January 3, 2020

First Unitarian Church
1342 N Astor Street
Milwaukee, WI 53202

STRUCTURAL CALCULATIONS FOR

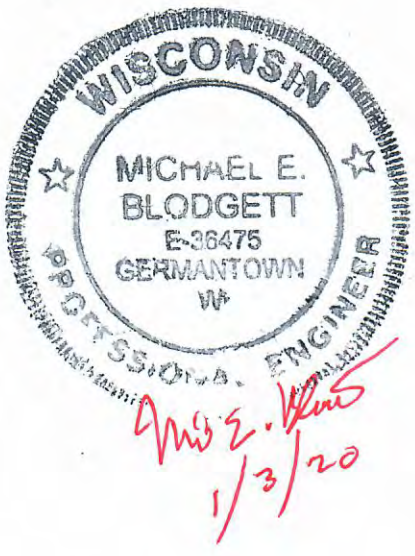
Solar Panel Arrays –
Upper Church Roof & Apartments Flat Roof
Structural Report

Provided for:

Arch Electric, Inc. | The Solar + Energy Storage Experts
Phone: 920-545-4429 Mobile: 920-321-8914
1237 Pilgrim Road, Plymouth, WI 53073
2025 N. Summit Avenue, Suite 100A, Milwaukee, WI 53202

Prepared by:

BLODGETT
Engineering, LLC
W169 N10815 Redwood Lane
Germantown, WI 53022
262-293-9923
blodgetteng@wi.rr.com



BLODGETT ENGINEERING LLC
STRUCTURAL CONSULTING ENGINEERS
W169 N10815 Redwood Lane
Germantown, WI 53022
blodgetteng@wi.rr.com
Tel/Fax: 262.293.9923

JOB Arch Electric - First Unitarian
SHEET NO. _____ OF _____
CALCULATED BY MEB DATE 1/2/20

1. GABLE ROOF: 1890's

242 - 0013 - 1966

- FULL 2" × 5.5" RAFTERS @ 16" o/c

POORLY OR 0 INSULATION CONSIDERED A WARM ROOF
$C_T \leq 1.0$

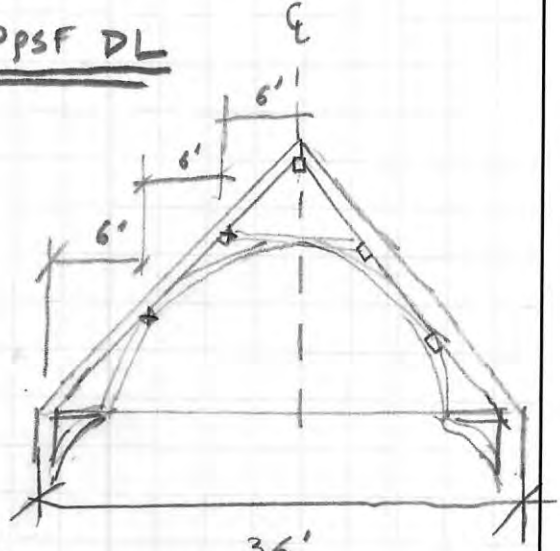
SHINGLED ROOF:

DEAD LOADS:

SHINGLES : 4
OSB : 2
1× BOARDS : 2.5
2 × 6 FULL : 1.6
+ PLASTER : 8 psF
18.1 psF → USE 20psF DL

ALL SLOPE FACTORS REDUCE SNOW TO < R_{LL} = 20 psF
∴ SNOW DOES NOT CONTROL

*ROOF LIVE LOAD OF 20 psF GOVERNS



SPAN OF RAFTERS:

SPANS BETWEEN ROOF BEAMS

2 D MODEL USING ROUGH SAWN
2" × 5" IN MODEL
(ACTUAL = 2" × 5.5")
Pre-1944 JOISTS

WT OF ARRAY:

PANEL = 22 kg = 48.5 #
A = 1968 × 990 = 1948320 mm² = 20.97 SF
} PSF = 2.3 psF MODULES

ADD 0.7 psF RAILS + MISC = 3.0 psF TOTAL
(ADD TO MODEL)

Zak 11.21 First Unitarian Society, 1342 N Astor St, Milwaukee, WI 53202

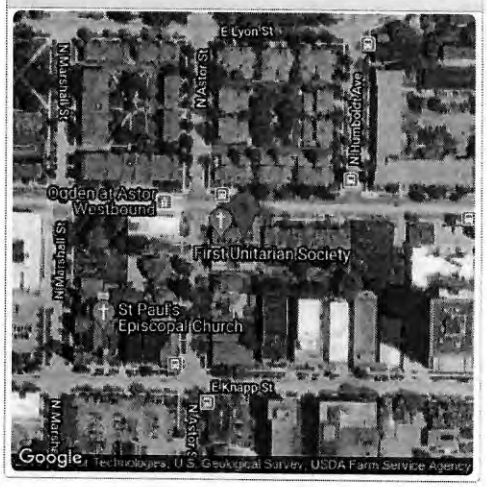
Report

Project Name	First Unitarian Society
Project Address	1342 N Astor St, Milwaukee, WI 53202
Prepared By	Dan Steinhardt dan@archelec.com

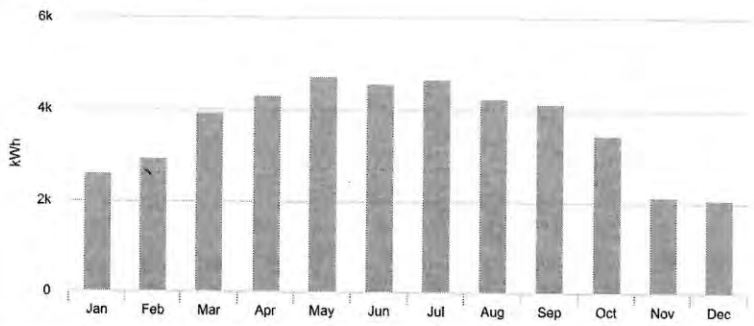
System Metrics

Design	Zak 11.21
Module DC Nameplate	34.8 kW
Inverter AC Nameplate	28.8 kW Load Ratio: 1.21
Annual Production	44.04 MWh
Performance Ratio	80.5%
kWh/kWp	1,266.3
Weather Dataset	TMY, MILWAUKEE MITCHELL INTL AP, NSRDB (tmy3, I)
Simulator Version	a721496c3a-208a66d7f1-b582af6697-77987d21ec

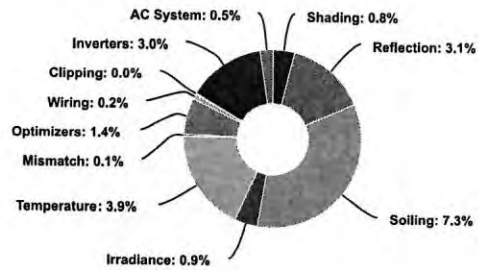
Project Location



Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,406.8	
	POA Irradiance	1,572.2	11.8%
	Shaded Irradiance	1,559.1	-0.8%
	Irradiance after Reflection	1,510.8	-3.1%
	Irradiance after Soiling	1,401.1	-7.3%
	Total Collector Irradiance	**1,401.0**	**0.0%**
Energy (kWh)	Nameplate	48,774.1	
	Output at Irradiance Levels	48,337.5	-0.9%
	Output at Cell Temperature Derate	46,429.0	-3.9%
	Output After Mismatch	46,392.7	-0.1%
	Optimizer Output	45,742.5	-1.4%
	Optimal DC Output	45,650.3	-0.2%
	Constrained DC Output	45,631.8	0.0%
	Inverter Output	44,262.3	-3.0%
	Energy to Grid	**44,041.0**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		10.8 °C
	Avg. Operating Cell Temp		22.8 °C
Simulation Metrics			
	Operating Hours		4687
	Solved Hours		4687

Condition Set

Description	Condition Set 1
Weather Dataset	TMY, MILWAUKEE MITCHELL INTL AP, NSRDB (tmy3, I)
Solar Angle Location	Meteo Lat/Lng
Transposition Model	Perez Model
Temperature Model	Sandia Model

Temperature Model Parameters

Rack Type	a	b	Temperature Delta
Fixed Tilt	-3.56	-0.075	3°C
Flush Mount	-2.81	-0.0455	0°C

Soiling (%)

J	F	M	A	M	J	J	A	S	O	N	D
15	15	5	5	5	5	5	5	5	5	15	15

Irradiation Variance	5%
Cell Temperature Spread	4° C
Module Binning Range	-2.5% to 2.5%
AC System Derate	0.50%

Module Characterizations

Module	Uploaded By	Characterization
PS-M72 370W Amman (Philadelphia Solar)	Folsom Labs	Spec Sheet Characterization, PAN

Component Characterizations

Device	Uploaded By	Characterization
SE14.4KUS (SolarEdge)	Folsom Labs	CEC
P860 (SolarEdge)	Folsom Labs	Sheet

Components

Component	Name	Count
Inverters	SE14.4KUS (SolarEdge)	2 (28.8 kW)
Strings	10 AWG (Copper)	6 (631.3 ft)
Optimizers	P860 (SolarEdge)	48 (41.3 kW)
Module	Philadelphia Solar, PS-M72 370W Amman (370W)	94 (34.8 kW)

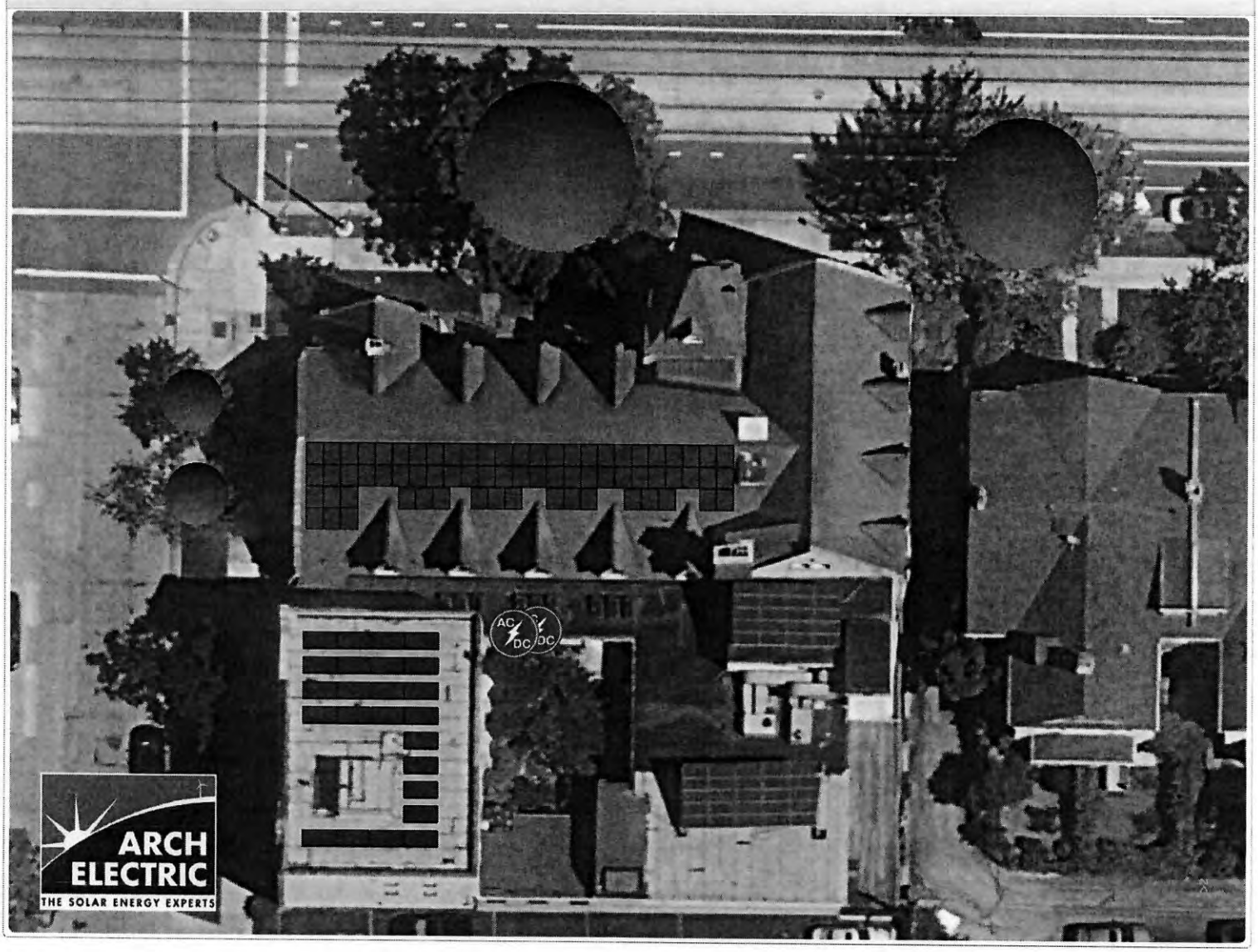
Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	7-17	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
South Gable	Flush Mount	Portrait (Vertical)	50°	180°	0.0 ft	1x1	70	70	25.9 kW
East Gable	Flush Mount	Landscape (Horizontal)	60°	180°	0.0 ft	1x1			0
Apt. Flat Roof	Fixed Tilt	Landscape (Horizontal)	10°	180°	1.6 ft	1x1	24	24	8.88 kW

Detailed Layout



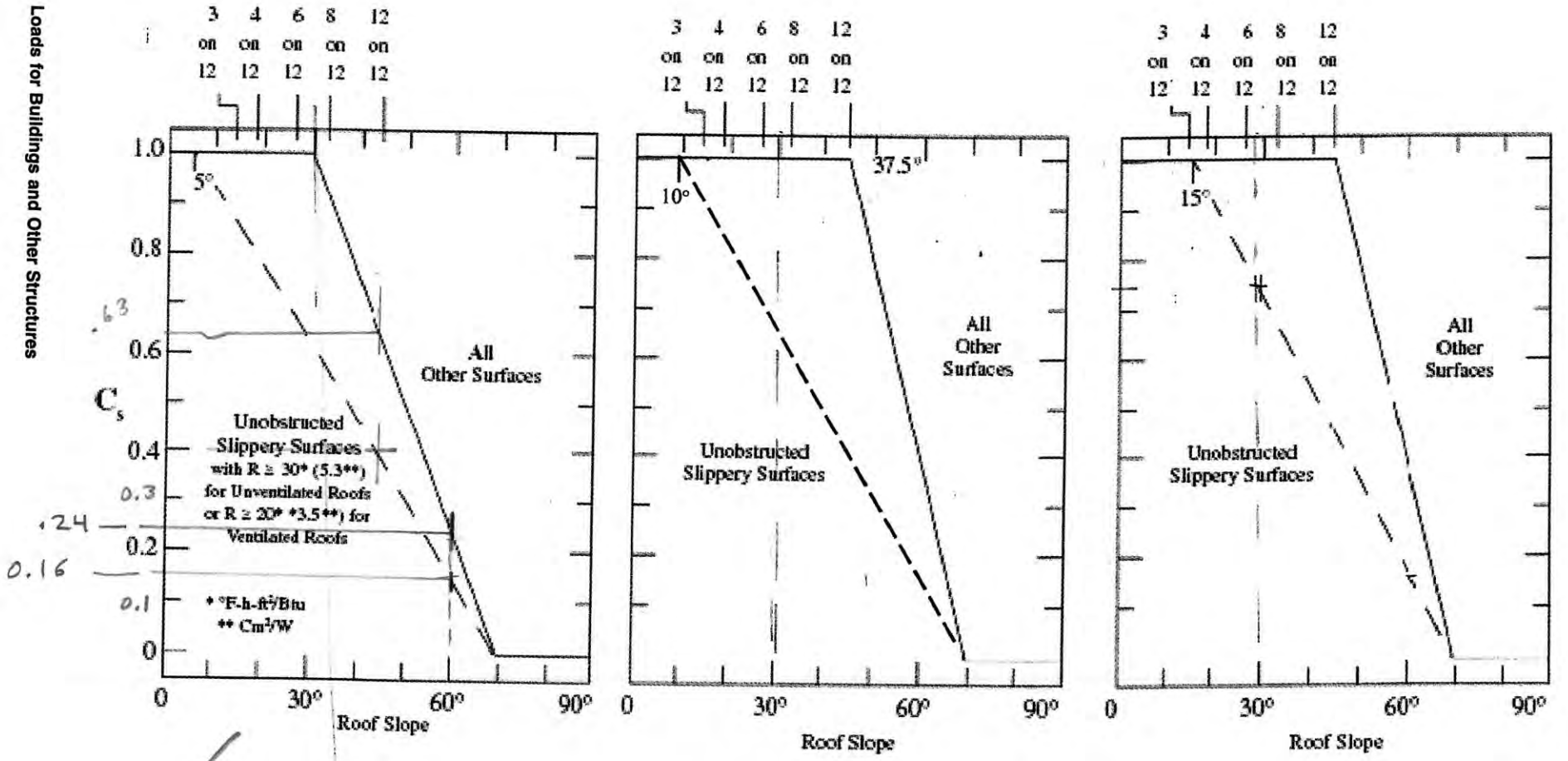


FIGURE 7-2 Graphs for Determining Roof Slope Factor C_s, for Warm and Cold Roofs (See Table 7-3 for C_t Definitions).

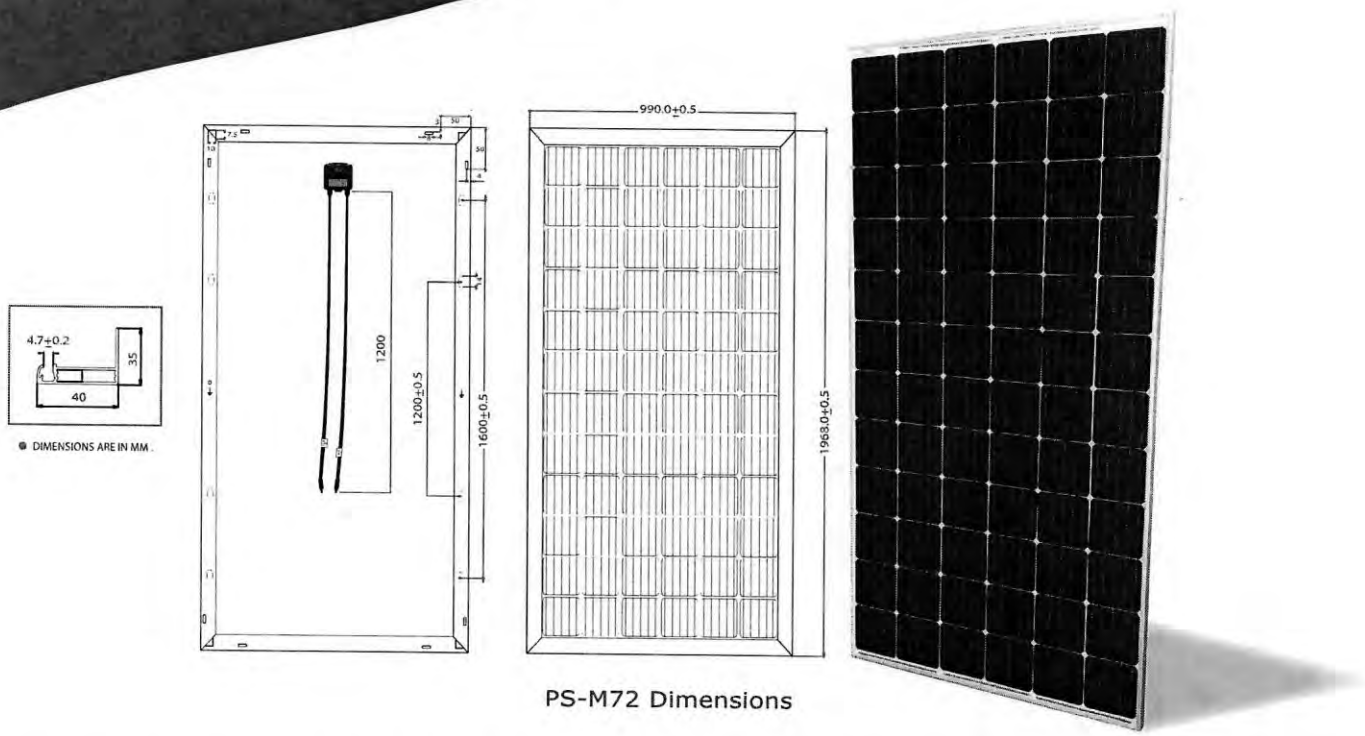
CONVERTING TO SLIPPERY PANELS CANNOT REDUCE SNOW FARTHER (TOO STEEP)


HABS No. MI-286-7

PS-M72 (370-385 W) AMMAN

MONO-CRYSTALLINE MODULE

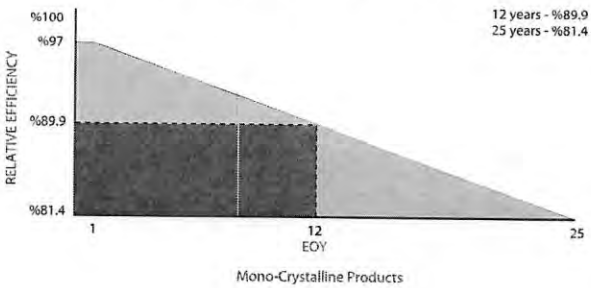
Philadelphia Solar
Delivering Clean Energy Solutions



PS-M72 Dimensions

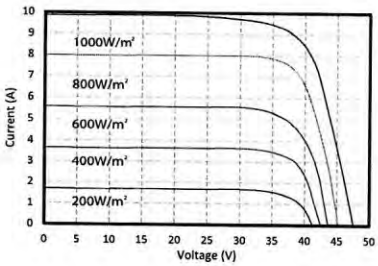
Philadelphia Solars' Mono-Crystalline modules with power up to 385 Wp are produced using the state-of-the-art (automated) robotic production lines. These modules are suitable to be used for most electrical power applications and have excellent durability to prevailing weather conditions.

LINER PERFORMANCE WARRANTY



Mono-Crystalline Products

IV - CURVE M72 - 370 W



Certificates

- Bankability Report DNV GL

EN ISO 9001:2015 EN ISO 14001:2015 EN ISO 18001:2007

QP-04-CAD/REV4.

ELECTRICAL CHARACTERISTICS	370W	375W	380W	385W
Characteristics (STC)	STC	STC	STC	STC
Open Circuit Voltage - Voc (V)	48.00	48.30	48.63	49.00
Short Circuit Current - Isc (A)	9.90	9.95	9.98	10.01
Maximum Power Voltage - Vmpp (V)	38.90	39.23	39.61	40.02
Maximum Power Current - Impp (A)	9.52	9.57	9.60	9.63
Maximum Power - Pmax (W)	370	375	380	385
Module Efficiency - η′ (%)	19.0	19.2	19.5	19.8

Values at Standard Test Conditions STC (Air Mass AM1.5, Irradiance 1000W/m², Cell Temperature °25C).

MATERIAL CHARACTERISTICS	
Characteristics	Value
Cells per Module	72
Cell Type	Grade A - Mono-Crystalline Silicon (PERC), 156.75x156.75mm
Front Surface	Anti-Reflective Coated Tempered 3.2mm Glass
Encapsulant	PID Free EVA
Back Cover	Backsheet
Frame	Anodized Aluminum
Junction Box	IP68, 3 Bypass Diodes
Cable and Connector	1.2m Solar Cables with MC4 interconnection
Fire Classification	Spread of flame : A / Burning brand : C

PACKAGING	
Physical Characteristics	Value
Module Dimensions (mm)	1968 x 990 x 40
Module Weight (kg)	22
Pallet Dimensions W.D.H (mm)	2010 x 1140 x 1130
Modules per Pallet	27
Container Capacity	Value
20 Feet Container	270 Modules
40 Feet High-Cube Container	594 Modules

METRIC SIZE

THERMAL CHARACTERISTICS	
Characteristics	Value
Voltage Temperature Coefficient (%/°C)	- 0.291
Current Temperature Coefficient (%/°C)	+ 0.033
Power Temperature Coefficient (%/°C)	- 0.39
NOCT (°C)	45 ± 2

OPERATING CONDITIONS	
Maximum Sytem Voltage - Vmax (V)	1000/1500
Maximum Series Fuse (A)	15
Operating Temperature Range (°C)	IEC: - 40 to + 85 UL: - 40 to + 90

WARRANTY	
Product	12 Years
Power Output	12 Years; 89.9 % of Power Output 25 Years; 81.4 % of Power Output

FEATURE

- Positive power tolerance up to %3 extra output.
- Excellent low light performance.
- Salt mist and ammonia resistant to endure coastal and agricultural environments.
- Excellent high mechanical loads, certified to withstand high wind load (2400 pa) and snow load (5400 pa).
- In-line and post EL (Electroluminescence) machines.
- PID resistant.

BENEFITS

- Outstanding technical support.
- Pre and after sales-service.
- 12 years warranty on material and workmanship .
- 25 years linear performance warranty.
- Marketing support to official distributors.
- Customized mounting solutions.

APPLICATIONS

- Power measuring tolerance: ± %3, other measurements tolerances: ± %5
- Datasheet is subjected to changes without prior notice, always obtain the most recent version of the datasheet.
- Caution: For professional use only, the installation and handling of PV modules and cleaning modules require professional skills and should only be performed by qualified professionals, please read the Installation and Operation Manual before using the modules, also Cleaning Guidelines.

BLODGETT ENGINEERING LLC
STRUCTURAL CONSULTING ENGINEERS
W169 N10815 Redwood Lane
Germantown, WI 53022
blodgetteng@wi.rr.com
Tel/Fax: 262.293.9923

JOB _____

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

ANCHORAGE:

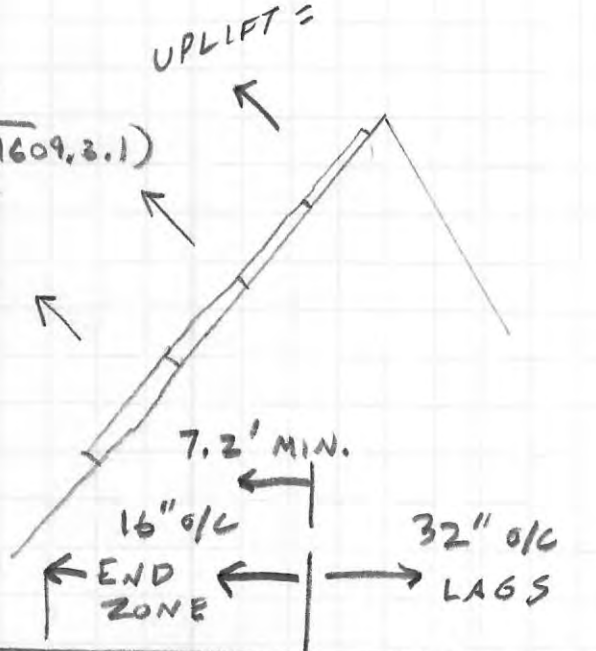
USE: AWC $\frac{5}{16}$" ϕ LAG SCREWS @ 266 #/LAG

WIND UPLIFT PRESSURES: ASCE 7-10

ULTIMATE	ASD (IBC 1609.3.1)
MID ZONE = -17.5 psf	⇒ 13.55 psf
END ZONE = -25.2 psf	⇒ 19.52 psf

USE 2.3 psf DL

A_{PANEL} = 20.97 sf



WORST CASE:

FULL PANEL AT EDGE ZONE

P = 19.52 psf × 6.456' = 126.02 #/FT

(2) $\frac{5}{16}$" ϕ LAG SCREWS GIVE: 266 #/LAG

RAIL SPACING = $\frac{266\ \#}{1\ LAG} \times \frac{FT}{126.02\ \#}$ = 2.11'/LAG

⇒ OK

SPACING = 1.33' o/c

∴ USE THAT

ATTACH EVERY 16" o/c AT END ZONES

P = 13.55 × 6.456 = 87.5 #/FT

$\frac{266}{87.5}$ = 3.04 ⇒ USE 2.66' o/c AT MIDDLE ZONES

AWC Lag Pull-out Chart

Lag pull-out (withdrawal) capacities (lbs) in typical roof lumber (ASD)

Material	Specific Gravity	Lag Screw Specifications*
Douglas Fir, Larch	0.50	266
Douglas Fir, South	0.46	235
Engelmann Spruce, Lodgepole Pine (MSR 1650 f & higher)	0.46	235
Hem, Fir, Redwood (close grain)	0.43	212
Hem, Fir (North)	0.46	235
Southern Pine	0.55	307
Spruce, Pine, Fir	0.42	205
Spruce Pine Fir (E of 2 million psi and higher grades of MSR and MEL)	0.50	266

Sources: American Wood Council, NDS 2005, Table 11.2A, 11.3.2A.

Notes: (1) Thread must be embedded in the side grain of a rafter or other structural member integral with the building structure.
(2) Lag bolts must be located in the middle third of the structural member.
(3) These values are not valid for wet services.
(4) This table does not include shear capacities. If necessary, contact a local engineer to specify lag bolt size with regard to shear forces.
(5) Install lag bolts with head and washer flush to surface (no gap). Do not over-torque.
(6) Withdrawal design values for lag screw connections shall be multiplied by applicable adjustment factors if necessary. See Table 10.3.1 in the American Wood Council NDS for Wood Construction.

**5/16" shaft, per inch thread depth (Use flat washers with lag screws).*

Blodgett Engineering, LLC
W169 N 10815 Redwood Lane
Germantown, WI
262-293-9923

JOB TITLE Arch Electric - Astor Apartments

JOB NO. _____ SHEET NO. _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____

Wind Loads - MWFRS h≤60' (Low-rise Buildings) except for open buildings

Kz = Kh (case 1) = 0.70
Base pressure (qh) = **20.2 psf**
GCpi = +/-0.18

Edge Strip (a) = 3.6 ft
End Zone (2a) = 7.2 ft
Zone 2 length = 18.0 ft

Wind Pressure Coefficients

Surface	CASE A GCpf	CASE A θ = 45 deg w/-GCpi	CASE A w/+GCpi		CASE B GCpf	CASE B w/-GCpi	CASE B w/+GCpi
1	0.56	0.74	0.38		-0.45	-0.27	-0.63
2	0.21	0.39	0.03		-0.69	-0.51	-0.87
3	-0.43	-0.25	-0.61		-0.37	-0.19	-0.55
4	-0.37	-0.19	-0.55		-0.45	-0.27	-0.63
5					0.40	0.58	0.22
6					-0.29	-0.11	-0.47
1E	0.69	0.87	0.51		-0.48	-0.30	-0.66
2E	0.27	0.45	0.09		-1.07	-0.89	-1.25
3E	-0.53	-0.35	-0.71		-0.53	-0.35	-0.71
4E	-0.48	-0.30	-0.66		-0.48	-0.30	-0.66
5E					0.61	0.79	0.43
6E					-0.43	-0.25	-0.61

Ultimate Wind Surface Pressures (psf)

1	14.9	7.7		-5.4	-12.7
2	7.9	0.6		-10.3	-17.5
3	-5.0	-12.3		-3.8	-11.1
4	-3.8	-11.1		-5.4	-12.7
5				11.7	4.4
6				-2.2	-9.5
1E	17.5	10.3		-6.0	-13.3
2E	9.1	1.8		-17.9	-25.2
3E	-7.1	-14.3		-7.1	-14.3
4E	-6.0	-13.3		-6.0	-13.3
5E				15.9	8.7
6E				-5.0	-12.3

ASD
× √0.6
= 13.55 psf
× √0.6
= 19.52 psf

Parapet

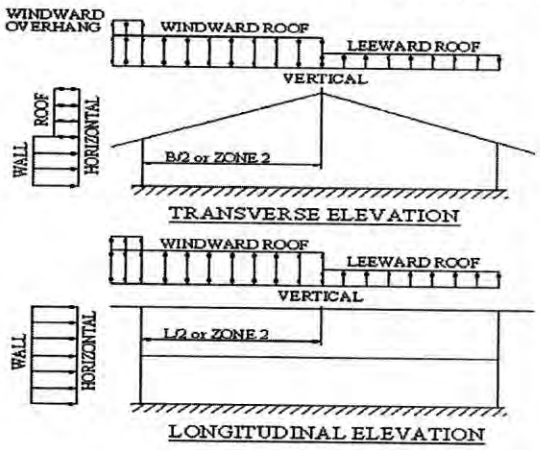
Windward parapet = 32.1 psf (GCpn = +1.5)
Leeward parapet = -21.4 psf (GCpn = -1.0)

Windward roof overhangs = 14.1 psf (upward) add to windward roof pressure

Horizontal MWFRS Simple Diaphragm Pressures (psf)

Transverse direction (normal to L)
Interior Zone: Wall 18.8 psf
Roof 12.9 psf
End Zone: Wall 23.6 psf
Roof 16.1 psf

Longitudinal direction (parallel to L)
Interior Zone: Wall 13.9 psf
End Zone: Wall 21.0 psf



BLODGETT ENGINEERING LLC
STRUCTURAL CONSULTING ENGINEERS
W169 N10815 Redwood Lane
Germantown, WI 53022
blodgetteng@wi.rr.com
Tel/Fax: 262.293.9923

JOB Arch Electric: 1334 - APARTMENTS
SHEET NO. _____ OF _____
CALCULATED BY _____ DATE _____

BUILT: 1929: APARTMENTS

ROOF = 50' x 40' (APPROX)

ORIGINAL SNOW LOADS:

$P_g = 30$ psf $= P_f$

(NO REDUCTIONS)

CURRENT SNOW LOADS:

$P_g = 30$ psf

$P_f = 0.7 C_e C_t I P_g = 21$ psf

NET Δ SNOW $= 30 - 21 = 9$ psf - CAPACITY

SOLAR ARRAY WT = 5.79 psf (INCLUDES BALLAST)

USE 2.5 psf FOR ARRAY ONLY (NO BALLAST) ∴ $9 - 2.5 = 6.5$ psf

BALLAST CAPACITY / JOIST $= 6.5$ psf $\times 1.33' \times 40' = 346.58$ # FOR BALLAST

BALLAST BRICKS = 32#

TOTAL BRICKS AT WORST CASE $= 3+3+1+3+1+3+2 = 16$

16×32

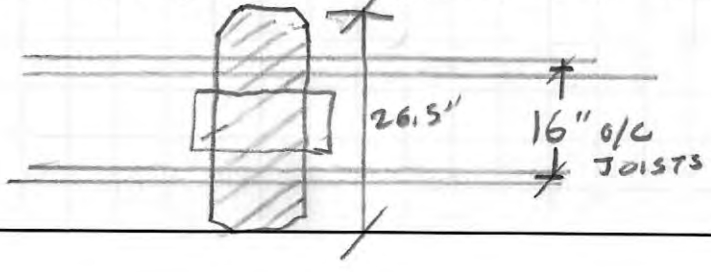
512 #

MAX BALLAST IN A ROW = 10.83 BRICKS ON A SINGLE JOIST

∴ PLACE FEET OVER 2 JOISTS:

MAX BALLAST = 21.66 BRICKS ON 2 JOISTS ⇒ OK

ECO FOOT BASE MEASURES: 26.5" x 18.25"



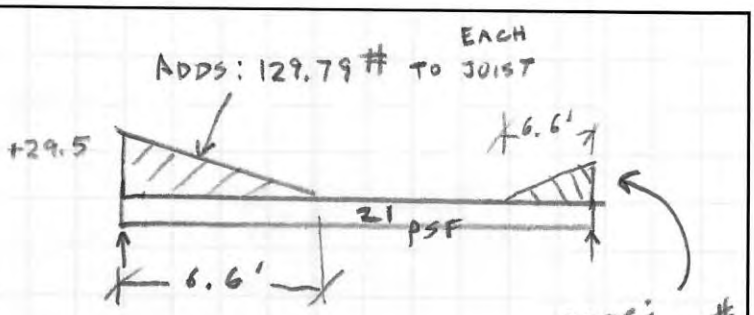
BLODGETT ENGINEERING LLC
STRUCTURAL CONSULTING ENGINEERS
W169 N10815 Redwood Lane
Germantown, WI 53022
blodgetteng@wi.rr.com
Tel/Fax: 262.293.9923

JOB_____

SHEET NO._____ OF _____

CALCULATED BY_____ DATE_____

JOIST CHECK W/ DRIFT AND SOLAR:



BALLAST CAPACITY OF 2 JOISTS

$346.58 - 129.79 - 48.84 = 167.9 \times 2 = \frac{335.90\ \#}{32} = 10.5$ BLOCKS

$10.5 \geq 9.0$ BLOCKS

X EAST/WEST ROW OF ARRAY WORKS W/ SNOW DRIFTS FROM EAST + WEST ⇒ O.K.

* STAY OUT OF NORTH AND SOUTH DRIFT ZONE

Blodgett Engineering, LLC
W169 N 10815 Redwood Lane
Germantown, WI
262-293-9923

JOB TITLE Arch Electric - Astor Apartments

JOB NO. _____ SHEET NO. _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____

Snow Loads : ASCE 7-10

Nominal Snow Forces

Roof slope	=	1.2 deg
Horiz. eave to ridge dist (W)	=	10.0 ft
Roof length parallel to ridge (L)	=	10.0 ft
Type of Roof		Monoslope
Ground Snow Load	Pg =	30.0 psf
Risk Category	=	II
Importance Factor	I =	1.0
Thermal Factor	Ct =	1.00
Exposure Factor	Ce =	1.0
Pf = 0.7*Ce*Ct*I*Pg	=	21.0 psf
Unobstructed Slippery Surface		no
Sloped-roof Factor	Cs =	1.00
Balanced Snow Load	=	**21.0 psf**
Rain on Snow Surcharge Angle		0.20 deg
Code Maximum Rain Surcharge		5.0 psf
Rain on Snow Surcharge	=	0.0 psf
Ps plus rain surcharge	=	21.0 psf
Minimum Snow Load	Pm =	20.0 psf
Uniform Roof Design Snow Load	=	**21.0 psf**

Near ground level surface balanced snow load = **30.0 psf**

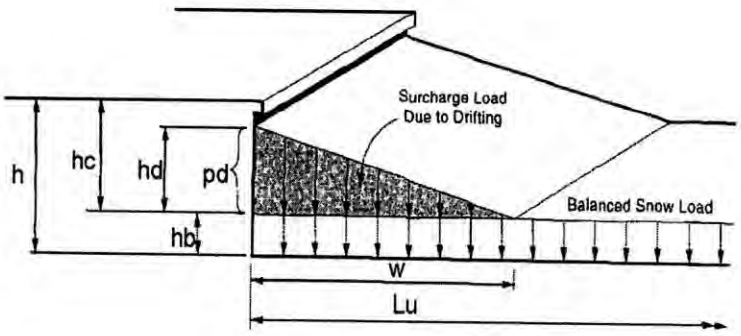
NOTE: Alternate spans of continuous beams shall be loaded with half the design roof snow load so as to produce the greatest possible effect - see code for loading diagrams and exceptions for gable roofs..

Windward Snow Drifts 1 - Against walls, parapets, etc

Upwind fetch	lu =	50.0 ft
Projection height	h =	2.0 ft
Snow density	g =	17.9 pcf
Balanced snow height	hb =	1.17 ft
	hd =	1.86 ft
	hc =	0.83 ft
hc/hb >0.2 = 0.7	**Therefore, design for drift**	
Drift height (hc)	=	0.83 ft
Drift width	w =	6.61 ft
Surcharge load:	pd = γ*hd =	**14.8 psf**
Balanced Snow load:	=	21.0 psf
		35.8 psf

Windward Snow Drifts 2 - Against walls, parapets, etc

Upwind fetch	lu =	40.0 ft
Projection height	h =	10.0 ft
Snow density	g =	17.9 pcf
Balanced snow height	hb =	1.17 ft
	hd =	1.65 ft
	hc =	8.83 ft
hc/hb >0.2 = 7.5	**Therefore, design for drift**	
Drift height (hd)	=	1.65 ft
Drift width	w =	6.59 ft
Surcharge load:	pd = γ*hd =	**29.5 psf**
Balanced Snow load:	=	21.0 psf
		50.5 psf



Blodgett Engineering, LLC
W169 N 10815 Redwood Lane
Germantown, WI
262-293-9923

JOB TITLE Arch Electric - Astor Apartments
JOB NO. _____ SHEET NO. _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____

Snow Loads - from adjacent building or roof:

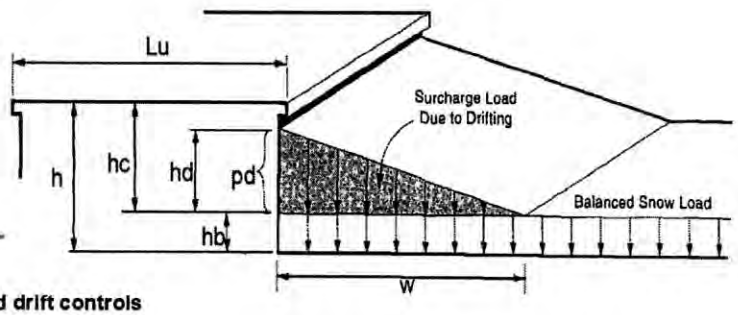
ASCE 7-10 — Nominal Snow Forces

		Higher Roof	Lower Roof
Roof slope	=	1.2 deg	0.25 / 12 = 1.2 deg
Horiz. eave to ridge dist (W)	=	10.0 ft	40.0 ft
Roof length parallel to ridge (L)	=	10.0 ft	50.0 ft
Projection height (roof step) h	=		10.0 ft
Building separation s	=		0.0 ft
Type of Roof		Monoslope	Monoslope
Ground Snow Load	Pg =	30.0 psf	30.0 psf
Risk Category	=	II	II
Importance Factor	I =	1.0	1.0
Thermal Factor	Ct =	1.00	1.00
Exposure Factor	Ce =	1.0	1.0
Pf = 0.7*Ce*Ct*I*Pg	=	21.0 psf	21.0 psf
Unobstructed Slippery Surface		no	no
Sloped-roof Factor	Cs =	1.00	1.00
Balanced Snow Load	**Ps =**	**21.0 psf**	**21.0 psf**
Rain on Snow Surcharge Angle		0.20 deg	0.80 deg
Code Maximum Rain Surcharge		5.0 psf	5.0 psf
Rain on Snow Surcharge	=	0.0 psf	0.0 psf
Ps plus rain surcharge	=	21.0 psf	21.0 psf
Minimum Snow Load	Pm =	20.0 psf	20.0 psf
Uniform Roof Design Snow Load	=	**21.0 psf**	**21.0 psf**
Building Official Minimum	=		

NOTE: Alternate spans of continuous beams and other areas shall be loaded with half the design roof snow load so as to produce the greatest possible effect - see code.

Leeward Snow Drifts - from adjacent higher roof

Upper roof length	lu =	10.0 ft
Snow density	γ =	17.9 pcf
Balanced snow height	hb =	1.17 ft
	hc =	8.83 ft
hc/hb >0.2 = 7.5	**Therefore, design for drift**	
Adj structure factor	=	1.00
Drift height (hd)	=	1.44 ft
Drift width	w =	5.74 ft
Surcharge load:	pd = γ*hd =	**25.7 psf**
Balanced Snow load:	=	21.0 psf
		46.7 psf **Windward drift controls**



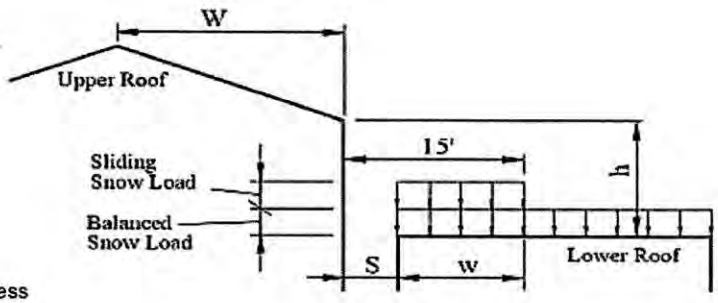
Windward Snow Drifts - from low roof against high roof

Lower roof length	lu =	32.0 ft
Adj structure factor	=	1.00
Drift height	hd =	1.45 ft
Drift width	w =	5.80 ft
Surcharge load:	pd = γ*hd =	**26.0 psf**
Balanced Snow load:	=	21.0 psf
		47.0 psf

Sliding Snow - onto lower roof

Sliding snow = 0.4 Pf W =	0.0 plf
Distributed over 15 feet =	0.0 psf
hd + hb =	1.17 ft
hd + hb < =h therefore sliding snow =	**0.0 psf**
Balanced snow load =	21.0 psf
Uniform snow load =	21.0 psf

Sliding snow not required since upper roof slope is 1/4 in 12 or less



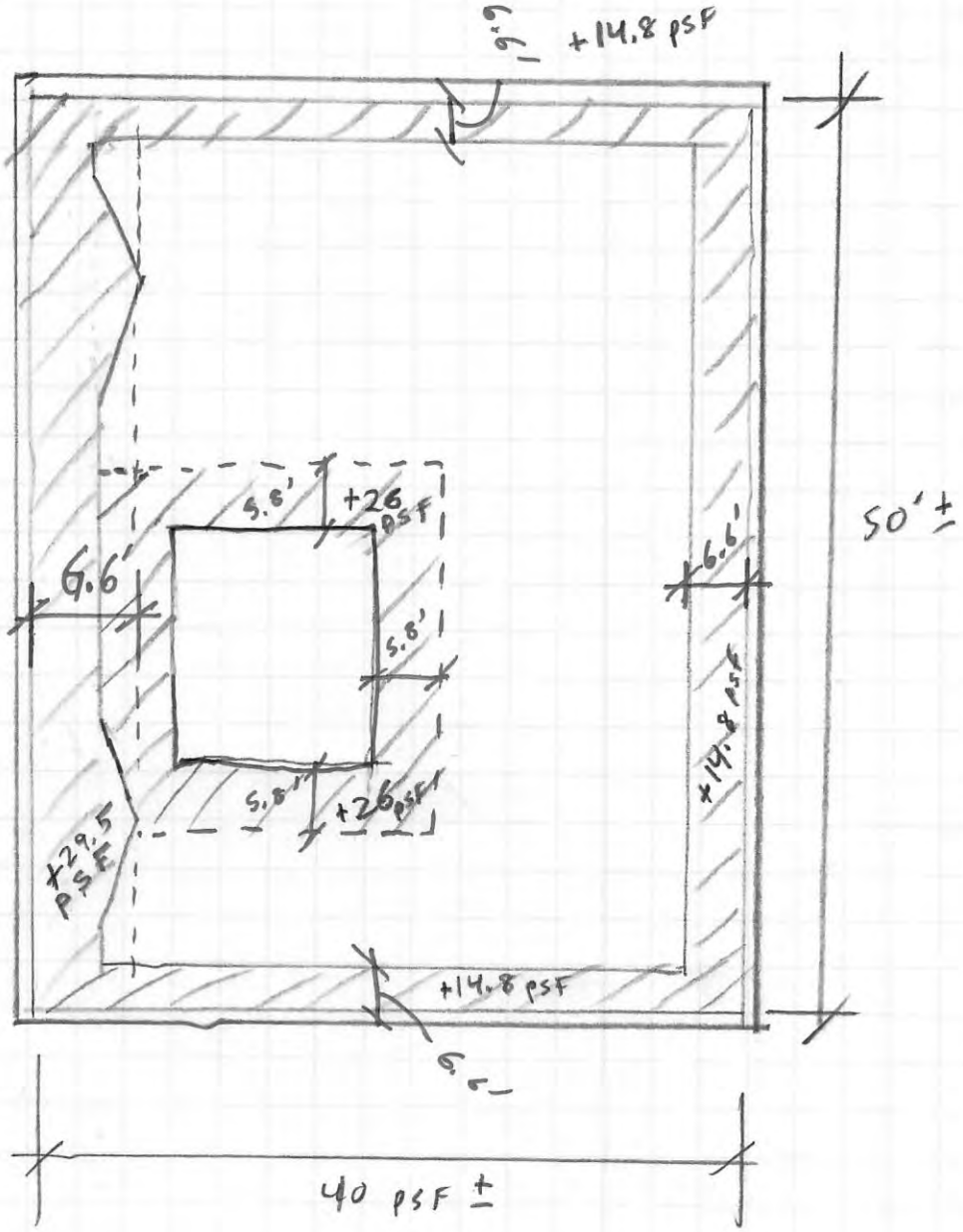
BLODGETT ENGINEERING LLC
STRUCTURAL CONSULTING ENGINEERS
W169 N10815 Redwood Lane
Germantown, WI 53022
blodgetteng@wi.rr.com
Tel/Fax: 262.293.9923

JOB _____

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

DRIFT ZONES:



APARTMENTS ROOF
W/ SNOW DRIFT

N

NOTES: AVOID NORTH AND SOUTH DRIFT ZONES

EcoDesigner Report

1929 CONSTRUCTION

PROJECT SUMMARY

Name:	1342 N Astor St
Address:	1342 N Astor St
	Milwaukee, WI 53202
Prepared By:	Justin Van Camp
	Arch Electric
	justin@archelec.com
	9205454430

SYSTEM OVERVIEW

System Size:	8.880 kW	Module Mfr:	Philadelphia Solar
Product:	EcoFoot2+	Module Model:	PS-M72-370
Annual Production:	10.435 kWh	Modules Quantity:	24
Module Tilt:	10°		

DESIGN CRITERIA

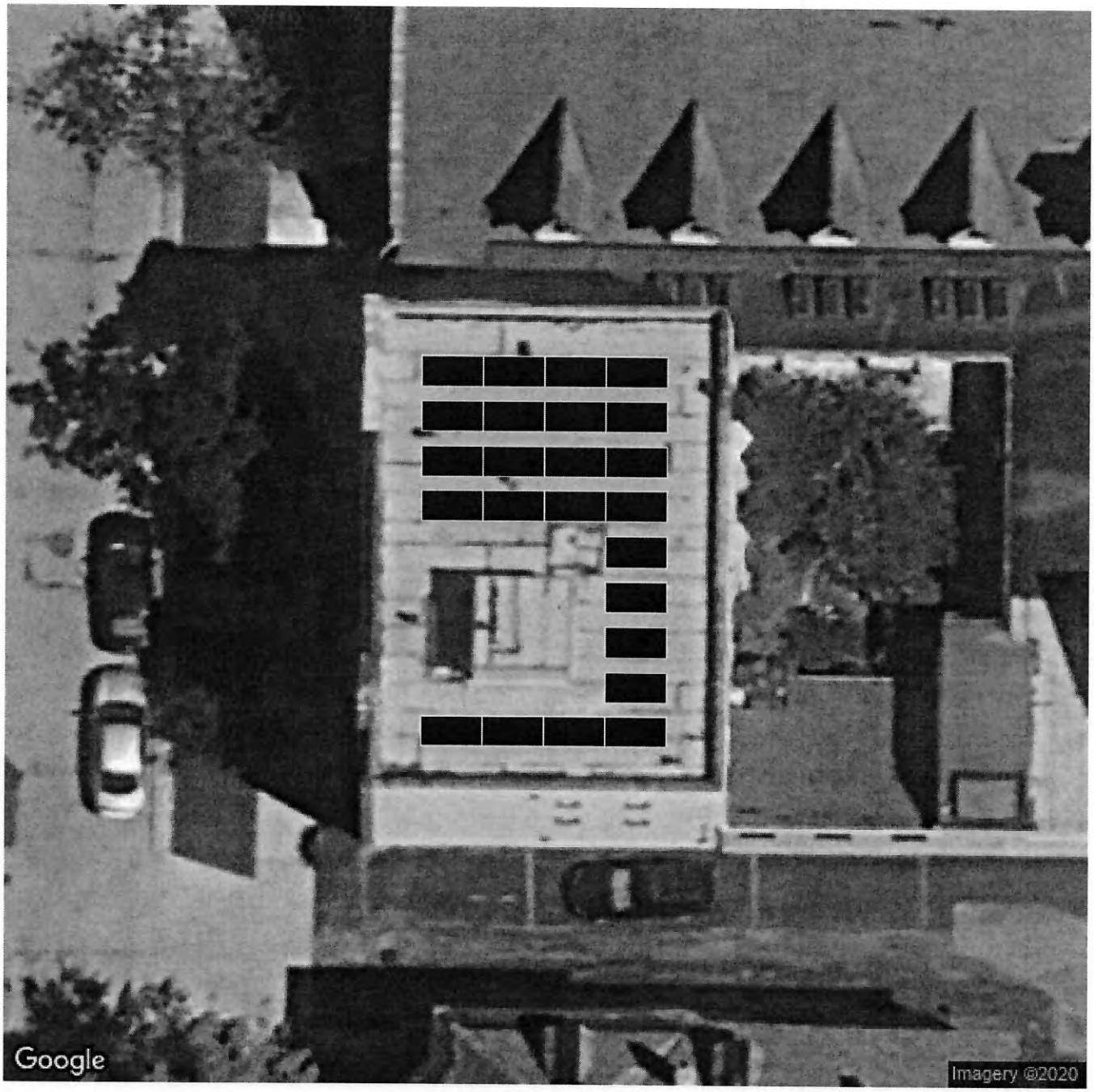
Wind Exposure:	B	Seismic (S_s):	0.09
Wind Speed:	100 mph	Soil Site Class:	D
Ground Snow Load:	30 psf	ASCE 7 Version:	2010
Ballast Block Weight:	32.00 lbs	Rick Category:	II

ROOF DETAILS

Roof Name:	Roof 1	Roof Height:	35.00'
Product:	EcoFoot2+	Roof Azimuth:	180°, 270°
Tilt Angle:	10°	Roof Material:	EPDM Membrane
Inter-row Spacing:	18.90"	Parapet Height:	36"
Array Azimuth:	180°	Roof Slope:	1°
Array Setback:	36"	Skewed Array:	No

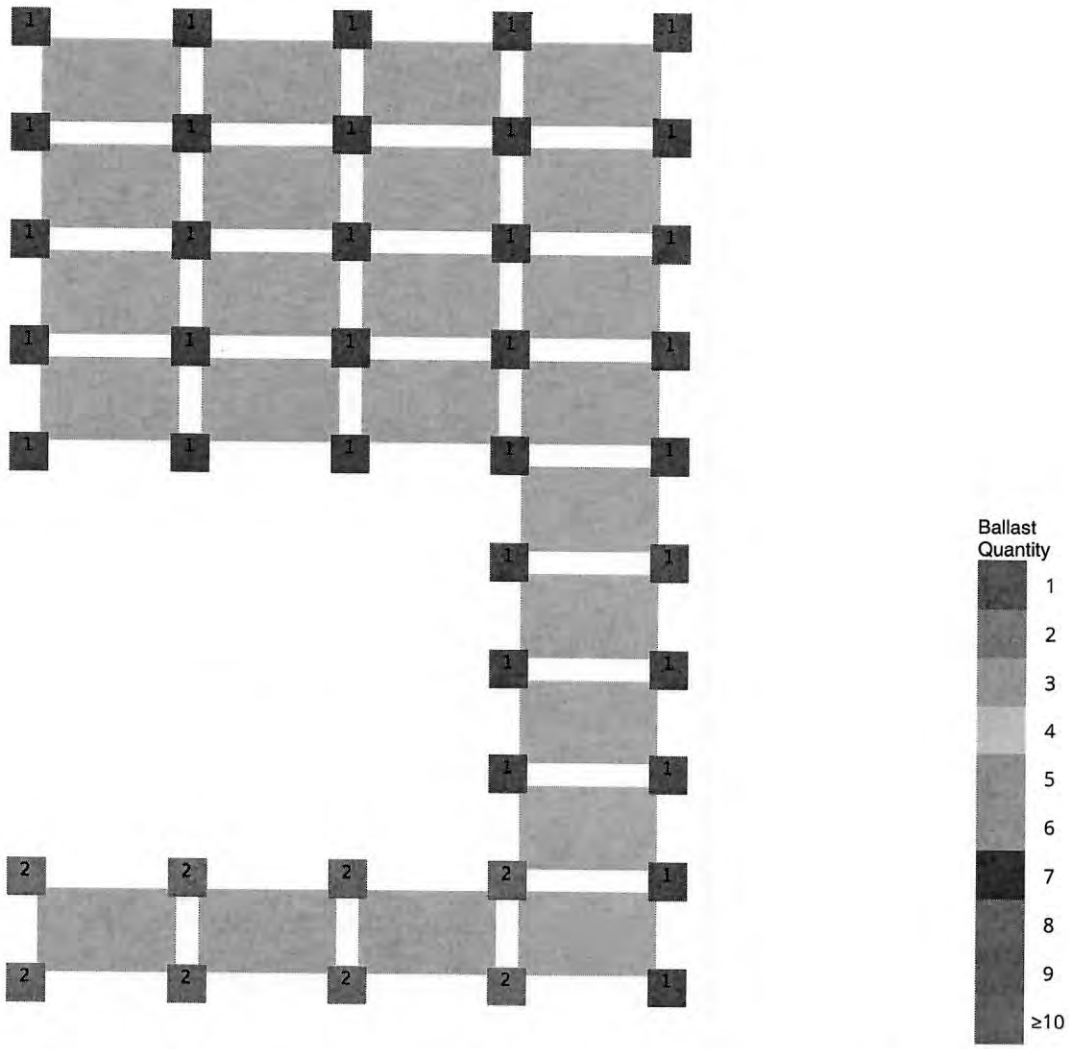
BILL OF MATERIAL

Part	Description	Quantity
ECO-002_207	EcoFoot2+ Base	41
ES10466	EcoFoot Universal Clamp Kit	33
ECO-002_311C	EcoFoot2+ 82" Wind Deflector	24
	Ballast Block Estimate	49
ES10493	EcoFoot Universal Clamp Kit w/ Power Accessory Mount	0
ES10378	38" Bonding Jumpers	8


Google
Imagery ©2020

Ecolibrium Solar

Roof 1 Array 1



NOT FOR CONSTRUCTION: Ballast Layout and Array Specifications are preliminary estimates. Please contact Sales@EcolibriumSolar.com for final ballast design prior to installation.

ARRAY SPECIFICATIONS

Height:	35 '	Array Sq. Ft:	745 sq.ft
Skewed:	No	Array Weight:	3,067.683 lb
Created:	January 02, 2020 09:42 PM	Array lbs/sq. ft:	4.12 lb/sq.ft
Mounting:	EcoFoot 2+	Ballast Block Weight:	32.000 lb
Modules:	Philadelphia Solar PS-M72-370	Ballast Blocks Qty:	49

BALLAST = 49 x 32 = 1568 #

ARRAY − BALLAST = 3067.6 − 1568 = 1499.6

ARRAY ONLY → $\frac{1499}{745} = 2.0$ PSF

EcoDesigner Report

Ecolibrium Solar

ARRAY BILL OF MATERIALS

Part	Description	Quantity
ECO-002_207	EcoFoot2+ Base	41
ES10466	EcoFoot Universal Clamp Kit	33
ECO-002_311C	EcoFoot2+ 82" Wind Deflector	24
ES10493	EcoFoot Universal Clamp Kit w/ Power Accessory Mount	0
ES10378	38" Bonding Jumpers	8
	Ballast Block Estimate	49