

**Design Criteria for Span Tables:**

Values in the maximum allowable rail span tables provided herein are subject to the following general criteria and additional criteria shown on individual span tables sheets. Values in span tables are based on the same engineering methodology and calculation algorithms used for U-Builder and are provided here for reference.

**Building Assumptions**

- Building Risk Category: II
- Mean Roof Height: 30 ft
- Roof Pitch: 0°-45°
- Site Elevation: 0 ft

**Wind Design Assumptions**

- Wind loads used are based on ASCE 7-10 Sec 30.4.2
- Exposure Category B, C, or D
- Basic Wind Speed = 90 – 180 mph
- Level terrain. Topographic factor,  $k_{zt} = 1.0$

**Snow Design Assumptions**

- Ground Snow Load = 0-100 psf
- Exposure Factor coefficients of Partially Exposed condition
- Thermal Factor = 1.0
- Results based on uniform snow load

**Seismic Design Assumptions**

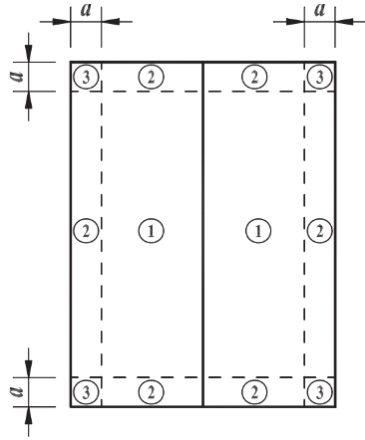
- 0.2-s Spectral Response Acceleration
- $S_s = 1.25$  and 3 per criteria shown on individual span tables sheets.
- $S_1 = 0.5$
- Seismic site class D

**Array Assumptions**

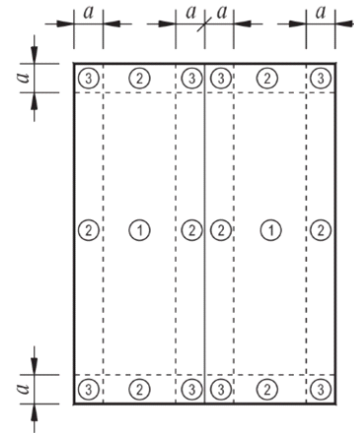
- Module orientation and Rail direction per criteria shown on individual span tables sheets.
- Maximum module dimensions of 40.1" x 67" (~19 sq.ft, 47.65 lbs) and 41" x 80" (~23 sq.ft, 58.6 lbs) per criteria shown on individual span tables sheets.
- Minimum distance between modules and roof edge is at least twice the module height above roof surface.
- Modules are parallel to roof surface and maximum height above roof surface is 5" to 10" depending on attachment type.
- Gaps between module rows and columns is 0.25" in to 1" depending on clamp type.
- The most restrictive of all roof zone spans shall be used when any part of the module is attributed to that span.

## Span Tables

Zone should be considered as per ASCE 7-10, Fig. 30.4-2A to 30.4-2D



Gable Roofs  $\theta \leq 7^\circ$



Gable Roofs  $7^\circ < \theta \leq 45^\circ$

Rails can be installed in these possible orientations.

#N/A



















ASCE 7-10  
Design Standard

II  
Risk Category

30 ft  
Roof Height

Ss = 3.00  
Seismic

18.66 sq.ft  
Module Area

PORTRAIT  
Orientation

CROSS-SLOPE  
Rail Direction

SML  
Rail Type

PRO SERIES  
Clamp

SM BUTYL Plywood  
Attachment

# SPAN TABLES

## Maximum Allowable Rail Spans for Rooftop Solar Panels Parallel to the Roof Surface (inches)

Ground Snow Load (psf)	Wind Exposure Category	Roof Tilt Angle (deg)	Basic Wind Speed (mph)																																						
			90			95			100			105			110			115			120			130			140			150			160			170			180		
			Roof Wind Zone																																						
			1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
0	B	0-7	47	47	29	47	43	26	47	38	23	47	34	21	47	31	19	47	28	17	47	25	16	41	21	13	35	18	11	30	16	10	26	14	8	23	12	11	20	11	10
		7-27	47	47	32	47	46	28	47	40	25	47	36	23	47	32	20	47	29	19	47	27	17	46	23	14	39	19	12	33	17	10	29	14	9	25	13	12	22	11	11
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	D	0-7	47	27	17	47	24	15	42	22	14	37	20	12	34	18	11	31	16	10	28	15	9	23	12	12	20	11	10	17	9	9	15	12	8	13	11	7	12	9	6
		7-27	47	29	18	47	26	16	47	23	15	42	21	13	38	19	12	34	17	11	31	16	10	26	13	8	22	11	11	19	10	9	17	8	8	15	11	7	13	10	6
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	C	0-7	33	33	20	33	29	18	33	26	16	33	24	15	33	21	13	33	19	12	33	18	11	28	15	9	24	13	12	21	11	10	18	9	9	16	8	8	14	11	7
		7-27	33	33	22	33	31	19	33	28	17	33	25	16	33	22	14	33	20	13	33	19	12	31	16	10	27	13	8	23	12	11	20	10	10	17	9	9	15	12	8
		27-45	47	47	47	45	45	42	40	38	36	36	36	35	32	32	33	29	29	30	27	27	26	23	23	23	19	19	20	17	17	18	14	14	15	13	13	14	11	11	
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		7-27	23	23	22	23	23	19	23	23	17	23	23	16	23	22	14	23	20	13	23	19	12	22	16	10	21	13	8	20	12	11	19	10	10	17	9	9	15	12	8
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	D	0-7	23	23	17	23	23	15	23	22	14	23	20	12	23	18	11	23	16	10	23	15	9	23	12	12	20	11	10	17	9	9	15	12	8	13	11	7	12	9	6
		7-27	23	23	18	23	23	16	23	23	15	23	21	13	23	19	12	23	17	11	22	16	10	21	13	8	20	11	11	19	10	9	17	8	8	15	11	7	13	10	6
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		27-45	28	28	28	28	28	28	28	28	28	28	28	28	28	28	27	27	27	27	26	26	26																		





ASCE 7-10  
Design Standard

II  
Risk Category

30 ft  
Roof Height

Ss = 3.00  
Seismic

18.66 sq.ft  
Module Area

LANDSCAPE  
Orientation

CROSS-SLOPE  
Rail Direction

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Rail Type

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SM BUTYL Plywood  
Attachment

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			Roof Wind Zone																																							
			1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
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		27-45	47	47	47	47	47	47																																		









ASCE 7-10  
Design Standard

II  
Risk Category

30 ft  
Roof Height

Ss = 3.00  
Seismic

22.78 sq.ft  
Module Area

LANDSCAPE  
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CROSS-SLOPE  
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# SPAN TABLES

## Maximum Allowable Rail Spans for Rooftop Solar Panels Parallel to the Roof Surface (inches)

Ground Snow Load (psf)	Wind Exposure Category	Roof Tilt Angle (deg)	Basic Wind Speed (mph)																																								
			90			95			100			105			110			115			120			130			140			150			160			170			180				
			1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3					
0	B	0-7	76	76	49	76	74	43	76	63	39	76	56	35	76	51	31	76	46	29	76	42	26	68	35	22	57	30	19	49	26	16	43	23	21	37	20	19	33	18	17		
		7-27	76	76	52	76	76	46	76	67	42	76	59	37	76	54	34	76	49	31	76	44	28	76	37	24	64	32	20	55	27	17	47	24	23	42	21	20	37	19	18		
		27-45	79	79	79	79	79	79	79	79	79	79	79	77	77	77	72	71	71	66	64	64	58	53	53	51	46	46	45	39	39	40	34	34	36	30	30	32	27	27			
	C	0-7	76	55	34	76	48	30	76	43	27	76	39	24	67	35	22	61	32	20	55	29	18	46	25	15	39	21	20	34	18	17	30	16	15	26	21	19	23	19	12		
		7-27	76	58	36	76	51	32	76	46	29	76	41	26	76	37	24	68	34	21	62	31	20	52	26	17	44	22	21	38	19	19	33	17	16	29	22	14	26	20	13		
		27-45	79	79	79	74	74	74	68	66	66	62	59	59	59	53	53	53	48	48	50	44	44	43	37	37	38	32	32	33	27	27	29	24	24	26	21	21	23	19	19		
	D	0-7	76	45	28	76	40	25	69	36	22	62	32	20	56	29	18	50	27	17	46	24	15	39	21	20	33	18	17	28	23	14	25	20	19	22	18	11	19	16	10		
		7-27	76	48	30	76	43	27	76	38	24	69	34	22	62	31	20	56	28	18	51	26	16	43	22	21	37	19	18	32	16	16	27	21	14	24	19	12	21	17	11		
		27-45	71	69	69	64	61	61	59	55	55	54	49	49	50	44	44	46	40	40	43	37	37	37	31	31	31	32	27	27	28	23	23	24	20	21	18	18	19	24	24		
	10	B	0-7	54	54	49	54	54	43	54	54	39	54	54	35	54	51	31	54	46	29	54	42	26	54	35	22	54	30	19	49	26	16	43	23	21	37	20	19	33	18	17	
			7-27	54	54	52	54	54	46	54	54	42	54	54	37	54	54	49	54	49	31	54	44	28	54	37	24	54	32	20	53	27	17	47	24	23	42	21	20	37	19	18	
			27-45	76	76	76	76	76	76	76	76	76	76	76	75	75	75	71	71	71	66	64	64	58	53	53	51	46	46	45	39	39	40	34	34	36	30	30	32	27	27		
C		0-7	54	54	34	54	48	30	54	43	27	54	39	24	54	35	22	54	32	20	54	29	18	46	25	15	39	21	20	34	18	17	30	16	15	26	21	19	23	19	12		
		7-27	54	54	36	54	51	32	54	46	29	54	41	26	54	37	24	54	34	21	54	31	20	52	26	17	44	22	21	38	19	19	33	17	16	29	22	14	26	20	13		
		27-45	76	76	76	73	73	73	68	66	66	62	59	59	58	53	53	53	48	48	50	44	44	43	37	37	38	32	32	33	27	27	29	24	24	26	21	21	23	19	19		
D		0-7	54	45	28	54	40	25	54	36	22	54	32	20	54	29	18	50	27	17	46	24	15	39	21	20	33	18	17	28	23	14	25	20	19	22	18	11	19	16	10		
		7-27	54	48	30	54	43	27	54	38	24	54	34	22	54	31	20	53	28	18	51	26	16	43	22	21	37	19	18	32	16	16	27	21	14	24	19	12	21	17	11		
		27-45	71	69	69	64	61	61	59	55	55	54	49	49	50	44	44	46	40	40	43	37	37	37	31	31	31	32	27	27	28	23	23	24	20	21	18	18	19	24	24		
20		B	0-7	38	38	38	38	38	38	38	38	38	38	35	38	38	31	38	38	29	38	38	26	38	35	22	38	30	19	38	26	16	38	23	21	37	20	19	33	18	17		
			7-27	38	38	38	38	38	38	38	38	38	38	37	38	38	34	38	38	31	38	38	28	38	37	24	38	32	20	37	27	17	36	24	23	34	21	20	33	19	18		
			27-45	62	62	62	62	62	62	62	62	62	62	62	61	61	61	59	59	59	56	56	56	51	51	47	46	46	43	39	39	40	34	34	36	30	30	32	27	27			
	C	0-7	38	38	34	38	38	30	38	38	27	38	38	24	38	35	22	38	32	20	38	29	18	38	25	15	38	21	20	34	18	17	30	16	15	26	21	19	23	19	12		
		7-27	38	38	36	38	38	32	38	38	29	38	38	26	38	37	24	38	34	21	38	31	20	37	26	17	35	22	21	33	19	19	31	17	16	29	22	14	26	20	13		
		27-45	62	62	62	60	60	60	57	57	57	54	54	54	51	51	51	49	48	48	46	44	44	42	37	37	38	32	32	33	27	27	29	24	24	26	21	21	23	19	19		
	D	0-7	38	38	28	38	38	25	38	36	22	38	32	20	38	29	18	38	27	17	38	24	15	38	21	20	33	18	17	28	23	14	25	20	19	22	18	11	19	16	10		
		7-27	38	38	30	38	38	27	38	38	24	38	34	22	38	31	20	37	28	18	37	26	16	35	22	21	33	19	18	31	16	16	27	21	14	24	19	12	21	17	11		
		27-45	60	60	60	57	57	57	53	53	53	50	49	49	48	44	44	45	40	40	43	37	37	37	31	31	32	27	27	28	23	23	24	20	20	21	18	18	19	24	24		
	30	B	0-7	36	36	36	36	36	36	36	36	36	36	35	36	36	31	36	36	29	36	36	26	36	35	22	36	30	19	36	26	16	36	23	21	37	20	19	33	18	17		
			7-27	38	38	38	38	38	38	38	38	38	38	37	38	38	34	38	38	31	38	38	28	38	37	24	38	32	20	37	27	17	36	24	23	34	21	20	33	19	18		
			27-45	53	53	53	53	53	53	53	53	53	53	53	52	52	52	50	50	50	48	48	48	45	45	41	41	41	38	38	38	35	34	34	33	30	30	31	27	27			
C		0-7	36	36	34	36	36	30	36	36	27	36	36	24	36	35	22	36	32	20	36	29	18	36	25	15	36	21	20	34	18	17	30	16	15	26	21	19	23	19	12		
		7-27	38	38	36	38	38	32	38	38	29	38	38	26	38	37	24	38	34	21	38	31	20	37	26	17	35	22	21	33	19	19	31	17	16	29	22	14	26	20	13		
		27-45	53	53	53	51	51	51	49	49	49	46	46	46	44	44	44	42	42	42	41	41	41	37	37	37	34	32	32	31	27	27	29	24	24	26	21	21	23	19	19		
D		0-7	38	38	28	38	38	25	38	36	22	38	32	20	38	29	18	38	27	17	38	24	15	38	21	20	33	18	17	28	23	14	25	20	19	22	18	11	19	16	10		
		7-27	38	38	30	38	38	27	38	38	24	38	34	22	38	31	20	37	28	18	37	26	16	35	22	21	33	19	18	31	16	16	27	21	14	24	19	12	21	17	11		
		27-45	52	52	52	49	49	49	47	47	47	44	44	44	42	42	42	40	40	40	38	37	37	35	31	31	31	27	27	28	23	23	24	20	20	21	18	18	19	24	24		
40		B	0-7	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	29	30	30	26	30	30	22	30	30	22	30	30	19	30	26	16	30	23	21	30	20	19	30	18	17
			7-27	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	31	32	32	28	32	32	24	32	32	20	32	27	17	30	24	23	29	21	20	28	19	18	
			27-45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	43	43	43	42	42	42																

















ASCE 7-10  
Design Standard

II  
Risk Category

30 ft  
Roof Height

Ss = 1.25  
Seismic

22.78 sq.ft  
Module Area

LANDSCAPE  
Orientation

CROSS-SLOPE  
Rail Direction

SML  
Rail Type

UAF  
Clamp

SM BUTYL Plywood  
Attachment

# SPAN TABLES

## Maximum Allowable Rail Spans for Rooftop Solar Panels Parallel to the Roof Surface (inches)

Ground Snow Load (psf)	Wind Exposure Category	Roof Tilt Angle (deg)	Basic Wind Speed (mph)																																						
			90			95			100			105			110			115			120			130			140			150			160			170			180		
			1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3			
			Roof Wind Zone																																						
0	B	0-7	76	76	49	76	74	43	76	63	39	76	56	35	76	51	31	76	46	29	76	42	26	68	35	22	57	30	19	49	26	16	43	23	14	37	20	12	33	18	17
		7-27	76	76	52	76	76	46	76	67	42	76	59	37	76	54	34	76	49	31	76	44	28	76	37	24	64	32	20	55	27	17	47	24	15	42	21	13	37	19	18
		27-45	79	79	79	79	79	79	79	79	79	79	79	79	77	77	77	72	71	71	66	64	64	58	53	53	51	46	46	45	39	39	40	34	34	36	30	30	32	27	27
	C	0-7	76	55	34	76	48	30	76	43	27	76	39	24	67	35	22	61	32	20	55	29	18	46	25	15	39	21	13	34	18	17	30	16	15	26	14	13	23	12	12
		7-27	76	58	36	76	51	32	76	46	29	76	41	26	76	37	24	68	34	21	62	31	20	52	26	17	44	22	14	38	19	19	33	17	16	29	15	14	26	13	13
		27-45	79	79	79	74	74	74	68	66	66	62	59	59	59	58	53	53	53	48	48	50	44	43	37	37	38	32	32	27	27	29	24	24	26	21	21	23	19	19	
	D	0-7	76	45	28	76	40	25	69	36	22	62	32	20	56	29	18	50	27	17	46	24	15	39	21	13	33	18	17	28	15	14	25	13	13	22	18	11	19	16	10
		7-27	76	48	30	76	43	27	76	38	24	69	34	22	62	31	20	56	28	18	51	26	16	43	22	14	37	19	18	32	16	16	27	14	14	24	19	12	21	17	11
		27-45	71	69	69	64	61	61	59	55	55	54	49	49	50	44	44	46	40	40	43	37	37	37	31	31	32	27	27	28	23	24	20	20	21	18	18	19	16	16	
10	B	0-7	54	54	49	54	54	43	54	54	39	54	54	35	54	51	31	54	46	29	54	42	26	54	35	22	54	30	19	49	26	16	43	23	14	37	20	12	33	18	17
		7-27	54	54	52	54	54	46	54	54	42	54	54	37	54	54	31	54	49	31	54	44	28	54	37	24	54	32	20	53	27	17	47	24	15	42	21	13	37	19	18
		27-45	76	76	76	76	76	76	76	76	76	76	76	75	75	75	71	71	71	66	64	64	58	53	53	51	46	46	45	39	39	40	34	34	36	30	30	32	27	27	
	C	0-7	54	54	34	54	48	30	54	43	27	54	39	24	54	35	22	54	32	20	54	29	18	46	25	15	39	21	13	34	18	17	30	16	15	26	14	13	23	12	12
		7-27	54	54	36	54	51	32	54	46	29	54	41	26	54	37	24	54	34	21	54	31	20	52	26	17	44	22	14	38	19	19	33	17	16	29	15	14	26	13	13
		27-45	76	76	76	73	73	73	68	66	66	62	59	59	58	53	53	53	48	48	50	44	44	43	37	37	38	32	32	27	27	29	24	24	26	21	21	23	19	19	
	D	0-7	54	45	28	54	40	25	54	36	22	54	32	20	54	29	18	50	27	17	46	24	15	39	21	13	33	18	17	28	15	14	25	13	13	22	18	11	19	16	10
		7-27	54	48	30	54	43	27	54	38	24	54	34	22	54	31	20	53	28	18	51	26	16	43	22	14	37	19	18	32	16	16	27	14	14	24	19	12	21	17	11
		27-45	71	69	69	64	61	61	59	55	55	54	49	49	50	44	44	46	40	40	43	37	37	37	31	31	32	27	27	28	23	24	20	20	21	18	18	19	16	16	
20	B	0-7	38	38	38	38	38	38	38	38	38	38	38	35	38	38	31	38	38	29	38	38	26	38	35	22	38	30	19	38	26	16	38	23	14	37	20	12	33	18	17
		7-27	38	38	38	38	38	38	38	38	38	38	38	37	38	38	34	38	38	31	38	38	28	38	37	24	38	32	20	37	27	17	36	24	15	34	21	13	33	19	18
		27-45	62	62	62	62	62	62	62	62	62	62	62	61	61	61	59	59	59	56	56	56	51	51	47	46	46	43	39	39	40	34	34	36	30	30	32	27	27		
	C	0-7	38	38	34	38	38	30	38	38	27	38	38	24	38	35	22	38	32	20	38	29	18	38	25	15	38	21	13	34	18	17	30	16	15	26	14	13	23	12	12
		7-27	38	38	36	38	38	32	38	38	29	38	38	26	38	37	24	38	34	21	38	31	20	37	26	17	35	22	14	33	19	19	31	17	16	29	15	14	26	13	13
		27-45	62	62	62	60	60	60	57	57	57	54	54	54	51	51	51	49	48	48	46	44	44	42	37	37	38	32	32	27	27	29	24	24	26	21	21	23	19	19	
	D	0-7	38	38	28	38	38	25	38	36	22	38	32	20	38	29	18	38	27	17	38	24	15	38	21	13	33	18	17	28	15	14	25	13	13	22	18	11	19	16	10
		7-27	38	38	30	38	38	27	38	38	24	38	34	22	38	31	20	37	28	18	37	26	16	35	22	14	33	19	18	31	16	16	27	14	14	24	19	12	21	17	11
		27-45	60	60	60	57	57	57	53	53	53	50	49	49	48	44	44	45	40	40	43	37	37	37	31	31	32	27	27	28	23	24	20	20	21	18	18	19	16	16	
30	B	0-7	36	36	36	36	36	36	36	36	36	36	36	35	36	36	31	36	36	29	36	36	26	36	35	22	36	30	19	36	26	16	36	23	14	36	20	12	33	18	17
		7-27	38	38	38	38	38	38	38	38	38	38	38	37	38	38	34	38	38	31	38	38	28	38	37	24	38	32	20	37	27	17	36	24	15	34	21	13	33	19	18
		27-45	53	53	53	53	53	53	53	53	53	53	53	53	52	52	52	50	50	50	48	48	48	45	45	41	41	38	38	38	35	34	34	33	30	30	31	27	27		
	C	0-7	36	36	34	36	36	30	36	36	27	36	36	24	36	35	22	36	32	20	36	29	18	36	25	15	36	21	13	34	18	17	30	16	15	26	14	13	23	12	12
		7-27	38	38	36	38	38	32	38	38	29	38	38	26	38	37	24	38	34	21	38	31	20	37	26	17	35	22	14	33	19	19	31	17	16	29	15	14	26	13	13
		27-45	53	53	53	51	51	51	49	49	49	46	46	46	44	44	44	42	42	42	41	41	41	37	37	37	34	32	32	27	27	29	24	24	26	21	21	23	19	19	
	D	0-7	38	38	28	38	38	25	38	36	22	38	32	20	38	29	18	38	27	17	38	24	15	38	21	13	33	18	17	28	15	14	25	13	13	22	18	11	19	16	10
		7-27	38	38	30	38	38	27	38	38	24	38	34	22	38	31	20	37	28	18	37	26	16	35	22	14	33	19	18	31	16	16	27	14	14	24	19	12	21	17	11
		27-45	52	52	52	49	49	49	47	47	47	44	44	44	42	42	42	40	40	40	38	37	37	35	31	31	31	27	27	28	23	24	20	20	21	18	18	19	16	16	
40	B	0-7	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	29	30	30	26	30	30	22	30	30	19	30	26	16	30	23	14	30	20	12	30	18	17
		7-27	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	31	32	32	28	32	32	24	32	32	27	17	30	24	15	29	21	13	28	19	18	
		27-45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	43	43	43	42	42	42	39														

















