+0.750U+0.750W+H 1.594 1.431 +D-0.750L+0.750U+0.750W+H 3.048 2.749 +D+0.750L+0.750L+0.750W+H 3.048 2.749 +D+0.750L+0.750U+0.5250E+H 1.594 1.431 +D+0.750L+0.750L+0.5250E+H 3.048 2.749 +0.60D+W+H 0.956 0.859 +0.60D+W+H 0.956 0.859 +0.60D+W+H 0.956 0.859 +0.0nly <	+D+S+H		1	3.3381	19	.800					0.0000		0.000
Load Combination Support 1 Support 2 Overall MIXimum 3.533 3.188 Overall MINimum 0.956 0.859 D Only 1.594 1.431 +D+L+H 1.594 1.431 +D+Lr+H 1.594 1.431 +D+SH 3.533 3.188 +D-0.750L+0.750L+H 1.594 1.431 +D+0.750L+0.750S+H 3.048 2.749 +D+0.750L+0.750S+H 3.048 2.749 +D+0.70E+H 1.594 1.431 +D+0.750L+0.750S+H 3.048 2.749 +D+0.750L+0.750S+0.750W+H 3.048 2.749 +D+0.750L+0.750S+0.750W+H 3.048 2.749 +D+0.750L+0.750S+0.5250E+H 1.594 1.431 LOnly 1.594 1.431 D-0750L+0.750S+0.7	Vertical Reactions					Suppor	t notation : Far le	eft is #1		Values in	I KIPS		
Overall MAXimum 3.533 3.188 Overall MINimum 0.956 0.859 D Only 1.594 1.431 +D+L+H 1.594 1.431 +D+S+H 3.533 3.188 +D+0.750Lr+0.750L+H 1.594 1.431 +D+0.750Lr+0.750L+H 1.594 1.431 +D+0.750L+0.750L+H 1.594 1.431 +D+0.705L+0.750L+H 1.594 1.431 +D+0.705L+0.750L+1 1.594 1.431 +D+0.705L+0.750L+0.750W+H 1.594 1.431 +D+0.750Lr+0.750L+0.750W+H 3.048 2.749 +D+0.750Lr+0.750L+0.5250E+H 3.048 2.749 +D+0.750Lr+0.750L+0.5250E+H 3.048 2.749 +D+0.750L+0.750S+0.5250E+H 3.048 2.749 +0.60D+W+H 0.956 0.859 D Only 1.594 1.431 +D+0.70E+H 0.956 0.859 D Only 1.594 1.431 L Only I I L Only I I	Load Combination		Support 1	Support 2									
Overall MINimum 0.956 0.859 D Only 1.594 1.431 +D+L+H 1.594 1.431 +D+Lr+H 1.594 1.431 +D+S-H 3.533 3.188 +D+0.750Lr+0.750L+H 1.594 1.431 +D+0.750Lr+0.750L+H 1.594 1.431 +D+0.750L+0.750L+H 1.594 1.431 +D+0.70E+H 1.594 1.431 +D+0.70E+H 1.594 1.431 +D+0.750L+0.750L+0.750W+H 3.048 2.749 +D+0.750L+0.750L+0.750W+H 3.048 2.749 +D+0.750L+0.750L+0.5250E+H 1.631 +D+0.750L+0.750L+0.5250E+H 3.048 2.749 +D+0.750L+0.750S+0.5250E+H 3.048 2.749 +0.60D+0.70E+H 0.956 0.859 D Only 1.594 1.431 +D+0.750L+0.750S+0.5250E+H 3.048 2.749 +0.60D+0.70E+H 0.956 0.859 D Only 1.594 1.431 +D-0.750L+0.750S+0.5250E+H 3.048 2.749 <td>Overall MAXimum</td> <td></td> <td>3.533</td> <td>3.188</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Overall MAXimum		3.533	3.188									
D Only 1.594 1.431 +D+L+H 1.594 1.431 +D+Lr+H 1.594 1.431 +D+S+H 3.533 3.188 +D+0.750L+0.750L+H 1.594 1.431 +D+0.750L+0.750S+H 3.048 2.749 +D+W+H 1.594 1.431 +D+0.750L+0.750S+H 3.048 2.749 +D+0.750L+0.750S+1 1.594 1.431 +D+0.750L+0.750S+1 3.048 2.749 +D+0.750L+0.750S+1 3.048 2.749 +D+0.750L+0.750S+1 3.048 2.749 +D+0.750L+0.750S+0.5250E+H 1.431 +D+0.750L+0.750S+0.5250E+H 3.048 2.749 +0.60D+0.70E+H 0.956 0.859 0.60D+0.70E+H 0.956 0.859 D Only 1.594 1.431 Lr Only 1.594 1.431 L Only 1.594 1.431 D Only 1.594 1.431 D Only 1.594 1.431 L Only 5.00 0.859 D Only 1.594 1.431 <t< td=""><td>Overall MINimum</td><td></td><td>0.956</td><td>0.859</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	Overall MINimum		0.956	0.859									
+D+L+H 1.594 1.431 +D+Lr+H 1.594 1.431 +D+S+H 3.533 3.188 +D+0.750L+0.750L+H 1.594 1.431 +D+0.750L+0.750S+H 3.048 2.749 +D+0.750L+0.750L+0.750W+H 1.594 1.431 +D+0.750L+0.750L+0.750W+H 1.594 1.431 +D+0.750L+0.750S+0.750W+H 1.594 1.431 +D+0.750L+0.750S+0.750W+H 1.594 1.431 +D+0.750L+0.750S+0.750W+H 3.048 2.749 +D+0.750L+0.750S+0.5250E+H 1.594 1.431 +D+0.750L+0.750S+0.5250E+H 3.048 2.749 +0.60D+W+H 0.956 0.859 +0.60D+W+H 0.956 0.859 +0.60D+W+H 0.956 0.859 D Only 1.594 1.431 Lr Only Lonly Lonly S Only 1.939 1.757 W Only E Only 1.939	D Only		1.594	1.431									
+D+Lr+H 1.594 1.431 +D+S+H 3.533 3.188 +D+0.750Lr+0.750L+H 1.594 1.431 +D+0.750L+0.750S+H 3.048 2.749 +D+W+H 1.594 1.431 +D+0.750L+0.750L+0.750W+H 1.594 1.431 +D+0.750L+0.750S+0.750W+H 1.594 1.431 +D+0.750L+0.750S+0.750W+H 3.048 2.749 +D+0.750L+0.750S+0.5250E+H 1.594 1.431 +D+0.750L+0.750S+0.5250E+H 3.048 2.749 +D-0.750L+0.750S+0.5250E+H 3.048 2.749 +D.60D+W+H 0.956 0.859 +0.60D+W+H 0.956 0.859 +0.60D+W.H 0.956 0.859 D Only 1.594 1.431 L Only 1.594 1.431 L Only 1.594 1.431 E Only 1.939 1.757 W Only 1.939 1.757	+D+L+H		1.594	1.431									
+D+S+H 3.533 3.188 +D+0.750Lr+0.750L+H 1.594 1.431 +D+0.750L+0.750S+H 3.048 2.749 +D+W+H 1.594 1.431 +D+0.70E+H 1.594 1.431 +D-0.750L+0.750L+0.750W+H 1.594 1.431 +D+0.750L+0.750L+0.750W+H 1.594 1.431 +D+0.750L+0.750S+0.750W+H 3.048 2.749 +D+0.750L+0.750L+0.5250E+H 3.048 2.749 +D+0.750L+0.750S+0.5250E+H 3.048 2.749 +D+0.750L+0.750S+0.5250E+H 3.048 2.749 +0.60D+W+H 0.956 0.859 +0.60D+W+H 0.956 0.859 Donly 1.594 1.431 Lr Only 1.594 1.431 L Only 1.594 1.591 E Only 1.939 1.757 W Only 1.939	+D+Lr+H		1.594	1.431									
+D+0.750Lr+0.750L+H 1.594 1.431 +D+0.750L+0.750S+H 3.048 2.749 +D+W+H 1.594 1.431 +D+0.70E+H 1.594 1.431 +D+0.750L+0.750U+0.750W+H 3.048 2.749 +D+0.750L+0.750L+0.5250E+H 3.048 2.749 +D+0.750L+0.750L+0.5250E+H 1.694 1.431 +D+0.750L+0.750S+0.5250E+H 3.048 2.749 +0.60D+W+H 0.956 0.859 D Only 1.594 1.431 Lr Only 1.594 1.431 L Only 1.594 1.431 E Only 1.939 1.757	+D+S+H		3.533	3.188									
+D+0.750L+0.750S+H 3.048 2.749 +D+W+H 1.594 1.431 +D+0.70E+H 1.594 1.431 +D+0.750Lr+0.750W+0.750W+H 1.594 1.431 +D+0.750L+0.750S+0.750W+H 3.048 2.749 +D+0.750L+0.750L+0.5250E+H 1.594 1.431 +D+0.750L+0.750S+0.5250E+H 1.594 1.431 +D+0.750L+0.750S+0.5250E+H 3.048 2.749 +0.60D+W+H 0.956 0.859 +0.60D+0.70E+H 0.956 0.859 +0.60D+0.70E+H 0.956 0.859 D Only 1.594 1.431 L Only 1.594 1.431 E Only 1.939 1.757	+D+0.750Lr+0.750L+H		1.594	1.431									
+D+W+H 1.594 1.431 +D+0.70E+H 1.594 1.431 +D+0.750Lr+0.750L+0.750W+H 1.594 1.431 +D+0.750L+0.750S+0.750W+H 3.048 2.749 +D+0.750Lr+0.750L+0.5250E+H 1.594 1.431 +D+0.750L+0.750S+0.5250E+H 3.048 2.749 +0.60D+W+H 0.956 0.859 +0.60D+W+H 0.956 0.859 D Only 1.594 1.431 Lr Only 1.594 1.431 L Only 1.594 1.431 E Only 1.939 1.757	+D+0.750L+0.750S+H		3.048	2.749									
+D+0.70E+H 1.594 1.431 +D+0.750L+0.750L+0.750W+H 1.594 1.431 +D+0.750L+0.750S+0.750W+H 3.048 2.749 +D+0.750L+0.750L+0.5250E+H 1.594 1.431 +D+0.750L+0.750S+0.5250E+H 3.048 2.749 +0.60D+W+H 0.956 0.859 +0.60D+0.70E+H 0.956 0.859 D Only 1.594 1.431 Lr Only 1.594 1.431 B Only 1.594 1.431 L Only 1.594 1.431 E Only 1.594 1.431 E Only 1.594 1.431	+D+W+H		1.594	1.431									
+D+0.750Lr+0.750L+0.750W+H 1.594 1.431 +D+0.750L+0.750S+0.750W+H 3.048 2.749 +D+0.750Lr+0.750L+0.5250E+H 1.594 1.431 +D+0.750L+0.750S+0.5250E+H 3.048 2.749 +0.60D+W+H 0.956 0.859 +0.60D+0.70E+H 0.956 0.859 D Only 1.594 1.431 Lr Only 1.594 1.431 B Only 1.939 1.757 W Only 1.939 1.757	+D+0.70E+H		1.594	1.431									
+D+0.750L+0.750S+0.750W+H 3.048 2.749 +D+0.750L+0.750L+0.5250E+H 1.594 1.431 +D+0.750L+0.750S+0.5250E+H 3.048 2.749 +0.60D+W+H 0.956 0.859 +0.60D+0.70E+H 0.956 0.859 D Only 1.594 1.431 Lr Only 1.594 1.431 L Only 1.594 1.431 E Only 1.939 1.757 W Only 0.956 0.956	+D+0.750Lr+0.750L+0.750W+	⊦H	1.594	1.431									
+D-0.750Lr+0.750L+0.5250E+H 1.594 1.431 +D+0.750L+0.750S+0.5250E+H 3.048 2.749 +0.60D+W+H 0.956 0.859 +0.60D+0.70E+H 0.956 0.859 D Only 1.594 1.431 Lr Only 1.594 1.431 Lr Only 1.594 1.431 E Only 1.939 1.757 W Only 1.939 1.757	+D+0.750L+0.750S+0.750W+	Н	3.048	2.749									
+D-0.750L+0.750S+0.5250E+H 3.048 2.749 +0.60D+W+H 0.956 0.859 +0.60D+0.70E+H 0.956 0.859 D Only 1.594 1.431 Lr Only LOnly S Only 1.939 1.757 W Only E Only	+D+0.750Lr+0.750L+0.5250E	+H	1.594	1.431									
+0.60D+W+H 0.956 0.859 +0.60D+0.70E+H 0.956 0.859 D Only 1.594 1.431 Lr Only L L S Only 1.939 1.757 W Only E E E Only 1.939 1.757	+D+0 750I +0 750S+0 5250F+	+H	3.048	2,749									
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D Only 1.594 1.431 Lr Only 1.939 1.757 S Only 1.939 1.757 W Only 1.939 1.757	+0.60D+0.70E+H		0.956	0.859									
L Only L Only S Only 1.939 1.757 W Only E Only	D Only		1 594	1 431									
L Only S Only 1.939 1.757 W Only E Only	Lr Only		1.074	1.451									
S Only 1.939 1.757 W Only E Only	LOnly												
W Only E Only	S Only		1 939	1 757									
E Only	W Only			1.757									
	E Only												
H Only	H Only												



DRIFT AREA 2 (B2)

Title Block Line 1 You can change using the "Setting and then using the Title Block" select	this area gs" menu it ne "Printing	em &				Project Title: Engineer: Project Descr:							Project ID:		
Title Block Line 6)											Printed:	22 NOV 2	2017, 10:20AM	
General E	Beam A	Analysis	5					File =	S:\Proje	cts\2017PR~1\17 ENERCALC, IN	'9604~1\01 IC. 1983-20	_CAL~1\88_ENE)17, Build:10.17.	E~1\JOI: 9.25, Ve	STC~1.EC6 er:10.17.9.25	
Lic. # : KW-06 Description :	006621 B2: S Dri	ift+Inter-Row+	SL+DL						Licer	nsee : MP-S	quared	Structural	Engir	neers, LLC	
General Bear	m Propert	ties													
Elastic Moduli Span #1	us 2	29,000.0 k Span Length	ksi h =	40.0 1	īt	Area =		10.0 in^2		Moment of	f Inertia	= ,	100.0) in^4	
										S((0.08375	0)			
								~ <u>S</u>	<u>(0,0.0</u>	<u>*</u> ****		,0) ▽S(0.1 S(02牡) ♡	548)	>	
×			¢	_	D	(0.051) S(☆	(0.1008)	_		\$ \$	4	\$	\$	×	
×														X	
						Span = 4	0.0 ft							I	
Applied Load	ds						Serv	ice loads	entere	ed. Load Fac	tors will	be applied	for ca	lculations.	
Uniform Uniform Uniform Varying	n Load : D n Load : D n Load : S n Uniform Lo	= 0.0510, S = 0.0240 k/ft = 0.1548 k/ft oad : S(S,E)	= 0.1008 t, Extent = t, Extent =) = 0.0->0.	k/ft, Tribu 29.833> 34.833> 08375 k/ft	tary Width = >> 40.0 ft, Tri >> 38.330 ft, , Extent = 25.	1.0 ft, (Unif ibutary Wic Tributary V .154>> 2	form DL & dth = 1.0 ft Vidth = 1.0 9.833 ft, 1	SL) (P.V. Pan ft, (Inter-ro rib Width =	el) ow) = 1.0 ft	, (S-Drift)					
		oad : S(S,E)) = 0.0837	5->0.0 k/ft	, Extent = 29.	.833>> 3	4.512 ft, 1	rib Width =	= 1.0 ft	;, (S-Drift)					
Maximum E	Bending =	=			34.000 k·	-ft Ma	aximum S	Shear =					4.0	36 k	
Load Comb	Load Combination				+D+S+H		Load	Combinat	ion				+D+S	5+H	
Location of Span # whe	maximum ere maximu	on span			21.200π Span # 1		LOCa Snar	tion of max # where r	(imum navimi	on span			40.0 Snan	UUU II #1	
Maximum E	Deflection				Sparr # 1		Spar	I # WHELE I	Παλιπτι				Span	"	
Max Down	ward Transie	nsient Defle	ction		2.345 in		204	Ļ		BOTH	SHE	AR AND)		
Max Opwa Max Dowr	ward Tota	al Deflection	1		3.437 in		13170)		MOME	INT A	RE OK			
		Periection			0.010 in	l	46617								
Maximum Fo	rces & St	resses for	Load Co	ombinatio Ratios	ons		Summary o	f Moment Va	alues			Summa	rv of S	hear Values	
Segment Len	igth	Span #	M	V	Mmax +	Mmax -	Ma - Max	Mnx	Mn	x/Omega Cb	Rm	Va Max	Vnx	Vnx/Omega	
Overall MAXimum Dsgn. L = 40.0	Envelope 0 ft	1			34.00		34.00					4.04			
D Only Dsgn. L = 40.0	0 ft	1			10.83		10.83					1.23			
+D+L+H Dsan I = 40.0	Ωft	1			10.83		10.83					1 23			
+D+Lr+H	0.8	1			10.00		10.03					1.20			
+D+S+H	01	1			10.05		10.03					1.23			
Dsgn. L = 40.0 +D+0.750Lr+0.750	υπ L+H	I			34.00		34.00					4.04			
Dsgn. L = 40.0 +D+0.750L+0.750S	0 ft S+H	1			10.83		10.83					1.23			
Dsgn. L = 40.0	0 ft	1			28.21		28.21					3.34			
Dsgn. L = 40.0	0 ft	1			10.83		10.83					1.23			
+D+0.70E+H Dsgn. L = 40.0	0 ft	1			10.83		10.83					1.23			
+D+0.750Lr+0.750 Dsgn. L = 40.0	L+0.750W+I 0 ft	H 1			10.83		10.83					1.23			
+D+0.750L+0.750S	S+0.750W+F 0 ft	1 1			28 21		28 21					3 34			
+D+0.750Lr+0.750	L+0.5250E+	·H 1			10.83		10.21					1 22			
+D+0.750L+0.750S	S+0.5250E+I	Η			10.03		10.03					1.20			
Usgn. L = 40.0 +0.60D+W+H	υπ	Т			28.21		28.21					3.34			
Dsgn. L = 40.0	Λft	1			6 50		6 50					0.74			
+0.60D+0.70E+H	υn	I			0.50		0.00								

General Beam Analysis

Description : B2: S Drift+Inter-Row+SL+DL

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	3.4372	20.400		0.0000	0.000
Vertical Reactions			Support	notation : Far left is #1	Values in KIPS	
Load Combination	Support 1	Support 2				
Overall MAXimum	3.213	4.036				
Overall MINimum	0.631	0.740				
D Only	1.051	1.233				
+D+L+H	1.051	1.233				
+D+Lr+H	1.051	1.233				
+D+S+H	3.213	4.036				
+D+0.750Lr+0.750L+H	1.051	1.233				
+D+0.750L+0.750S+H	2.672	3.335				
+D+W+H	1.051	1.233				
+D+0.70E+H	1.051	1.233				
+D+0.750Lr+0.750L+0.750W+H	1.051	1.233				
+D+0.750L+0.750S+0.750W+H	2.672	3.335				
+D+0.750Lr+0.750L+0.5250E+H	1.051	1.233				
+D+0.750L+0.750S+0.5250E+H	2.672	3.335				
+0.60D+W+H	0.631	0.740				
+0.60D+0.70E+H	0.631	0.740				
D Only	1.051	1.233				
Lr Only						
L Only						
S Only	2.162	2.803				
W Only						
E Only						
H Only						

Printed: 22 NOV 2017, 10:20AM File = S:\Projects\2017PR-1\179604-1\01_CAL-1\88_ENE-1\JOISTC-1.EC6 ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Licensee : MP-Squared Structural Engineers, LLC

Title Block Line 1 Project Title: Engineer: Project ID: You can change this area Project Descr: using the "Settings" menu item and then using the "Printing & Title Block" selection. Title Block Line 6 Printed: 22 NOV 2017, 10:27AM File = S:\Projects\2017PR~1\179604~1\01_CAL~1\88_ENE~1\JOISTC~1.EC6 General Beam Analysis ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Lic. # : KW-06006621 Licensee : MP-Squared Structural Engineers, LLC B2: Leeward N Drift+Inter-Row+SL+DL Description : CONTROLLING LOAD CASE FOR DRIFT AREA 2 (B2) **General Beam Properties** Elastic Modulus 29,000.0 ksi Span Length = Span #1 40.0 ft Area = 10.0 in^2 Moment of Inertia = 100.0 in^4 S(0.1548) S(0.1419,0) S(0,0.1419) D(0:024) D(0.051) S(0.1008) Span = 40.0 ft Applied Loads Service loads entered. Load Factors will be applied for calculations. Uniform Load : D = 0.0510, S = 0.1008 k/ft, Tributary Width = 1.0 ft, (Uniform DL & SL) Uniform Load : D = 0.0240 k/ft, Extent = 29.833 -->> 40.0 ft, Tributary Width = 1.0 ft, (PV Panel) Varying Uniform Load : S(S,E) = 0.0->0.1419 k/ft, Extent = 24.833 -->> 29.833 ft, Trib Width = 1.0 ft, (Leeward N-Drift) Varying Uniform Load : S(S,E) = 0.1419->0.0 k/ft, Extent = 29.833 -->> 34.833 ft, Trib Width = 1.0 ft, (Leeward N-Drift) Uniform Load : S = 0.1548 k/ft, Extent = 34.833 -->> 38.333 ft, Tributary Width = 1.0 ft, (Inter-row) DESIGN SUMMARY Maximum Bending = 35.731 k-ft Maximum Shear = 4.274 k Load Combination +D+S+H Load Combination +D+S+H 21.600ft Location of maximum on span 40.000 ft Location of maximum on span Span #1 Span #1 Span # where maximum occurs Span # where maximum occurs Maximum Deflection Max Downward Transient Deflection 2.520 in 190 BOTH SHEAR AND Max Upward Transient Deflection 0.039 in 12368 MOMENT ARE OK! Max Downward Total Deflection 3.613 in 132 Max Upward Total Deflection 0.010 in 46617 Maximum Forces & Stresses for Load Combinations Max Stress Ratios Summary of Moment Values Summary of Shear Values Load Combination Μ V Mmax + Mmax -Ma - Max Mnx Mnx/Omega Cb Rm Va Max Vnx Vnx/Omega Segment Length Span # Overall MAXimum Envelope Dsgn. L = 40.00 ft 1 35.73 35.73 4.27 D Only 10.83 1.23 Dsgn. L = 40.00 ft 1 10.83 +D+L+H Dsgn. L = 40.00 ft 10.83 10.83 1 1.23 +D+Lr+H Dsgn. L = 40.00 ft 1 10.83 10.83 1.23 +D+S+H

35.73

10.83

29.50

10.83

10.83

10.83

29.50

10.83

29.50

6.50

6.50

4.27

1.23

3.51

1.23

1.23

1.23

3.51

1.23

3.51

0.74

0.74 80 of 119

35.73

10.83

29.50

10.83

10.83

10.83

29.50

10.83

29.50

6.50

6.50

Dsgn. L = 40.00 ft

+D+0.750Lr+0.750L+H Dsgn. L = 40.00 ft

+D+0.750L+0.750S+H Dsgn. L = 40.00 ft

Dsgn. L = 40.00 ft

+D+0.750Lr+0.750L+0.750W+H Dsgn. L = 40.00 ft

+D+0.750L+0.750S+0.750W+H Dsgn. L = 40.00 ft

+D+0.750Lr+0.750L+0.5250E+H Dsgn. L = 40.00 ft

+D+0.750L+0.750S+0.5250E+H

Dsqn. L = 40.00 ft

Dsgn. L = 40.00 ft

+0.60D+W+H Dsgn. L = 40.00 ft

+0.60D+0.70E+H

+D+W+H

+D+0.70E+H Dsgn. L = 40.00 ft 1

1

1

1

1

1

1

1

1

1

General Beam Analysis

Description : B2: Leeward N Drift+Inter-Row+SL+DL

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	3.6126	20.400		0.0000	0.000
Vertical Reactions			Support	notation : Far left is #1	Values in KIPS	
Load Combination	Support 1	Support 2				
Overall MAXimum	3.294	4.274				
Overall MINimum	0.631	0.740				
D Only	1.051	1.233				
+D+L+H	1.051	1.233				
+D+Lr+H	1.051	1.233				
+D+S+H	3.294	4.274				
+D+0.750Lr+0.750L+H	1.051	1.233				
+D+0.750L+0.750S+H	2.733	3.514				
+D+W+H	1.051	1.233				
+D+0.70E+H	1.051	1.233				
+D+0.750Lr+0.750L+0.750W+H	1.051	1.233				
+D+0.750L+0.750S+0.750W+H	2.733	3.514				
+D+0.750Lr+0.750L+0.5250E+H	1.051	1.233				
+D+0.750L+0.750S+0.5250E+H	2.733	3.514				
+0.60D+W+H	0.631	0.740				
+0.60D+0.70E+H	0.631	0.740				
D Only	1.051	1.233				
Lr Only						
L Only						
S Only	2.243	3.041				
W Only						
E Only						
H Only						

Printed: 22 NOV 2017, 10:27AM File = S:\Projects\2017PR-1\179604-1\01_CAL-1\88_ENE-1\JOISTC-1.EC6 ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Licensee : MP-Squared Structural Engineers, LLC

Title Block Line 1 You can change this area using the "Settings" menu and then using the "Printin Title Block" selection.	item ng &				Project Title Engineer: Project Des	e: scr:	Projec	t ID:			
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General Beam	Analysis					File = S:\Pr	ojects\2017PR~1\17 ENERCALC, IN	9604~1\01_ C. 1983-201	_CAL~1\88_ENE^ 17, Build:10.17.9.	-1\JOISTC~1.EC 25, Ver:10.17.9.2	26 25
Lic. # : KW-06006621 Description : B2: Slice	ding Snow+SL+D	DL				Lic	ensee : MP-S	quared \$	Structural E	Ingineers, l	LC
General Beam Prope	erties										
Elastic Modulus Span #1	29,000.0 ks Span Length	si = 40.	.O ft	Area =	10.	.0 in^2	Moment of	Inertia	= 1	00.0 in^4	
									S(0 1008)		
						<u>\$(0.1</u> ♦ ♦ ♦	008 <u>)</u>	4	<u>S(0.1008</u>)	
4	\$		S(0.1008)		⇒		\$	D((0.024)	× →	
×		¢		<u>D(0.00</u>	51)		\$			×	
*										×	
4				Span = 4	0.0 ft					►	
Applied Loads					Service	loads ente	ared Load Fac	tors will	he applied f	or calculatio	ns
Load for Span Number	er 1				Octvice						
Uniform Load : I Uniform Load : I Uniform Load : S Uniform Load : S Uniform Load : S Uniform Load : S	D = 0.0510 k/ft, D = 0.0240 k/ft, S = 0.1008 k/ft,	Extent = 0.0> Extent = 29.833 Extent = 0.0> Extent = 34.833 Extent = 24.833 Extent = 24.833	> 40.0 ft, Tribut 3>> 40.0 ft, Tr > 29.833 ft, Trib 3>> 38.333 ft, 3>> 29.833 ft, 3>> 29.833 ft, 3>> 29.833 ft,	ary Width : ibutary Wid outary Widt Tributary \ Tributary \ Tributary \	= 1.0 ft, (Unifor dth = 1.0 ft, (P) h = 1.0 ft, (Bal Nidth = 1.0 ft, (Nidth = 1.0 ft, (Nidth = 1.0 ft, (m DL & SL V Panel) anced SL) (Balanced S (Sliding Sno (Sliding Sno) SL) SW)				
	3 – 0.1000 N/II,)>> 30.333 H,	mbutary	Muti – 1.0 ft, ((Shung Shu	JVV)				
Maximum Bending	=		33.287 k	-ft Ma	aximum She	ar =				3.473 k	
Load Combination			+D+S+H		Load Co	mbination				+D+S+H	
Location of maximur	n on span		21.000ft		Location	of maximu	m on span			40.000 ft	
Span # where maxin	num occurs		Span # 1		Span # v	where maxii	mum occurs		2	span # T	
MaxImum Deflection Max Downward Tra Max Upward Trans Max Downward To	ansient Deflec sient Deflection stal Deflection	tion n	2.244 in 0.035 in 3.336 in		213 13650 143		BOTH S MOMEN	SHEA NT AF	r and Re ok!		
Max Upward Total	Deflection		0.010 in	1	46617						
Maximum Forces & S	Stresses for L	_oad Combin	ations								
Load Combination	<u>N</u>	1ax Stress Ratios			Summary of Mo	ment Values		Der	Summary	of Shear Valu	les
Overall MAXimum Envelope	Span #	IVI V	IVIMAX +	ivimax -	ivia - iviax	IVINX IN	/inx/Omega Cb	RM	va wax	vnx vnx/Or	nega
Dsgn. L = 40.00 ft	1		33.29		33.29				3.47		
D Only Dsgn. L = 40.00 ft	1		10.83		10.83				1.23		
Dsgn. L = 40.00 ft	1		10.83		10.83				1.23		
Dsgn. L = 40.00 ft	1		10.83		10.83				1.23		
Dsgn. L = 40.00 ft	1		33.29		33.29				3.47		
Disgn. L = 40.00 ft	1		10.83		10.83				1.23		
Dsgn. L = 40.00 ft	1		27.67		27.67				2.91		
+D+W+H Dsgn. L = 40.00 ft	1		10.83		10.83				1.23		
+D+0.70E+H Dsgn. L = 40.00 ft	1		10.83		10.83				1.23		
+D+0.750Lr+0.750L+0.750W Dsgn. L = 40.00 ft	/+H 1		10.83		10.83				1.23		
+D+0.750L+0.750S+0.750W Dsgn. L = 40.00 ft	+H 1		27.67		27.67				2.91		
+D+0.750Lr+0.750L+0.5250E Dsgn I = 40.00 ft	E+H 1		10.83		10.83				1.23		
+D+0.750L+0.750S+0.5250E	É+H 1		77 47		10.03 77 67				1.2J 2.01		
+0.60D+W+H	1		27.07		21.01				2.71 0 7, 82	of 119	
Dsgn. L = 40.00 ft	1		0.50		6.50				0.74		

Title Block Line 6									Printe	d: 22 NOV 2	017, 10:32AM
General Beam An	alvsis					File = S	:\Projects\2017PR~1\1	79604~1\01	I_CAL~1\88_E	NE~1\JOIS	STC~1.EC6
	arysis						ENERCALC, IN	VC. 1983-2	017, Build:10.1	7.9.25, Ver	:10.17.9.25
Lic. # : KW-06006621						L	Icensee : MP-5	quared	Structura	i Engin	ieers, LLC
Description : B2: Sliding S	SNOW+SL+DL										
Load Combination	Max Stre	ess Ratios			Summary of Mo	oment Val	ues		Summ	nary of Sh	near Values
Segment Length Spa	an# M	V –	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega Cb	Rm	Va Max	Vnx	Vnx/Omega
		-									
Dsan. L = 40.00 ft	1		6.50		6.50				0.74		
Overall Maximum Deflect	tions										
Load Combination	Span	Max. "-" Defl	Locatior	n in Span	Load Comb	pination		Max	k. "+" Defl	Locatio	n in Span
+D+S+H	1	3.3364	2	20.200					0.0000		0.000
Vertical Deactions				Suppor	notation · Far I	off is #1		Values i	n KIPS		
	Command 1	Commont 2		Suppor		eit is # i		Values I			
	Support I	Support 2									
Overall MAXimum	3.179	3.4/3									
	0.631	0.740									
D Only	1.051	1.233									
+D+L+H	1.051	1.233									
+D+Lr+H	1.051	1.233									
+D+S+H	3.179	3.473									
+D+0./50Lr+0./50L+H	1.051	1.233									
+D+0./50L+0./50S+H	2.64/	2.913									
+D+W+H	1.051	1.233									
+D+0.70E+H	1.051	1.233									
+D+0.750Lr+0.750L+0.750W+I	H 1.051	1.233									
+D+0.750L+0.750S+0.750W+F	1 2.647	2.913									
+D+0./50Lr+0./50L+0.5250E+	H 1.051	1.233									
+D+0./50L+0./50S+0.5250E+	H 2.64/	2.913									
+0.60D+W+H	0.631	0.740									
+0.60D+0.70E+H	0.631	0.740									
D Only	1.051	1.233									
Lr Only											
L Only											
S Only	2.128	2.240									
W Only											
E Only											
H Only											



DRIFT AREA 4

Title Block Line 1 You can change this area using the "Settings" menu item and then using the "Printing & Title Block" selection.

itte Block" selection. Fitle Block Line 6				Printed: 22 NOV 2017, 10:50A
General Beam Analysis		File =	S:\Projects\2017PR~1\179604~1\01_CAL~ ENERCALC_INC_1983-2017_Bu	1\88_ENE~1\JOISTC~1.EC6 ild:10.17.9.25_Ver:10.17.9.25
.ic. # : KW-06006621			Licensee : MP-Squared Stru	ctural Engineers, L
Description : N Drift+Inter-Row+SL+DL	CON	TROLLING LOA	D CASE FOR DRIF	FAREA 4
General Beam Properties				
Elastic Modulus 29,000.0 ksi				
Span #1 Span Length =	40.0 ft Ar	ea = 10.0 in^2	2 Moment of Inertia =	100.0 in^4
S(0,0.1548) S(0.1548,0)		S(0 1548)		
	<u>S(0.1548)</u>	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	S(0.1548.0	0.508)
	D(0.024) ♦ D(0.05	51) S(0.1008) [↓]	÷ ÷ ÷ ; ;	↓ · · · · · · · · · · · · · · · · · · ·
×		\$	\$	×
×				×
	Spa	n = 40.0 ft		
4				
Applied Loads		Service loads	entered. Load Factors will be a	upplied for calculation
1000000000000000000000000000000000000	t Tributary Width – 1.0 ft	(Uniform DL & SL)		
Uniform Load : $D = 0.0240 \text{ k/ft}$, Extent = 6.3	833>> 28.833 ft, Tributa	ary Width = 1.0 ft, (P.V. Pa	inels)	
Varying Uniform Load : S(S,E) = 0.1548->0	0.05080 k/ft, Extent = 28.8	33>> 40.0 ft, Trib Width	n = 1.0 ft, (N-drift)	
Uniform Load : $S = 0.1548 \text{ k/ft}$, Extent = 11	.833>> 15.333 ft, Tribu	tary Width = 1.0 ft, (Inter-r	ow)	
Uniform Load : $S = 0.1548 \text{ k/ft}$, Extent = 20	1.333>> 23.833 ft, Tribu	tary Width = 1.0 ft, (Inter-r		
Varying Uniform Load : $S(S,E) = 0.0->0.15$ Varying Uniform Load : $S(S,E) = 0.1548->0.05$	48 K/II, EXterit = 1.833>:) 0 k/ft Exterit = 6.833>:	> 0.833 II, THD WIGHT = 1. > 11 833 ft Trib Width = 1	LOft (LEEWARD N-DRIFT)	
DESIGN SUMMARY				
Maximum Bending =	49.076 k-ft	Maximum Shear =		4.847 k
Load Combination	+D+S+H	Load Combina	tion	+D+S+H
Location of maximum on span	20.400ft	Location of ma	ximum on span	40.000 ft
Span # where maximum occurs	Span # 1	Span # where	maximum occurs	Span # 1
Maximum Deflection			BOTH SHEAR AND)
Max Downward Transient Deflection	3.543 in	135		
Max Downward Total Deflection	0.056 m 4.926 in	8498		
Max Upward Total Deflection	0.013 in	36537	ITE 5% INKESHC	
Maximum Forces & Stresses for Load Com	binations			
ad Combination Max Stress Ra	atios	Summary of Moment V	alues	Summary of Shear Valu
Segment Length Span # M	V Mmax + Mn	nax - Ma - Max Mn	x Mnx/Omega Cb Rm Va	Max Vnx Vnx/Om

Eoud Compilation						,						,	
Segment Length S	pan #	М	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
Overall MAXimum Envelope													
Dsgn. L = 40.00 ft	1			49.08		49.08					4.85		
D Only													
Dsgn. L = 40.00 ft	1			13.98		13.98					1.31		
+D+L+H													
Dsgn. L = 40.00 ft	1			13.98		13.98					1.31		
+D+Lr+H													
Dsgn. L = 40.00 ft	1			13.98		13.98					1.31		
+D+S+H													
Dsgn. L = 40.00 ft	1			49.08		49.08					4.85		
+D+0.750Lr+0.750L+H				10.00		10.00							
Dsgn. L = 40.00 ft	1			13.98		13.98					1.31		
+D+0./50L+0./50S+H	1			40.00		10.20					2.05		
$Dsgn. L = 40.00 \pi$	I			40.30		40.30					3.95		
+D+W+H	1			12.00		12.00					1 01		
DSGII. L = 40.00 II	I			13.98		13.98					1.31		
+D+0.70L+11 Dsan L = 40.00 ft	1			12 08		12 00					1 21		
$\pm D_{\pm}0.750$ r ± 0.750 r ± 0.750 W/ $\pm H$	'			13.70		13.70					1.51		
$D_{sqn} I = 40.00 \text{ ft}$	1			13 98		13 98					1 31		
+D+0 750I +0 750S+0 750W+H				10.70		10.70					1.01		
Dsan. L = 40.00 ft	1			40.30		40.30					3.95		
+D+0.750Lr+0.750L+0.5250E+H													
Dsgn. L = 40.00 ft	1			13.98		13.98					1.31		
+D+0.750L+0.750S+0.5250E+H													
Dsgn. L = 40.00 ft	1			40.30		40.30					3.95		
+0.60D+W+H											R	5 of 11	9
Dsgn. L = 40.00 ft	1			8.39		8.39					0.79		0

Title Block Line 6									Printe	d: 22 NOV 2	017, 10:50AM
General Beam An	alvsis					File = S	:\Projects\2017PR~1\1	79604~1\01	1_CAL~1\88_E	NE~1\JOIS	STC~1.EC6
	arysis			_		_	ENERCALC, IN	VC. 1983-2	017, Build:10.1	7.9.25, Ver	:10.17.9.25
LIC. # : KW-06006621							Icensee : MP-5	quared	Structura	i Engin	ieers, LLC
Description : N Dritt+Inter-	R0W+SL+DL										
Load Combination	Max Stre	ess Ratios			Summary of Mo	oment Vali	ues		Summ	nary of Sh	ear Values
Segment Length Spa	in# M	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega Cb	Rm	Va Max	Vnx	Vnx/Omega
+0.60D+0.70E+H							5				
Dsgn. L = 40.00 ft	1		8.39		8.39				0.79		
Overall Maximum Deflect	ions										
Load Combination	Span	Max. "-" Defl	Location	n in Span	Load Comb	oination		Max	x. "+" Defl	Locatio	n in Span
+D+S+H	1	4.9260	2	20.000					0.0000		0.000
Vertical Reactions				Suppor	t notation : Far I	eft is #1		Values i	in KIPS		
Load Combination	Support 1	Support 2									
Overall MAXimum	4.758	4.847									
Overall MINimum	0.788	0.753									
D Only	1.313	1.255									
+D+L+H	1.313	1.255									
+D+Lr+H	1.313	1.255									
+D+S+H	4.758	4.847									
+D+0.750Lr+0.750L+H	1.313	1.255									
+D+0.750L+0.750S+H	3.897	3.949									
+D+W+H	1.313	1.255									
+D+0.70E+H	1.313	1.255									
+D+0.750Lr+0.750L+0.750W+H	H 1.313	1.255									
+D+0.750L+0.750S+0.750W+H	3.897	3.949									
+D+0.750Lr+0.750L+0.5250E+	H 1.313	1.255									
+D+0.750L+0.750S+0.5250E+H	H 3.897	3.949									
+0.60D+W+H	0.788	0.753									
+0.60D+0.70E+H	0.788	0.753									
D Only	1.313	1.255									
Lr Only											
L Only											
S Only	3.446	3.592									
W Only											
E Only											
H Only											

Title Block Line 1 Project Title: Engineer: Project ID: You can change this area Project Descr: using the "Settings" menu item and then using the "Printing & Title Block" selection. Title Block Line 6 Printed: 22 NOV 2017, 10:47AM File = S:\Projects\2017PR~1\179604~1\01_CAL~1\88_ENE~1\JOISTC~1.EC6 General Beam Analysis ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Lic. # : KW-06006621 Licensee : MP-Squared Structural Engineers, LLC Description : S Drift+Inter-Row+SL+DL **General Beam Properties** Elastic Modulus 29,000.0 ksi Span Length = Span #1 40.0 ft Area = 10.0 in^2 Moment of Inertia = 100.0 in^4 S(0,0.0568)^{S(0.0568,0)} S(0.0915) S(0.0915) <u>S(0.1071,0)</u> D(0.024) D(0.051) S(0.1008) Span = 40.0 ft Applied Loads Service loads entered. Load Factors will be applied for calculations. Uniform Load : D = 0.0510, S = 0.1008 k/ft, Tributary Width = 1.0 ft, (Uniform DL & SL) Uniform Load : D = 0.0240 k/ft, Extent = 6.833 -->> 28.833 ft, Tributary Width = 1.0 ft, (P.V. Panels) Varying Uniform Load : S(S,E) = 0.1071->0.0 k/ft, Extent = 28.833 -->> 34.814 ft, Trib Width = 1.0 ft, (LEEWARD S-drift) Uniform Load : S = 0.09150 k/ft, Extent = 11.833 -->> 15.333 ft, Tributary Width = 1.0 ft, (Inter-row) Uniform Load : S = 0.09150 k/ft, Extent = 20.333 -->> 23.833 ft, Tributary Width = 1.0 ft, (Inter-row) Varying Uniform Load : S(S,E) = 0.0->0.05680 k/ft, Extent = 3.662 -->> 6.833 ft, Trib Width = 1.0 ft, (S-drift) Varying Uniform Load : S(S,E) = 0.05680->0.0 k/ft, Extent = 6.833 -->> 10.004 ft, Trib Width = 1.0 ft, (S-drift) DESIGN SUMMARY Maximum Bending = 41.267 k-ft Maximum Shear = 3.906 k Load Combination +D+S+H Load Combination +D+S+H Location of maximum on span 20.400ft Location of maximum on span 0.000 ft Span # where maximum occurs Span # 1 Span # where maximum occurs Span # 1 Maximum Deflection Max Downward Transient Deflection 2.724 in 176 **BOTH SHEAR AND** Max Upward Transient Deflection 0.043 in 11132 **MOMENT ARE OK!** Max Downward Total Deflection 4.107 in 116 Max Upward Total Deflection 36537 0.013 in Maximum Forces & Stresses for Load Combinations Max Stress Ratios Summary of Moment Values Summary of Shear Values Load Combination Μ V Mmax + Mmax -Ma - Max Mnx Mnx/Omega Cb Rm Va Max Vnx Vnx/Omega Span # Segment Length **Overall MAXimum Envelope** Dsgn. L = 40.00 ft 1 41.27 41.27 3.91 D Only 13.98 Dsqn. L = 40.00 ft1 13.98 1.31 +D+L+H Dsgn. L = 40.00 ft 1 13.98 13.98 1.31 +D+Lr+H Dsgn. L = 40.00 ft 1 13.98 13.98 1.31 +D+S+H Dsgn. L = 40.00 ft 41.27 41.27 3 91 1 +D+0.750Lr+0.750L+H Dsgn. L = 40.00 ft 13.98 1.31 1 13.98 +D+0.750L+0.750S+H Dsgn. L = 40.00 ft 1 34.44 34.44 3.26 +D+W+H Dsgn. L = 40.00 ft 13.98 1.31 1 13.98 +D+0.70E+H

13.98

13.98

34.44

13.98

34.44

8.39

13.98

13.98

34.44

13.98

34.44

8.39

1.31

1.31

3.26

1.31

3.26

0.79 87 of 119

Dsgn. L = 40.00 ft

+D+0.750Lr+0.750L+0.750W+H Dsgn. L = 40.00 ft

+D+0.750L+0.750S+0.750W+H Dsgn. L = 40.00 ft

+D+0.750Lr+0.750L+0.5250E+H Dsan. L = 40.00 ft

+D+0.750L+0.750S+0.5250E+H Dsqn. L = 40.00 ft

Dsgn. L = 40.00 ft

+0.60D+W+H

1

1

1

1

1

Title Block Line 6									Printee	1: 22 NOV 2	017, 10:47AM
General Beam An	alvsis					File = S	:\Projects\2017PR~1\1	79604~1\01	_CAL~1\88_E	NE~1/JOIS	STC~1.EC6
	arysis		_	_		_	ENERCALC, IN	VC. 1983-2	017, Build:10.1	7.9.25, Ver	:10.17.9.25
LIC. # : KW-06006621	Down SL + DL						Icensee : MP-5	quared	Structura	i Engin	eers, LLC
Description : 5 Drit+Inter	-ROW+SL+DL										
Load Combination	Max Stre	ess Ratios			Summary of Mc	oment Valu	ues		Summ	ary of Sh	ear Values
Segment Length Spa	ın# M	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega Cb	Rm	Va Max	Vnx	Vnx/Omega
+0.60D+0.70E+H											
Dsgn. L = 40.00 ft	1		8.39		8.39				0.79		
Overall Maximum Deflect	ions										
Load Combination	Span	Max. "-" Defl	Locatior	n in Span	Load Comb	pination		Max	<. "+" Defl	Locatio	n in Span
+D+S+H	1	4.1074	2	20.000					0.0000		0.000
Vertical Reactions				Suppor	notation : Far I	eft is #1		Values i	n KIPS		
Load Combination	Support 1	Support 2									
Overall MAXimum	3.906	3.835									
Overall MINimum	0.788	0.753									
D Only	1.313	1.255									
+D+L+H	1.313	1.255									
+D+Lr+H	1.313	1.255									
+D+S+H	3.906	3.835									
+D+0.750Lr+0.750L+H	1.313	1.255									
+D+0.750L+0.750S+H	3.258	3.190									
+D+W+H	1.313	1.255									
+D+0.70E+H	1.313	1.255									
+D+0.750Lr+0.750L+0.750W+H	H 1.313	1.255									
+D+0.750L+0.750S+0.750W+H	3.258	3.190									
+D+0.750Lr+0.750L+0.5250E+	H 1.313	1.255									
+D+0.750L+0.750S+0.5250E+H	H 3.258	3.190									
+0.60D+W+H	0.788	0.753									
+0.60D+0.70E+H	0.788	0.753									
D Only	1.313	1.255									
Lr Only											
L Only											
S Only	2.594	2.579									
W Only											
E Only											
H Only											

Title Block Line 1 Project Title: Project ID: Engineer: You can change this area Project Descr: using the "Settings" menu item and then using the "Printing & Title Block" selection. Title Block Line 6 Printed: 22 NOV 2017, 10:52AM File = S:\Projects\2017PR~1\179604~1\01 CAL~1\88 ENE~1\JOISTC~1.EC6 General Beam Analysis ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Lic. # : KW-06006621 Licensee : MP-Squared Structural Engineers, LLC Description : Sliding Snow+SL+DL **General Beam Properties** Elastic Modulus 29,000.0 ksi Span Length = 10.0 in^2 Span #1 40.0 ft Area = Moment of Inertia = 100.0 in^4 S(0.1008) <u>S(0.1008)</u> S(0.1008) <u>S(0.1008)</u> S(0.1008) S(0.1008) Span = 40.0 ft **Applied Loads** Service loads entered. Load Factors will be applied for calculations. Load for Span Number 1 Uniform Load : S = 0.1008 k/ft, Extent = 0.0 -->> 6.833 ft, Tributary Width = 1.0 ft, (Balanced SL) Uniform Load : S = 0.1008 k/ft, Extent = 11.833 -->> 15.333 ft, Tributary Width = 1.0 ft, (Balanced SL) Uniform Load : S = 0.1008 k/ft, Extent = 20.330 -->> 23.833 ft, Tributary Width = 1.0 ft, (Balanced SL) Uniform Load : S = 0.1008 k/ft, Extent = 28.833 -->> 40.0 ft, Tributary Width = 1.0 ft, (Balanced SL) Uniform Load : S = 0.1008 k/ft, Extent = 1.833 -->> 6.833 ft, Tributary Width = 1.0 ft, (Sliding SL) Uniform Load : S = 0.1008 k/ft, Extent = 10.333 -->> 15.333 ft, Tributary Width = 1.0 ft, (Sliding SL) Uniform Load : S = 0.1008 k/ft, Extent = 18.833 -->> 23.833 ft, Tributary Width = 1.0 ft, (Sliding SL) Uniform Load : D = 0.0510 k/ft, Tributary Width = 1.0 ft, (Uniform DL) Uniform Load : D = 0.0240 k/ft, Extent = 6.833 -->> 28.833 ft, Tributary Width = 1.0 ft, (P.V. Panels) **DESIGN SUMMARY** Maximum Bending = 32.812 k-ft Maximum Shear = 3.518 k Load Combination +D+S+H Load Combination +D+S+H Location of maximum on span 20.000ft Location of maximum on span 0.000 ft Span # where maximum occurs Span # 1 Span # where maximum occurs Span # 1 Maximum Deflection BOTH SHEAR AND Max Downward Transient Deflection 1.877 in 255 Max Upward Transient Deflection 0.030 in 15941 MOMENT ARE OK! Max Downward Total Deflection 3.260 in 147 Max Upward Total Deflection 0.013 in 36537 Maximum Forces & Stresses for Load Combinations Max Stress Ratios Summary of Moment Values Summary of Shear Values Load Combination Span # М V Mmax + Mmax -Ma - Max Mnx Mnx/Omega Cb Rm Va Max Vnx Vnx/Omega Segment Length **Overall MAXimum Envelope** Dsgn. L = 40.00 ft 32.81 32.81 3.52 1 D Only Dsgn. L = 40.00 ft 13.98 13.98 1.31 1

D . J				
+D+L+H				
Dsgn. L = 40.00 ft	1	13.98	13.98	1.31
+D+Lr+H				
Dsgn. L = 40.00 ft	1	13.98	13.98	1.31
+D+S+H				
Dsgn. L = 40.00 ft	1	32.81	32.81	3.52
+D+0.750Lr+0.750L+H				
Dsgn. L = 40.00 ft	1	13.98	13.98	1.31
+D+0.750L+0.750S+H				
Dsgn. L = 40.00 ft	1	28.10	28.10	2.97
+D+W+H				
Dsgn. L = 40.00 ft	1	13.98	13.98	1.31
+D+0.70E+H				
Dsgn. L = 40.00 ft	1	13.98	13.98	1.31
+D+0.750Lr+0.750L+0.750W+H				
Dsgn. L = 40.00 ft	1	13.98	13.98	1.31
+D+0.750L+0.750S+0.750W+H				
Dsgn. L = 40.00 ft	1	28.10	28.10	2.97
+D+0.750Lr+0.750L+0.5250E+H				
Dsgn. L = 40.00 ft	1	13.98	13.98	1.31 89 of 119

+D+0.750L+0.750S+0.5250E+H

L

Title Block Line 6										Printee	d: 22 NOV 2	017, 10:52AM
General Beam A	nalv	sis					File = S	:\Projects\2017PR~1\1	79604~1\01	_CAL~1\88_E	NE~1\JOIS	TC~1.EC6
Lic. # · KW-06006621		_	_		_	_		icensee : MP-S	auared	Structura	1.9.25, ver	eers. LLC
Description : Sliding Sn	ow+SL+	-DL										
Load Combination		Max Stre	ss Ratios			Summary of Mo	oment Val	ues		Summ	hary of Sh	ear Values
Segment Length S	pan #	М	V	Mmax	+ Mmax -	Ma - Max	Mnx	Mnx/Omega Cb	Rm	Va Max	Vnx	Vnx/Omega
Dsgn. L = 40.00 ft +0.60D+W+H	1			28.1	0	28.10				2.97		
Dsgn. L = 40.00 ft +0.60D+0.70E+H	1			8.3	9	8.39				0.79		
Dsgn. L = 40.00 ft	1			8.3	9	8.39				0.79		
Overall Maximum Defle	ctions	5										
Load Combination		Span	Max. "-" Defl	Loc	ation in Span	Load Comb	oination		Max	. "+" Defl	Locatio	n in Span
+D+S+H		1	3.2604		20.000					0.0000		0.000
Vertical Reactions					Suppor	t notation : Far I	eft is #1		Values ir	n KIPS		
Load Combination		Support 1	Support 2									
Overall MAXimum		3.518	3.083									
Overall MINimum		0.788	0.753									
D Only		1.313	1.255									
+D+L+H		1.313	1.255									
+D+Lr+H		1.313	1.255									
+D+S+H		3.518	3.083									
+D+0.750Lr+0.750L+H		1.313	1.255									
+D+0.750L+0.750S+H		2.966	2.626									
+D+W+H		1.313	1.255									
+D+0.70E+H		1.313	1.255									
+D+0.7501 r+0.7501 +0.750W	+Η	1.313	1.255									
+D+0.750I +0.750S+0.750W	+H	2.966	2.626									
+D+0 750l r+0 750l +0 5250l	 -+H	1.313	1,255									
+D+0.750I +0.750S+0.5250F	+H	2.966	2.626									
+0.60D+W+H		0 788	0 753									
+0.60D+0.70F+H		0.788	0.753									
D Only		1 313	1 255									
Lr Only		1.010	1.200									
LOnly												
S Only		2 205	1 827									
W Only		2.200	1.027									
E Only												

E Only H Only



SECONDARY ANALYSIS OF PROBLEM AREAS

The easiest, and perhaps the best, way to alleviate the issues encountered with the new snow drift load patterns is to lower the standoff height between the low-side of the photovoltaic cells and the roof. The following calculations will illustrate that reinforcing of existing framing can be avoided by simply lowering the low-side of the panel to a maximum height of 14" above the roof.

PROPOSED P.V. CELL SCHEMATIC



22 Nov 2017 11:26:27 - Solar Panel Sliding Snow & Closely Spaced Drift (14in low side, Drift Area 1).sm

Snow Load Pattern for Elevated, Tilted-Open Solar Panel Array

THIS SHEET ASSUMES THE LOW SIDE h_{p1}:=14 *in* Low side dimension OF THE PANEL(S) FACES SOUTH. SWAP l horiz = 60 in Length of horizontal projection DIRECTIONS IN THE HEADINGS, IF DIFFERENT $\theta \coloneqq 20 \ deg$ Angle of tilt $l_{p} = \left(\frac{l_{horiz}}{\cos(\theta)}\right) = 63.851 in$ Length of panel $h_{p2} = h_{p1} + l_{p} \sin(\theta) = 35.838 in$ High side dimension laisle = 42 in Width of aisle between rows Drift Fetch Distances: 1 := 54.667 ft Upwind fetch for wind OUT OF THE NORTH 1 := 57.25 ft Upwind fetch for wind OUT OF THE SOUTH Balanced Snow Load Exposure Category: B Exposure Category: B C = 1.2 I = 1.0 C t = 1.0 p = 30 psf C t = 1.0 $p_f = 0.7 \cdot C_e \cdot C_t \cdot I_s \cdot p_g = 25.2 \, psf$ fully exposed roof would be considered partially exposed with the addition of solar panels. C = 1.0 Obstructed & monoslope roof $p_s = C_s p_f = 25.2 psf$ $\gamma := 0.13 \cdot \frac{1}{ft} \cdot p_{g} + 14 \frac{lbf}{ft^{3}} = 17.9 \frac{lbf}{ft^{3}}$ $h_{b} = \frac{p_{s}}{v} = 16.894 in$ $h_{c} = h_{p2} - h_{b} = 18.944 in$ $h_{exposed} = h_{p2} - h_{b} = 18.944 in$ Amount of panel exposed above balanced snow load depth. If positive, sliding snow surcharge from the solar panels must be considered. Sliding Snow Load THE SLIDING SNOW LOAD PATTERN CHANGES BUT AS BEFORE, IT WILL NOT CONTROL. (TYPICAL) Consider only if panels are exposed above balanced snow depth. $w_{c} = \frac{\begin{pmatrix} -1 \\ horiz \end{pmatrix} \cdot \begin{pmatrix} h_{b} - h_{p1} \end{pmatrix}}{\begin{pmatrix} h_{p2} - h_{p1} \end{pmatrix}} + 1_{horiz} = 52.049 in$ Width of sliding snow surcharge w_c panel horiz w_c = 7.951 *in* Horizontal projection of panel covered by sliding snow $w_{aisle} = w_{c} - w_{c} = 44.098 in$ Width of aisle covered by sliding snow Note: For a open-back tilted panel, the slding snow can slide under the panel itself. For a closed-back panel, the sliding snow stops at the panel back. 18" of the surcharge is under the adjacent panel. p_f+p_s=50.4 psf Balanced snow load in aisle plus sliding surcharge (use balanced snow load only for portion of aisle not covered by sliding snow)

Drift Load

Check requirements to avoid calculating drift patterns. $check_1a = if h_{p2} < 1.2 \cdot h_b$ = "DRIFT REQ'D, CHECK LOW-SIDE" "DRIFT NOT REQ'D, CHECK 2ND CONDITION" else "DRIFT REQ'D, CHECK LOW-SIDE" = "DRIFT REQ'D" check_1b=if h_{p1}<h_b "DRIFT REQ'D" else "CHECK 2ND CONDITION" $check_2 := if h_{p1} < 2 ft + 2 h_b = "DRIFT REQ'D"$ "DRIFT REO'D" else "DRIFT NOT REO'D" Check if closely spaced. check_close=if l_aisle > 8 h_c = "YES" "NO else "YES" NEW SNOW DRIFT PATTERN FOR Wind out of the south DRIFT AREA 1 CONTROLLING LOAD $l_{u \text{ south}} = 1_{\text{south}} \cdot \frac{1}{ft} = 57.25$ $l_{u_south} = l_{south} \cdot \frac{1}{ft} = 57.25$ CASE $h_{d} = \left[0.43 \cdot l_{u_south} \cdot \left[p_g \cdot \frac{1}{psf} + 10 \right]^{\frac{1}{4}} - 1.5 \right] ft = 32.014 in$ Leeward drift depth $A_{d_{expected}} = 2 \cdot h_{d}^{2} = 2049.767 in^{2}$ $h_{dw} = 0.75 \cdot h_{d} = 24.01 in$ Windward drift depth per ASCE7 $h_{s} = 0.707 \cdot h_{dw} = 16.975 in$ h := if h > h = 16.975 in Windward drift for wind blowing at low-side of panel s design s c h else h P______i=h____Y=25.322*psf* Drift surcharge for wind blowing at low-side of panel d_windward s_design l drift_windard = if 4 h s_design horiz = 5 ft Horizontal extent for wind blowing at low-side of panel (multiply by 2) l horiz else 4 ∙ h s design $h_{u} = \frac{A_{d} \text{ expected}}{l_{aisle}} = 48.804 \text{ in}$





Title Block Selection.							Drintod, 22 MOV 2017, 11,20 MM
General Ream /	nalveis				File = S:\Projec	ts\2017PR~1\179604~1\01_CA	L~1\88_ENE~1\JOISTC~1.EC6
	anary 515			_	Licon	ENERCALC, INC. 1983-2017,	Build:10.17.9.25, Ver:10.17.9.25
Description Area 1 (s	south side)					see . MP-Squared St	ructural Engineers, EL
Trying 14	I" low-side					IG LOAD CASE	
General Beam Property	ies		S Drift+Inte	r-row+SL	-+DL		
Elastic Modulus	29,000.0 ksi						
Span #1	Span Length =	40.0 ft	Area =	10.0	0 in^2	Moment of Inertia =	100.0 in^4
				D(0.024)			
	v	*		v (0.442)		<u>S(0.113)</u>	<u>S(0.113)</u> ^v
	S(0.1012	<u>S(0.113)</u>	**	(0.113) * * *			
\$(0,0)		vv	D(0.051) S(0.1	008)		\$	
×							×
<u> </u>							— Č
_			Span = 40.0	ft			_
•							-
Applied Loads				Service le	oads entere	d. Load Factors will be	e applied for calculations
Uniform Load : D	= 0.0510, S = 0.1008	k/ft, Tributary Widt	h = 1.0 ft, (Unifori	n DL & SL)			
Varying Uniform L	pad : S(S,E) = 0.0->0	.1012 k/ft, Extent =	1.833>> 6.833	ft, Trib Width	h = 1.0 ft, (S-I	Drift)	
Uniform Load : S	= 0.1130 k/ft. Extent =	->0.0 K/II, EXTERIT =	ft. Tributary Wic	th = 1.0 ft. (I	inter-Row)	-Dhity	
Uniform Load : S	= 0.1130 k/ft, Extent =	20.333>> 23.833	ft, Tributary Wic	th = 1.0 ft, (1)	nter-Row)		
Uniform Load : S	= 0.1130 k/ft, Extent =	28.833>> 32.333	ft, Tributary Wic	th = 1.0 ft, (I)	nter-Row)		
Uniform Load : S	= 0.1130 K/II, EXTENT = - 0.0240 k/ft Extent -	37.333>> 40.0 ft	, Tributary Width Tributary Width -	= 1.0 It, (Int∈ - 1.0 ft (PV F	er-ROW) Panel)		
	- 0.0240 km, Extern -	0.000 >> 40.0 m,		· 1.0 II, (I V I	uncij		
Maximum Bending =		44 91	6 k-ft Maxi	mum Shea	ar =		4.535 k
Load Combination	-	+D+S+	H	Load Con	nbination		+D+S+H
Location of maximum	on span	20.40	DOft	Location	of maximum of	on span	40.000 ft
Span # where maximu	Im occurs	Span #	1	Span # w	here maximu	m occurs	Span # 1
Maximum Deflection	1			· ·			
Max Downward Tran	sient Deflection	3.02	9 in	158	BOTH S	SHEAR AND M	IOMENT ARE

Max Downward Total Deflection	4.498 in
Max Upward Total Deflection	0.014 in

Max Upward Transient Deflection

Maximum Forces & Sti	resses f	or Load C	ombinati	ions									
Load Combination		Max Stress	s Ratios			Summary of Mo	oment Valu	Jes			Summa	ry of Sh	near Values
Segment Length	Span #	М	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
Overall MAXimum Envelope													
Dsgn. L = 40.00 ft	1			44.92		44.92					4.53		
D Only													
Dsgn. L = 40.00 ft	1			14.72		14.72					1.49		
+D+L+H													
Dsgn. L = 40.00 ft	1			14.72		14.72					1.49		
+D+Lr+H													
Dsgn. L = 40.00 ft	1			14.72		14.72					1.49		
+D+S+H													
Dsgn. L = 40.00 ft	1			44.92		44.92					4.53		
+D+0.750Lr+0.750L+H													
Dsgn. L = 40.00 ft	1			14.72		14.72					1.49		
+D+0.750L+0.750S+H													
Dsgn. L = 40.00 ft	1			37.37		37.37					3.77		
+D+W+H													
Dsgn. L = 40.00 ft	1			14.72		14.72					1.49		
+D+0.70E+H													
Dsgn. L = 40.00 ft	1			14.72		14.72					1.49		
+D+0.750Lr+0.750L+0.750W+H	ł												
Dsgn. L = 40.00 ft	1			14.72		14.72					1.49		
+D+0.750L+0.750S+0.750W+H													
Dsgn. L = 40.00 ft	1			37.37		37.37					3.77		
+D+0.750Lr+0.750L+0.5250E+I	-												
Dsgn. L = 40.00 ft	1			14.72		14.72					1.49		
+D+0.750L+0.750S+0.5250E+H	1												
Dsgn. L = 40.00 ft	1			37.37		37.37					3.77 g	7 of 11	9
+0.60D+W+H													

9932

106 34647 WITHIN THE 5% THRESHOLD. OK!

0.048 in

Title Block Line 6									Printec	: 22 NOV 2	017, 11:38AM
General Beam Ana	alvsis					File = S	:\Projects\2017PR~1\17	79604~1\01_	CAL~1\88_E	NE~1\JOIS	TC~1.EC6
Lic # : KW-06006621	aryono -	_	_	_	_		ENERCALC, IN	IC. 1983-20 guared	17, Build:10.1. Structura	7.9.25, Ver	:10.17.9.25
Description : Area 1 (south	side)					-		quareu	onuclura	r Engin	
Trving 14" low	/-side										
Load Combination	Max Stre	ss Ratios			Summary of Mo	oment Valu	ues		Summ	ary of Sh	ear Values
Segment Length Spar	n# M	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega Cb	Rm	Va Max	Vnx	Vnx/Omega
Dsgn. L = 40.00 ft 1			8.83		8.83				0.89		
+0.60D+0.70E+H											
Dsgn. L = 40.00 ft 1			8.83		8.83				0.89		
Overall Maximum Deflecti	ons										
Load Combination	Span	Max. "-" Defl	Location i	n Span	Load Comb	pination		Max.	"+" Defl	Locatio	n in Span
+D+S+H	1	4.4978	20	.000					0.0000		0.000
Vertical Reactions				Suppor	t notation : Far l	eft is #1		Values in	KIPS		
Load Combination	Support 1	Support 2									
Overall MAXimum	4.327	4.535									
Overall MINimum	0.810	0.892									
D Only	1.350	1.486									
+D+L+H	1.350	1.486									
+D+Lr+H	1.350	1.486									
+D+S+H	4.327	4.535									
+D+0.750Lr+0.750L+H	1.350	1.486									
+D+0.750L+0.750S+H	3.583	3.773									
+D+W+H	1.350	1.486									
+D+0.70E+H	1.350	1.486									
+D+0.750Lr+0.750L+0.750W+H	1.350	1.486									
+D+0.750L+0.750S+0.750W+H	3.583	3.773									
+D+0.750Lr+0.750L+0.5250E+H	ł 1.350	1.486									
+D+0.750L+0.750S+0.5250E+H	3.583	3.773									
+0.60D+W+H	0.810	0.892									
+0.60D+0.70E+H	0.810	0.892									
D Only	1.350	1.486									
Lr Only											
L Only											
S Only	2.977	3.049									
W Only											
E Only											
H Only											

Title Block Line 6					Pr	inted: 22 NOV 2017, 11:48AM
General Be	am Analysis			File = S:\Pro	ects\2017PR~1\179604~1\01_CAL~1\88	ENE~1\JOISTC~1.EC6
Lic. # : KW-0600	06621			Lice	nsee : MP-Squared Structu	Iral Engineers, LLC
Description :	Area 1&3 (north-side) Trying 14" low-side depth					
General Beam	Properties			-IUW+SL+DL		
Elastic Modulus Span #1	29,000.0 ksi Span Length =	40.0 ft	Area =	10.0 in^2	Moment of Inertia =	100.0 in^4
S(0.113)	÷	D(0.024)	<u>S(0.113)</u> ★ ★ ★ ★ ★	\$ \$	S(0.113,0)	
× × × ×	∕ <u>S(0.113)</u>		D(0.051) S(0.1008) ∜		Ŷ	×
						×
 •			Span = 40.0 ft			
Applied Loads			Ser	vice loads enter	ed. Load Factors will be app	lied for calculations.
Uniform L	.oad : D = 0.0510, S = 0.1008	k/ft, Tributary Widtl	h = 1.0 ft, (Uniform DL &	sL)		

Uniform Load : S = 0.1130 k/ft, Extent = $8.333 \rightarrow 1.833$ ft, Tributary Width = 1.0 ft, (Inter-row) Uniform Load : S = 0.1130 k/ft, Extent = $0.0 \rightarrow 3.333$ ft, Tributary Width = 1.0 ft, (Inter-row) Uniform Load : S = 0.1130 k/ft, Extent = 16.833 -->> 20.333 ft, Tributary Width = 1.0 ft, (Inter-row) Varying Uniform Load : S(S,E) = 0.1130->0.0 k/ft, Extent = 25.333 -->> 34.995 ft, Trib Width = 1.0 ft, (N-Drift)

Uniform Load : D = 0.0240 k/ft, Extent = 0.0 -->> 25.333 ft, Tributary Width = 1.0 ft, (PV Panel)

DESIGN SUMMARY

Maximum Bending =	43.020 k-ft	Maximum She	ear =	4.476 k	
Load Combination	+D+S+H	Load Co	ombination	+D+S+H	
Location of maximum on span	19.400ft	Location	n of maximum on span	0.000 ft	
Span # where maximum occurs	Span # 1	Span # v	where maximum occurs	Span # 1	
Maximum Deflection					
Max Downward Transient Deflection	2.917 in	164			
Max Upward Transient Deflection	0.046 in	10351	DUTH SHEAK AND		
Max Downward Total Deflection	4.278 in	112	WITHIN THE 5% THRESHOLD.		
Max Upward Total Deflection	0.013 in	36996			

Maximum Forces & Str	esses	for Load Co	ombinat	ions									
Load Combination Max Stress Ratios				Summary of Moment Values						Summary of Shear Values			
Segment Length	Span #	М	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omeg	a Cb	Rm	Va Max	Vnx	Vnx/Omega
Overall MAXimum Envelope													
Dsgn. L = 40.00 ft	1			43.02		43.02					4.48		
D Only													
Dsgn. L = 40.00 ft	1			13.74		13.74					1.44		
+D+L+H													
Dsgn. L = 40.00 ft	1			13.74		13.74					1.44		
+D+Lr+H													
Dsgn. L = 40.00 ft	1			13.74		13.74					1.44		
+D+S+H													
Dsgn. L = 40.00 ft	1			43.02		43.02					4.48		
+D+0.750Lr+0.750L+H													
Dsgn. L = 40.00 ft	1			13.74		13.74					1.44		
+D+0.750L+0.750S+H													
Dsgn. L = 40.00 ft	1			35.70		35.70					3.72		
+D+W+H													
Dsgn. L = 40.00 ft	1			13.74		13.74					1.44		
+D+0.70E+H													
Dsgn. L = 40.00 ft	1			13.74		13.74					1.44		
+D+0.750Lr+0.750L+0.750W+H													
Dsgn. L = 40.00 ft	1			13.74		13.74					1.44		
+D+0.750L+0.750S+0.750W+H													
Dsgn. L = 40.00 ft	1			35.70		35.70					3.72		
+D+0.750Lr+0.750L+0.5250E+H	1												
Dsgn. L = 40.00 ft	1			13.74		13.74					1.44		
+D+0.750L+0.750S+0.5250E+H													
Dsgn. L = 40.00 ft	1			35.70		35.70					3.72		
+0.60D+W+H													
Dsgn. L = 40.00 ft	1			8.24		8.24					0.86	0 of 11	0
+0.60D+0.70E+H											9	9011	9
Dsgn. L = 40.00 ft	1			8.24		8.24					0.86		

Printed: 22 NOV 2017, 11:48AM File = S:\Projects\2017PR-1\179604-1\01_CAL-1\88_ENE-1\JOISTC-1.EC6 ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Licensee : MP-Squared Structural Engineers, LLC

General Beam Analysis

Lic. # : KW-06006621

Description : Area 1&3 (north-side) Trying 14" low-side depth

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	4.2780	20.000		0.0000	0.000
Vertical Reactions			Support notation : Far left is #1		Values in KIPS	
Load Combination	Support 1	Support 2				
Overall MAXimum	4.476	3.917				
Overall MINimum	0.861	0.728				
D Only	1.435	1.213				
+D+L+H	1.435	1.213				
+D+Lr+H	1.435	1.213				
+D+S+H	4.476	3.917				
+D+0.750Lr+0.750L+H	1.435	1.213				
+D+0.750L+0.750S+H	3.716	3.241				
+D+W+H	1.435	1.213				
+D+0.70E+H	1.435	1.213				
+D+0.750Lr+0.750L+0.750W+H	1.435	1.213				
+D+0.750L+0.750S+0.750W+H	3.716	3.241				
+D+0.750Lr+0.750L+0.5250E+H	1.435	1.213				
+D+0.750L+0.750S+0.5250E+H	3.716	3.241				
+0.60D+W+H	0.861	0.728				
+0.60D+0.70E+H	0.861	0.728				
D Only	1.435	1.213				
Lr Only						
L Only						
S Only	3.041	2.705				
W Only						
E Only						
H Only						

22 Nov 2017 11:54:56 - Solar Panel Sliding Snow & Closely Spaced Drift (14in low-side, Drift Area 2, A).sm

Snow Load Pattern for Elevated, Tilted-Open Solar Panel Array

Snow Load Pattern for Elev	rated, Tilted-	Open Solar Panel Array					
h _{p1} :=14 <i>in</i> Low side dimension		THIS SHEET ASSUMES THE LOW SIDE OF THE PANEL(S) FACES SOUTH. SWAP					
l:= 60 <i>in</i> Length of horizor	tal projection	DIRECTIONS IN THE HEADINGS, IF DIFFERENT					
θ= 20 <i>deg</i> Angle of tilt							
$l_{p} = \left(\frac{l_{horiz}}{\cos(\theta)}\right) = 63.851 in \text{ Length}$	of panel						
$h_{p2} = h_{p1} + l_{p} \sin(\theta) = 35.838 in$	High side dimens	ion					
l := 42 in Width of aisle b	etween rows						
Drift Fetch Distances:	for using OT						
north	for wind our of	THE NORTH					
l := 63 ft Upwind fetch for wind OUT OF THE SOUTH							
Balanced Snow Load							
Exposure Category: B							
C_= 1.2 I_= 1.0	for Ct, ignore and from a solar panel	ny thermal contribution el array. For Ce, the presence					
$C_t = 1.0$ $p_g = 30 psf$	of solar panels bumps the roof exposure into a more severe state. For example, an otherwise fully exposed roof would be considered partially exposed with the addition of solar panels.						
$p_f = 0.7 \cdot C_e \cdot C_t \cdot I_s \cdot p_g = 25.2 psf$							
C ∷= 1.0 Obstructed & monosl	ope roof						
$p_{s} = C_{s} \cdot p_{f} = 25.2 psf$							
$Y = 0.13 \cdot \frac{1}{ft} \cdot p_{g} + 14 \frac{lbf}{ft^{3}} = 17.9 \frac{lbf}{ft^{3}}$							
$h_{b} = \frac{p_{s}}{\gamma} = 16.894 in$ $h_{c} = h_{p2} - h_{b}$	= 18.944 in						
<pre>h = h - h = 18.944 in exposed p2 b Amount of panel exposed above balanced snow load depth. If positive, sliding snow surcharge from the solar panels must be considered.</pre>							
Sliding Snow Load							
Consider only if panels are exp	osed above balan	ced snow depth.					
$w_{c} := \frac{(-l_{horiz}) \cdot (h_{b} - h_{p1})}{(h_{p2} - h_{p1})} + l_{horiz} = 5$	52.049 <i>in</i> Width	of sliding snow surcharge					
<pre>wc_panel = l horiz wc = 7.951 in</pre>	Horizontal proj	ection of panel covered by sliding snow					
waisle c wc_panel 44.098 in	Width of aisle of	covered by sliding snow					
	Note: For a open-back can slide under panel, the slid the surcharge i	tilted panel, the slding snow the panel itself. For a closed-back ing snow stops at the panel back. 18" of s under the adjacent panel.					
$p_+p_=50.4 psf$ Balanced snow	load in aisle p	lus sliding surcharge					

p_f+p_s=50.4 psf Balanced snow load in aisle plus sliding surcharge
 (use balanced snow load only for portion of aisle
 not covered by sliding snow)

Drift Load

```
Check requirements to avoid calculating drift patterns.
check_1a = if h_{p2} < 1.2 \cdot h_b
                                                           = "DRIFT REQ'D, CHECK LOW-SIDE"
              "DRIFT NOT REQ'D, CHECK 2ND CONDITION"
            else
              "DRIFT REQ'D, CHECK LOW-SIDE"
check_1b=if h<sub>p1</sub><h<sub>b</sub>
                                       = "DRIFT REO'D"
              "DRIFT REQ'D"
            else
              "CHECK 2ND CONDITION"
check_2 := if h_{p1} < 2 ft + 2 h_b = "DRIFT REQ'D"
             "DRIFT REO'D"
           else
             "DRIFT NOT REO'D"
Check if closely spaced.
check_close=if l aisle > 8 h c = "YES"
                  "NO
                else
                  "YES"
Wind out of the south
l_{u_south} = l_{south} \cdot \frac{1}{ft} = 63
h_{d} \coloneqq \left[ 0.43 \cdot l_{u_{south}} \cdot \left( p_{g} \cdot \frac{1}{p_{sf}} + 10 \right)^{\frac{1}{4}} - 1.5 \right] ft = 33.635 in \text{ Leeward drift depth}
A_{d_{expected}} = 2 \cdot h_d^2 = 2262.638 in^2
h_{dw} = 0.75 \cdot h_{d} = 25.226 in Windward drift depth per ASCE7
h_{s} = 0.707 \cdot h_{dw} = 17.835 in
h := if h > h = 17.835 in Windward drift for wind blowing at low-side of panel s design s c
               h
             else
               h
l ______ = if 4 h ______ > l _____ = 5 ft Horizontal extent for wind blowing at low-side of panel (multiply by
                                                           at low-side of panel (multiply by 2)
                     l
horiz
                   else
                      4 ⋅ h
s design
A_{d_SW} = 0.5 \cdot h_{s_{design}} (2 \cdot l_{drift_{windar}}) = 1070.1 in^2 Drift area at low-side of panel
h_{u} = \frac{A_{d} \text{ expected}}{l_{aisle}} = 53.872 \text{ in}
```



Pd_leeward u_design γ=28.259*psf* Inter-row surcharge $n_{rows} = \frac{6 \cdot h_d^2 - A_{d_NW}}{h_{u_design}^1 \text{ aisle}}$ 5.983 Extent of inter-row surcharge (round up) ASSUME 6 ROWS ARE FILLED BY INTER-ROW SURCHARGE ONLY 3 ROWS ARE AVAILABE. THEREFORE, CALCULATE LEEWARD DRIFT.

22 Nov 2017 12:03:02 - Drift Area 2 (14in low-side, A) Leeward Drifts.sm




Title Block Line 6					Pi	rinted: 22 NOV 2017, 12:09PM			
General Bea	am Analysis		File = S:\Projects\2017PR-1\179604~1\01_CAL~1\88_ENE~1\JOISTC-1.EC6 ENERCALC_INC_1983-2017_Ruild:10.17.9.25_Ver:10.17.9.25						
Lic. # : KW-06006	621			Lic	ensee : MP-Squared Structu	ural Engineers, LLC			
Description :	Drift Area 2 (A1) Trying 14" low-side		DRIFT AREA 2 (A1) CONTROLLING LOAD CASE						
General Beam F	Properties		Leeward 5 D	mt+mter-row4	-3L+DL				
Elastic Modulus	29,000.0 ksi								
Span #1	Span Length =	40.0 ft	Area =	10.0 in^2	Moment of Inertia =	100.0 in^4			
		D(0.024)							
<u> </u>	∜ S(0.113)	¢	\$	\$					
	\diamond \diamond \diamond \diamond	\$	S(0.113)	\	<u>S(</u> 0.113,0)				
×	¢		D(0.051) S(0.1008	/ +		×			
Č –						Č I			
			Span = 40.0 ft						
-									
Applied Loads			S	ervice loads ente	red. Load Factors will be app	lied for calculations.			
Uniform Lo	ad : D = 0.0510, S = 0.1008	3 k/ft, Tributary Width	= 1.0 ft, (Uniform DL	& SL)					
Varying Un	iform Load : $S(S,E) = 0.113$	0->0.0 k/ft, Extent = 2	5.250>> 37.879 ft,	Trib Width = 1.0 f	t, (Leeward S-drift)				
Uniform Lo	ad : S = 0.1130 k/tt, Extent :	= 16./50>> 20.250 f	t, Tributary Width =	1.0 ft, (Inter-row)					
Uniform Lo	au : S = 0.1130 K/II, EXIENT : ad : S = 0.1130 k/ft Extent :	= 0.200>> 11.750 II, = 0.0>> 3.250 ft Tri	inductory Width = $1 \cap ft$	(Inter-row)					

 $\begin{array}{l} \mbox{Uniform Load}: S = 0.1130 \mbox{ k/ft, Extent} = 0.0 \dashrightarrow 3.250 \mbox{ ft, Tributary Width} = 1.0 \mbox{ ft, (Inter-row)} \\ \mbox{Uniform Load}: D = 0.0240 \mbox{ k/ft, Extent} = 0.0 \dashrightarrow 25.250 \mbox{ ft, Tributary Width} = 1.0 \mbox{ ft, (Solar Panels)} \\ \end{array}$

DESIGN SUMMARY

Maximum Bending -	13 581 k-ft	Maximum She	por -	150 k
	43.301 K-IL			4.50 K
Load Combination	+D+S+H	Load Co	ombination	+D+S+H
Location of maximum on span	19.400ft	Location	n of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span #	where maximum occurs	Span # 1
Maximum Deflection				
Max Downward Transient Deflection	2.984 in	160	BOTH SHEAR AND	MOMENT ARE
Max Upward Transient Deflection	0.047 in	10154		
Max Downward Total Deflection	4.344 in	110	WITHIN THE 5% TH	RESHOLD. OK!
Max Upward Total Deflection	0.013 in	37034		

Maximum Forces & Str	esses fo	or Load Co	mbinatio	ons									
Load Combination		Max Stress	Ratios		0	Summary of Mo	ment Valu	ies			Summa	ry of Sh	ear Values
Segment Length S	pan #	М	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omeg	a Cb	Rm	Va Max	Vnx	Vnx/Omega
Overall MAXimum Envelope													
Dsgn. L = 40.00 ft	1			43.58		43.58					4.50		
D Only													
Dsgn. L = 40.00 ft	1			13.72		13.72					1.43		
+D+L+H													
Dsgn. L = 40.00 ft	1			13.72		13.72					1.43		
+D+Lr+H													
Dsgn. L = 40.00 ft	1			13.72		13.72					1.43		
+D+S+H													
Dsgn. L = 40.00 ft	1			43.58		43.58					4.50		
+D+0.750Lr+0.750L+H													
Dsgn. L = 40.00 ft	1			13.72		13.72					1.43		
+D+0.750L+0.750S+H													
Dsgn. L = 40.00 ft	1			36.12		36.12					3.73		
+D+W+H													
Dsgn. L = 40.00 ft	1			13.72		13.72					1.43		
+D+0.70E+H				40 70		10 70							
Dsgn. L = 40.00 ft	1			13.72		13.72					1.43		
+D+0./50Lr+0./50L+0./50W+H				40.70		40.70					4.40		
Dsgn. L = 40.00 ft	1			13.72		13.72					1.43		
+D+0./50L+0./50S+0./50W+H	1			27.12		27.12					0.70		
$DSgn. L = 40.00 \pi$	1			36.12		36.12					3.73		
+D+0.750L1+0.750L+0.5250E+F	1			10 70		10 70					1 40		
DSgn. L = 40.00 II	I			13.72		13.72					1.43		
+D+0.750L+0.750S+0.5250E+H	1			26 12		26.12					2 7 2		
DSgII. L = 40.00 II	I			30.1Z		30.12					3.73		
+0.00D+W+H	1			0.00		0.00					0.94		
	I			0.23		0.23					0.0010	7 of 11	9
-0.002+0.702+11 Deap L = 40.00 ft	1			8 23		8 23					0.86		
D_{3} Syn. L = 40.00 II	1			0.25		0.25					0.00		

Printed: 22 NOV 2017, 12:09PM File = S:\Projects\2017PR-1\179604~1\01_CAL-1\88_ENE~1\JOISTC-1.EC6 ENERCALC, INC. 1983-2017, Build:10.17.9.25, Ver:10.17.9.25 Licensee : MP-Squared Structural Engineers, LLC

General Beam Analysis

Lic. # : KW-06006621

Description : Drift Area 2 (A1) Trying 14" low-side

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	4.3436	20.000		0.0000	0.000
Vertical Reactions			Support	notation : Far left is #1	Values in KIPS	
Load Combination	Support 1	Support 2				
Overall MAXimum	4.500	4.049				
Overall MINimum	0.861	0.727				
D Only	1.435	1.211				
+D+L+H	1.435	1.211				
+D+Lr+H	1.435	1.211				
+D+S+H	4.500	4.049				
+D+0.750Lr+0.750L+H	1.435	1.211				
+D+0.750L+0.750S+H	3.734	3.340				
+D+W+H	1.435	1.211				
+D+0.70E+H	1.435	1.211				
+D+0.750Lr+0.750L+0.750W+H	1.435	1.211				
+D+0.750L+0.750S+0.750W+H	3.734	3.340				
+D+0.750Lr+0.750L+0.5250E+H	1.435	1.211				
+D+0.750L+0.750S+0.5250E+H	3.734	3.340				
+0.60D+W+H	0.861	0.727				
+0.60D+0.70E+H	0.861	0.727				
D Only	1.435	1.211				
Lr Only						
L Only						
S Only	3.066	2.838				
W Only						
E Only						
H Only						

Snow Load Pattern for Elevated, Tilted-Open Solar Panel Array

THIS SHEET ASSUMES THE LOW SIDE h_{p1}:= 14 *in* Low side dimension OF THE PANEL(S) FACES SOUTH. SWAP 1 horiz = 60 in Length of horizontal projection DIRECTIONS IN THE HEADINGS, IF DIFFERENT $\theta \coloneqq 20 \ deg$ Angle of tilt $l_{p} = \left(\frac{l_{horiz}}{\cos(\theta)}\right) = 63.851 in$ Length of panel $h_{n2} = h_{n1} + l_n \sin(\theta) = 35.838 in$ High side dimension laisle = 42 in Width of aisle between rows Drift Fetch Distances: 1 := 131.25 ft Upwind fetch for wind OUT OF THE NORTH 1 south = 21.25 ft Upwind fetch for wind OUT OF THE SOUTH Balanced Snow Load Exposure Category: B Exposure Category: B C = 1.2 I = 1.0 C t = 1.0 p = 30 psf C t = 1.0 $p_f = 0.7 \cdot C_e \cdot C_t \cdot I_s \cdot p_g = 25.2 \, psf$ fully exposed roof would be considered partially exposed with the addition of solar panels. C = 1.0 Obstructed & monoslope roof $p_s = C_s p_f = 25.2 psf$ $\gamma := 0.13 \cdot \frac{1}{ft} \cdot p_{g} + 14 \frac{lbf}{ft^{3}} = 17.9 \frac{lbf}{ft^{3}}$ $h_{b} = \frac{p_{s}}{v} = 16.894 in$ $h_{c} = h_{p2} - h_{b} = 18.944 in$ $h_{exposed} = h_p - h_b = 18.944 in$ Amount of panel exposed above balanced snow load depth. If positive, sliding snow surcharge from the solar panels must be considered. Sliding Snow Load Consider only if panels are exposed above balanced snow depth. $W_{c} \coloneqq \frac{\left(-\frac{1}{boriz}\right) \cdot \left(\frac{h_{b} - h_{p1}}{b}\right)}{\left(\frac{h_{c} - h_{p1}}{b}\right)} + \frac{1}{boriz} = 52.049 in$ Width of sliding snow surcharge w_c panel horiz w_c = 7.951 *in* Horizontal projection of panel covered by sliding snow $w_{aisle} = w_{c} - w_{c} = 44.098 in$ Width of aisle covered by sliding snow Note: For a open-back tilted panel, the slding snow can slide under the panel itself. For a closed-back panel, the sliding snow stops at the panel back. 18" of the surcharge is under the adjacent panel. p_f+p_s=50.4 psf Balanced snow load in aisle plus sliding surcharge (use balanced snow load only for portion of aisle not covered by sliding snow)

Drift Load

Check requirements to avoid calculating drift patterns. $check_1a = if h_{p2} < 1.2 \cdot h_b$ = "DRIFT REQ'D, CHECK LOW-SIDE" "DRIFT NOT REQ'D, CHECK 2ND CONDITION" else "DRIFT REQ'D, CHECK LOW-SIDE" = "DRIFT REO'D" check_1b=if h_{p1}<h_b "DRIFT REQ'D" else "CHECK 2ND CONDITION" $check_2 := if h_{p1} < 2 ft + 2 h_b = "DRIFT REQ'D"$ "DRIFT REO'D" else "DRIFT NOT REO'D" Check if closely spaced. check_close=if l_aisle > 8 h_c = "YES" "NO else "YES" Wind out of the south $l_{u_south} = l_{south} \cdot \frac{1}{ft} = 21.25$ $h_{d} \coloneqq \left[0.43 \cdot l_{u_{south}} + \frac{1}{3} \cdot \left(p_{g} \cdot \frac{1}{p_{sf}} + 10 \right)^{\frac{1}{4}} - 1.5 \right] ft = 17.943 in \text{ Leeward drift depth}$ $A_{d_{expected}} = 2 \cdot h_{d}^{2} = 643.922 in^{2}$ $h_{dw} = 0.75 \cdot h_{d} = 13.457 in$ Windward drift depth per ASCE7 $h_{s} = 0.707 \cdot h_{dw} = 9.514 in$ h := if h > h = 9.514 in Windward drift for wind blowing at low-side of panel
s_design s c h else h l ______ = if 4 h ______ > l _____ = 3.171 ft Horizontal extent for wind blowing at low-side of panel (multiply by at low-side of panel (multiply by 2) l horiz else 4 ⋅ h s design $h_{u} = \frac{A_{dexpected}}{l_{aisle}} = 15.331 in$





22 Nov 2017 12:41:51 - Drift Area 4 (14in low-side) Leeward Drifts.sm





Title Block Line 6					Printed: 22 NOV 2017, 12:44PM
General Beam Analysis			File = S:\Pro	jects\2017PR~1\179604~1\01_CAL~1 ENERCALC_INC_1983-2017_Buil	\88_ENE~1\JOISTC~1.EC6 d·10 17 9 25 Ver·10 17 9 25
Lic. # : KW-06006621			Lice	nsee : MP-Squared Struc	tural Engineers, LLC
Description : Trying 14" low-side N Drift+Inter-Row+SL+DL			4 CONTROL	LING LOAD CASE	
General Beam Properties			EK-KUW+3	L+DL	
Elastic Modulus29,000.0 ksiSpan #1Span Length =	40.0 ft	Area =	10.0 in^2	Moment of Inertia =	100.0 in^4
$\underbrace{S(0,0.113)}_{\forall} \underbrace{S(0,0.113,0)}_{\forall} S(0,$	<u>S(0.113)</u> [★] D(0 [★] D	.024) (0.051) <u>Ş(0.1008</u>)	3) ☆ ↔ ☆		013) * · · · ·
×		V		V	×
		Span = 40.0 ft			
•		opan = 40.0 h			
Applied Loads		Se	rvice loads enter	red. Load Factors will be ap	oplied for calculations.
Uniform Load : $D = 0.0510$, $S = 0.1008$ k/f Uniform Load : $D = 0.0240$ k/ft, Extent = 6. Varying Uniform Load : $S(S,E) = 0.1130$ -> Uniform Load : $S = 0.1130$ k/ft, Extent = 11 Uniform Load : $S = 0.1130$ k/ft, Extent = 20 Varying Uniform Load : $S(S,E) = 0.0$ ->0.11 Varying Uniform Load : $S(S,E) = 0.0$ ->0.11	ft, Tributary Width = 833>> 28.833 ft, T 0.0130 k/ft, Extent = 1.833>> 15.333 ft, 0.333>> 23.833 ft, 30 k/ft, Extent = 1.83 0.0 k/ft, Extent = 6.83	1.0 ft, (Uniform DL Tributary Width = 1. 28.833>> 40.0 ft, Tributary Width = Tributary Width = 33>> 6.833 ft, Tr 33>> 11.833 ft, T	& SL) 0 ft, (P.V. Panels) Trib Width = 1.0 1.0 ft, (Inter-row) 1.0 ft, (Inter-row) b Width = 1.0 ft, (I rib Width = 1.0 ft,	ft, (N-drift) LEEWARD N-DRIFT) (LEEWARD N-drift)	
DESIGN SUMMARY					
Maximum Bending =	44.781 k	-ft Maximum	Shear =		4.360 k
Load Combination	+D+S+H	Lc	ad Combination		+D+S+H
Location of maximum on span	20.200ft	Lo	cation of maximur	n on span	0.000 ft
Span # where maximum occurs	Span # 1	Sp	an # where maxin	num occurs	Span # 1
Maximum Deflection Max Downward Transient Deflection Max Upward Transient Deflection Max Downward Total Deflection Max Upward Total Deflection	3.102 ir 0.049 ir 4.485 ir 0.013 ir	1 1 96 1 1 1 365	BOTH BOTH WITHI	SHEAR AND MO N THE 5% THRE	MENT ARE SHOLD. OK!
Maximum Forces & Stresses for Load Com	nbinations				

Load Combination		Max Stress	s Ratios	Summary of Moment Values					Summary of Shear Values				
Segment Length	Span #	М	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
Overall MAXimum Envelope													
Dsgn. L = 40.00 ft	1			44.78		44.78					4.36		
D Only													
Dsgn. L = 40.00 ft	1			13.98		13.98					1.31		
+D+L+H													
Dsgn. L = 40.00 ft	1			13.98		13.98					1.31		
+D+Lr+H													
Dsgn. L = 40.00 ft	1			13.98		13.98					1.31		
+D+S+H													
Dsgn. L = 40.00 ft	1			44.78		44.78					4.36		
+D+0.750Lr+0.750L+H													
Dsgn. L = 40.00 ft	1			13.98		13.98					1.31		
+D+0.750L+0.750S+H													
Dsgn. L = 40.00 ft	1			37.08		37.08					3.60		
+D+W+H													
Dsgn. L = 40.00 ft	1			13.98		13.98					1.31		
+D+0.70E+H													
Dsgn. L = 40.00 ft	1			13.98		13.98					1.31		
+D+0.750Lr+0.750L+0.750W+H													
Dsgn. L = 40.00 ft	1			13.98		13.98					1.31		
+D+0.750L+0.750S+0.750W+H													
Dsgn. L = 40.00 ft	1			37.08		37.08					3.60		
+D+0.750Lr+0.750L+0.5250E+I	4												
Dsgn. L = 40.00 ft	1			13.98		13.98					1.31		
+D+0.750L+0.750S+0.5250E+H													
Dsgn. L = 40.00 ft	1			37.08		37.08					3.60		
+0.60D+W+H											11	5 of 11	9
Dsgn. L = 40.00 ft	1			8.39		8.39					0.79		-

THE DIUCK LINE U										Printeo	: 22 NOV 20	017, 12:44PM
General Bea	m Analy	/sis					File = S:	Projects\2017PR~1\17	9604~1\01_	CAL~1\88_E	NE~1\JOIS	TC~1.EC6
Lic. # : KW-060066	521		_		_	_		icensee : MP-S	duared 3	Structura	l Enain	eers. LLC
Description : Tr	ying 14" low-sid	de										
N	Drift+Inter-Row	/+SL+DL										
Load Combination		Max Stre	ess Ratios			Summary of Mo	oment Valu	Jes		Summ	ary of Sh	ear Values
Segment Length	Span #	М	V	Mmax +	Mmax -	Ma - Max	Mnx	Mnx/Omega Cb	Rm	Va Max	Vnx	Vnx/Omega
+0.60D+0.70E+H												
Dsgn. L = 40.00 ft	1			8.39		8.39				0.79		
Overall Maximun	n Deflection	IS										
Load Combination		Span	Max. "-" Defl	Location	n in Span	Load Comb	pination		Max.	"+" Defl	Locatio	n in Span
+D+S+H		1	4.4853		20.000					0.0000		0.000
Vertical Reaction	าร				Suppor	t notation : Far I	eft is #1		Values in	KIPS		
Load Combination		Support 1	Support 2									
Overall MAXimum		4.360	4.300									
Overall MINimum		0.788	0.753									
D Only		1.313	1.255									
+D+L+H		1.313	1.255									
+D+Lr+H		1.313	1.255									
+D+S+H		4.360	4.300									
+D+0.750Lr+0.750L	+Н	1.313	1.255									
+D+0.750L+0.750S+	H	3.598	3.539									
+D+W+H		1.313	1.255									
+D+0.70E+H		1.313	1.255									
+D+0.750Lr+0.750L·	+0.750W+H	1.313	1.255									
+D+0.750L+0.750S+	0.750W+H	3.598	3.539									
+D+0.750Lr+0.750L	+0.5250E+H	1.313	1.255									
+D+0.750L+0.750S+	-0.5250E+H	3.598	3.539									
+0.60D+W+H		0.788	0.753									
+0.60D+0.70E+H		0.788	0.753									
D Only		1.313	1.255									
Lr Only												
L Only												
S Only		3.047	3.045									
W Only												
E Only												
H Only												



GIRDER CHECK

The existing roof was originally designed to support a 30 psf uniform snow load. As a preliminary check to determine whether or not a full stress analysis is warranted, the total uniform load on a fully-loaded girder using the as-designed 30 psf snow load will be compared to that of the now solar-paneled roof using the modern 25.2 psf snow load and the drift effects produced by lowering the low-side of each row to 14" maximum. This method is considered a "rational analysis of loads."

Existing Girder Check

Dead Loads

 $DL_{\text{ioist}} \coloneqq \frac{10.7 \frac{DI}{ft}}{4 ft} = 2.675 psf \qquad DL_{ST} \coloneqq 10 psf \qquad DL_{PV} \coloneqq 6 psf$ DL totall = DL joist + DL = 12.675*psf* w/o P.V. panels DL total2^{:= DL} joist + DL SI + DL PV = 18.675*psf* w/ P.V. panels Snow Loads SL1:= 30 psf w/o P.V. panels (original design load) SL2:= 25.2 psf w/ P.V. panels (sheltered) SL = 28.259*psf* d aisle SL = 25.2 psf Load Ratios for Snow/Drift in P.V. Panel Aisles & Sliding Snow L:= 40 ft L := 40 ft Aisle Snow/Drift: Sliding Snow: $l_{1B} = 5.75 ft$ $R_{1B} = \frac{l_{1B}}{L} = 0.144$ 1 ___:= 6 *ft* $R_{1,n} = \frac{1}{1} = 0.15$ $l_{2A} = 14.5 ft$ $R_{2A} = \frac{1}{T} = 0.362$ $l_{2B} = 14.25 ft$ $R_{2B} = \frac{1}{T} = 0.356$ $l_{3A} = 23 ft$ $R_{3A} = \frac{1}{L} = 0.575$ $l_{3B} = 22.75 ft$ $R_{3B} = \frac{1}{L} = 0.569$ $l_{4A} = 31.5 ft$ $R_{4A} = \frac{1}{T} = 0.788$ $l_{4B} = 31.25 ft$ $R_{4B} = \frac{1}{T} = 0.781$ $l_{5B} = 39.75 ft$ $R_{5B} = \frac{l_{5B}}{L} = 0.994$ $l_{5A} = 40 ft$ $R_{5A} = \frac{l_{5A}}{L} = 1$ $l_{6B} = 31.75 ft$ $R_{6B} = \frac{l_{6B}}{L} = 0.794$ $l_{6A} := 31.5 ft$ $R_{6A} := \frac{1}{1.6A} = 0.788$ $l_{7A} = 23 ft$ $R_{7A} = \frac{1_{7A}}{L} = 0.575$ $l_{7B} = 23.25 ft$ $R_{7B} = \frac{1}{1} = 0.581$ $l_{8A} = 14.5 ft$ $R_{8A} = \frac{1}{5} = 0.362$ $l_{8B} = 14.75 ft$ $R_{8B} = \frac{1}{5} = 0.369$ $l_{9A} = 6 ft$ $R_{0A} = \frac{1}{T} = 0.15$ $l_{9B} = 6.25 ft$ $R_{9B} = \frac{1}{T} = 0.156$

 $R_{A_{total}} = R_{1A} + R_{2A} + R_{3A} + R_{4A} + R_{5A} + R_{6A} + R_{7A} + R_{8A} + R_{9A} = 4.8$ $R_{B_{total}} = R_{1B} + R_{2B} + R_{3B} + R_{4B} + R_{5B} + R_{6B} + R_{7B} + R_{8B} + R_{9B} = 4.7$



PROJECT LOCATION: PROJECT NUMBER:

 Dane County Solar Array

 PROJECT NAME:
 Dane County Job Center PV Solar Array
 Madison, Wisconsin 2017010



Question & Response Log

#	RFB Questions	Responder	Reply
1	In Page 173, it is mentioned assembled within USA required for modules. Does this mean modules assembled in any other countries cannot be used? In Page 175, it is mentioned cell materials as monocrystalline. Is there an exemption to use higher wattage polycrystalline instead of lower wattage monocrystalline?	STRANG	Provide "Made in USA" per Specifications. Provide monocrystalline per specifications.
2	Does the design have to be exactly 170 kW AC or is it permissible to get to the expected production of 226,049 kWh with a lower system size ?	STRANG	Provide per specifications. Energy production is an estimate based upon modeled software.
3	Regarding the inverters, are only micro inverters allowed? Is it allowed to use a string inverter which is more efficient than the Enphase, both NEC 2014/2017 compliant and CA Rule 21 compliant instead of the mentioned Enphase IQ7Plus?	STRANG	Provide microinverters per Specification.
4	Is it possible to share the structural report?	Dane County	Included with Addendum.
5	Regarding the mounting structures, does it specifically have to be at 20 degrees tilt angle? Is 5 and 10 degrees permissible for mounting structures that will still meet all the characteristics mentioned?	STRANG	Provide 20 degree tilt angle.
6	With respect to the monitoring system, can we use a third party monitoring system instead of using Enphase IQ Envoy System?	STRANG	Provide per specifictions.
7	Is there mandatory requirement of using union labor for this project?	Dane County	No
8	Is there prevailing wages for this project?	Dane County	No
9	In page 177 of the document, (Photovoltaic Collectors, 26 31 00 - 9, 2.8 Mounting Structures) it mentions the required manufacturer of mounting structures as Cooper B-Line ARISTA monolithic solar mounting system. We reached out to the manufacturer, Cooper B-Line and they informed us that the ARISTA monolithic solar mounting system is no longer in production and it was discontinued couple of years ago. Kindly let us know how to proceed as the representatives from Strang instructed us to use 20 degree ARISTA mounting system during the site walk last week.	Strang	Approved equivalent flat roof, ballasted system as manufacutred by: Schletter, Inc. (Windsafe); Krannich/K2 System Triangle/Multiangle 20 degree.

DANE COUNTY REB 3170.31	Department of Public Works, Highway & Transportation	JOBCENTER PV ARRAY FEB 8/2018 PRE-BID SITE TOUR
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