



Town of Haymarket
 15000 Washington Street, #100
 Haymarket, VA 20169
 703-753-2600

Lydia Schauss
Town Planner

MEMORANDUM

TO: Architectural Review Board
 FROM: Lydia M. Schauss
 DATE: March 12, 2026
 SUBJECT: ZP #2026-008, Installation of Roof Mounted Solar Panels at 6515 Crossroads Village Blvd

APPLICATION SUMMARY:

Business/Applicant: Fusion Solar Services
 Street Address: 6515 Crossroads Village Blvd, Haymarket Va 20169
 Proposed Alteration: Solar Panel and Universal Wall Charger Installation
 Applicant’s Brief Description of the Activity: Installation of a 48-panel, 20.64kW roof mounted solar (PV) system. Install one Universal Wall Charger.

The applicant will be installing 20.64kW Solar Photovoltaic System; modifications will include microinverters located under and hidden by the solar modules. Use “triple-black” (black frames, black back sheets, black cells) solar modules.

Town Planner Assessment		
Zoning Ordinance	Application Details	Staff Response
Sec. 58-16.8 Matters to be considered by board in acting on appropriateness of erection, reconstruction, alteration, restoration or demolition of building or structure.	Installation of a 48 panel, 20.64kW roof mounted solar (PV) system. (1) Tesla Universal Wall Connector.	The proposed alteration is visible from the public right of way. The Board shall consider the new roof mounted solar panels installation.
Sec. 58-16.8 (1) Exterior architectural features, including all signs, which are subject to public view from a public street, way or place.	Installation of a 48 panel, 20.64kW roof mounted solar (PV) system. (1) Tesla Universal Wall Connector.	The proposed alteration is visible from the public right of way. The Board shall consider the new roof mounted solar panels installation.
Sec. 58-16.8 (2) General Design Arrangement	Installation of a 48 panel, 20.64kW roof mounted solar (PV) system. (1) Tesla Universal Wall Connector.	The roof mounted solar panels will be flush to the roof and utilize microinverters hidden by the panels, the panels will be “triple black.”
Sec. 58-16.8 (3) Texture, material and color	Installation of a 48 panel, 20.64kW roof mounted solar	The solar modules consist of triple-black photovoltaic panels with

	(PV) system. (1) Tesla Universal Wall Connector.	tempered glass with anti-reflective coating. The new panels will be a triple black color. The frames are devised from anodized aluminum alloy.
Sec. 58-16.8 (4) The relation of the factors, subsections (1), (2), and (3) of this section, to similar features of the buildings and structures in the immediate surroundings	Installation of a 48 panel, 20.64kW roof mounted solar (PV) system. (1) Tesla Universal Wall Connector.	The installation closely matches the existing roof surface. Therefore, the system blends with the roof plane rather than contrasting and pulling attention from surrounding homes.
Sec. 58-16.8 (5) The extent to which the building or structure would be harmonious with or obviously incongruous with the old and historic aspect of the surroundings	Installation of a 48 panel, 20.64kW roof mounted solar (PV) system. (1) Tesla Universal Wall Connector.	The purposed solar installation incorporates renewable energy in manner that minimizes visual impact on the historic character of the surrounding Town property.
Sec. 58-16.8 (6) In the case of a building to be razed, a primary consideration will be the extent to which its continued existence would tend to protect irreplaceable historic places and preserve the general historic atmosphere of the Town	Not applicable	Not applicable
Sec. 58-16.8 (7) The extent to which the building or structure will promote the general welfare of the Town, and all citizens, by the preservation and protection of historic places and areas	Installation of a 48 panel, 20.64kW roof mounted solar (PV) system. (1) Tesla Universal Wall Connector.	Not applicable
Sec. 58-16.8 (8) The extent to which the building or structure will promote the general welfare by: (a) Maintaining and increasing real estate values (b) Generating business (c) Creating new positions (d) Attracting tourists, students, writers, historians, artists and artisans, and new residents	Installation of a 48 panel, 20.64kW roof mounted solar (PV) system. (1) Tesla Universal Wall Connector.	These matters are at the discretion of the ARB.

(e) Encouraging study of and interest in American history		
(f) Stimulating interest in and study of architecture and design		
(g) Educating citizens in American culture and heritage		
(h) Making the Town a more attractive and desirable place in which to live		
Comprehensive Plan		
Comp Plan 1.5.3 Historic Resource Inventory List	Site – 6515 Crossroads Village Blvd	The main structure/site IS NOT listed as a Historic Resource
Comp Plan 1.5.4 Potential Archaeological Site	Site – 6515 Crossroads Village Blvd	The site IS NOT one of those listed as a potential archaeological site in the Comprehensive Plan
Architectural Review Board Historic Guidelines		
I. Introduction (E) Community Design and the Comprehensive Plan	Site – 6515 Crossroads Village Blvd	Commercial Property
II. Streetscape and Site Design		
II. (a) Washington Street Enhancement Project	Not applicable	Not applicable
II. (b) Streetscapes Other Than Washington Street	Not applicable	Not applicable
II. (c) Fences and Walls		
II. (d) Lighting (Free Standing/Posts)	Not Applicable	Not Applicable
II. (e) Telecommunication Dishes, Drums and Towers	Not Applicable	Not Applicable
II. (f) Screening	Not Applicable	Not Applicable
III. New Construction and Additions to Existing Non-Historic and Non-Contributing Structures		
III. (a) General Guidelines	<i>“To create a more pleasing blend of historic and new elements in the Town, new structures shall be compatible with the prevailing and recognized historic architectural character of the existing adjacent structures”</i>	These matters are at the discretion of the ARB
III. (b) Colors	Triple Black	All elements are acceptable within the Town’s Zoning Ordinance
III. (c) Exterior Elements	Installation of a 48 panel, 20.64kW roof mounted solar	All elements are acceptable within the ARB Guidelines and the Town’s Zoning Ordinance.

	(PV) system. (1) Tesla Universal Wall Connector.	
III. (d) Chimneys	Not Applicable	Not Applicable
III. (e) Roofing	Installation of a 48 panel, 20.64kW roof mounted solar (PV) system.	All elements are acceptable within the ARB Guidelines and the Town’s Zoning Ordinance.
III. (f) Lighting, (attached to structure)	Not Applicable	Not Applicable
III. (g) Windows and Doors	Not Applicable	Not Applicable
III. (h) Decks	Not Applicable	Not Applicable
III. (i) Handicapped Ramps	Not Applicable	Not Applicable
III. (j) Awnings	Not Applicable	Not Applicable
IV. Guidelines for Alterations or Additions to Historic Structures or Contributing Structures		
IV. (a) General Guidelines	Not Applicable	Not Applicable
V. Signage	Not Applicable	Not Applicable, not historic or contributing
VI. Demolition Guidelines	Not Applicable	Not Applicable
VII. Situations Not Covered, Additional Requirements	Not Applicable	Not Applicable

Discussion:

ARB shall discuss the design, placement, and color palette of the proposed roof mounted solar panel system.

STAFF RECOMMENDATION:

Based on the application submitted, the rendering provided, and additional information received from the applicant, the Zoning Administrator recommends the approval of the Certificate of Appropriateness for 6515 Crossroads Village Blvd.

The roof-mounted solar panels are a welcome improvement to the structure providing architectural interest. The new panel triple-black color is in keeping with the zoning ordinance color palette and will not hinder the aesthetics of the structure.

Draft Motion: I move the Architectural Review Board approve ZP #2026-008, Installation of Roof Mounted Solar Panels at 6515 Crossroads Village Blvd. The approval includes the following details: the installation of the 48-panel, 20.64kW roof mounted solar system and (1) Tesla Universal Wall Connector as shown in the submitted plans and renderings.

Or alternate motion.



ZONING PERMIT APPLICATION

ZONING PERMIT #: 2026-008

NOTE: This application must be filled out completely and all components of submission requirements must be met before the application can be accepted and scheduled for review/hearing.

ZONING ACTIVITY: New Construction Alteration/Repair Addition Sign (See Spec sheet)
(Check all that apply) New Tenant/Use Change of Use Relocation

NAME OF BUSINESS/APPLICANT: Fusion Solar Services

PROPOSED USE: Commerical Size (Sq. Ft./Length) of Construction: 1257

SITE ADDRESS: 6515 Crossroads Village Bld, Haymarket20169 Parcel ID #: 7298-81-0546.

Subdivision Name: Crossroad Village Center Lot Size: _____

ZONING DISTRICT: R-1 R-2 B-1 B-2 I-1

C-1 Special Use Permit Required: Yes No Site Plan Required: Yes No

Off-Street Parking: Spaces Required: _____ Spaces Provided: _____

BRIEF DESCRIPTION OF ACTIVITY: (i.e. previous use, height/length of fencing, deck specs, etc.)

Install (48) Roof Mounted Solar Panels. System Size 20.64kw Install (1) Universal Wall Charger

Supporting Documentation (attached): Narrative Plan/Plat Specification Sheet

FEE: \$50.00 Residential \$100.00 Commercial

CERTIFICATE OF APPROPRIATENESS

ADDITIONAL DESCRIPTION: (i.e. color, type of material, font style, etc. See Sign Spec Sheet for Signage detail)

Supporting Documentation (attached): Specification Sheet Photograph(s)

PERMIT HOLDER INFORMATION		PROPERTY OWNER INFORMATION	
Fusion Solar Services		Hassan Saeed	
Name		Name	
3600 Commerce Drive		6515 Crossroads Village Boulevard	
Address		Address	
Baltimore Maryland 21227		Haymarket, VA, 20169	
City	State	City	State
4434253023	permits@fusionss.net	440-463-7364	jonsnowar@icloud.com
Phone#	Email	Phone#	Email

APPLICANT / PROPERTY OWNER SIGNATURE

*******REQUIRED*******

I, as owner or authorized agent for the above-referenced parcel, do hereby certify that I have the authority to make the foregoing application and that the information provided herein is correct. Construction of improvements described herein and as shown on the attached plat, plan and/or specifications will comply with the ordinances of the Town of Haymarket and any additional restrictions and/or conditions prescribed by the Architectural Review Board (ARB), Planning Commission or the Town Council and all other applicable laws.

Ola Carew
box SIGN 427XYL51-4P2XKXKK

Applicant Signature

Hassan Saeed
box SIGN 4Q3ZX5L9-4P2XKXKK

Property Owner Signature

*****OFFICE USE ONLY*****

Date Filed: _____ Fee Amount: _____ Date Paid: _____

DATE TO ZONING ADMINISTRATOR: _____

APPROVED DISAPPROVED TABLED UNTIL: _____ DEFERRED UNTIL: _____

SIGNATURE

PRINT

CONDITIONS:

DATE TO ARCHITECTURAL REVIEW BOARD (ARB): _____

APPROVED DISAPPROVED TABLED UNTIL: _____ DEFERRED UNTIL: _____

SIGNATURE

PRINT

CONDITIONS:

DATE TO TOWN COUNCIL (IF APPLICABLE): _____

APPROVED DISAPPROVED TABLED UNTIL: _____ DEFERRED UNTIL: _____

TOWN COUNCIL {where required):

SIGNATURE

PRINT

CONDITIONS:

INSTRUCTIONS FOR COMPLETING APPLICATION

In addition to applying for a Certificate of Appropriateness, the applicant is responsible for obtaining any other required permits and approvals applicable to the project.

1. Provide name, phone number, and email address of business or individual requesting approval for proposed work. If different from property owner, please provide contact information for property owner as well.
2. Indicate site address
3. Indicate mailing address of applicant and owner (if different).
4. Describe in detail work proposed and then attach all required and any additional documentation or material that will describe the project in detail to the reviewing authority. Adequate documentation must be provided. Applicant should provide any necessary item(s), in addition to the items listed on the checklist below.

Check List

Signs/Fences/New Building/Additions/Remodel

The Completed application must be submitted to the Town Clerk's office no later than 4:30pm one week prior to the meeting date.

- 1) One copy of the Plat-showing location of sign/fence/addition on the façade or grounds
- 2) Photograph of the existing structure and closest neighboring structures
- 3) Photograph/drawings, including measurements, of the proposed change
- 4) Material specifications
- 5) Color/material samples
- 6) Description of method of mounting and description of hardware to be used
- 7) Landlord/HOA approval letter where indicated
- 8) Copy of business or occupational license if contractor has designed or will install
- 9) Narrative, if special requests or exceptions to the ARB Guidelines are being requested.
- 10) Applicant or a representative **must** be present at the ARB meeting, on the scheduled Wednesday of every month at 7:00pm. If a representative is not present at the meeting to answer any questions that may arise, your application may be deferred or denied until the next regularly scheduled meeting. Please check the Town's website for a list of the Town's scheduled meetings. It is the applicant's responsibility to keep apprised of the Town's meeting schedule.
- 11) If an interpreter is required, the applicant needs to bring one with them.

Please mail application and all applicable information and materials to:

**Town of Haymarket
15000 Washington Street, Suite 100
Haymarket, VA 20169**

SIGN SPECIFICATION SHEET

SIGN 1:

Type of Sign: Wall Hanging Freestanding Menu Individual Letter Window
Other _____

Height above Ground at Signs: Lower Edge: _____ Upper Edge: _____

Height of Sign Structure: _____ Sign Width: _____ Length: _____ Area in Sq Ft: _____

Number of Faces: _____ Sign Material/Color/Font: _____

Location of Sign (Include photo): _____

Lighting Type/Fixture (No internal illumination is allowed): _____

SIGN 2:

Type of Sign: Wall Hanging Freestanding Menu Individual Letter Window
Other _____

Height above Ground at Signs: Lower Edge: _____ Upper Edge: _____

Height of Sign Structure: _____ Sign Width: _____ Length: _____ Area in Sq Ft: _____

Number of Faces: _____ Sign Material/Color/Font: _____

Location of Sign (Include photo): _____

Lighting Type/Fixture (No internal illumination is allowed): _____

SIGN 3:

Type of Sign: Wall Hanging Freestanding Menu Individual Letter Window
Other _____

Height above Ground at Signs: Lower Edge: _____ Upper Edge: _____

Height of Sign Structure: _____ Sign Width: _____ Length: _____ Area in Sq Ft: _____

Number of Faces: _____ Sign Material/Color/Font: _____

Location of Sign (Include photo): _____

Lighting Type/Fixture (No internal illumination is allowed): _____

SIGN 4:

Type of Sign: Wall Hanging Freestanding Menu Individual Letter Window
Other _____

Height above Ground at Signs: Lower Edge: _____ Upper Edge: _____

Height of Sign Structure: _____ Sign Width: _____ Length: _____ Area in Sq Ft: _____

Number of Faces: _____ Sign Material/Color/Font: _____

Location of Sign (Include photo): _____

Lighting Type/Fixture (No internal illumination is allowed): _____

FREQUENTLY ASKED QUESTIONS

1. *What projects require architectural review?*

Any project involving alterations to the exterior of an existing building, visible from public view (e.g. fences, signs, awnings, mechanical equipment, landscaping, façade changes) and the construction of new buildings, all require an architectural review.

2. *How long does the architectural review process take?*

The time required to process an application will vary depending on the size of the project. Once the application has been deemed complete, the architectural review process can take between four to eight weeks, to complete, if no changes/revisions are required by any of the reviewing body throughout the process. Vague or incomplete description of the project or failure to provide any pertinent information regarding the project will delay the review process.

3. *What does the ARB look for in a project?*

Refer to the Town of Haymarket Architectural Review Design Guidelines.

4. *What happens after I submit my application?*

After an application is submitted, a town clerk will review it for its completeness (not for the accuracy or content of the submission). If the application is incomplete, the missing materials will be required BEFORE the application can be forwarded for review. If complete, the application (and all required supporting documentation) will continue with the review process.

5. *What is the review process?*

For any submission, there are two reviewing bodies in the Town. The Zoning Administrator, and the Architectural Review Board (If applicable). All reviewing bodies in the Town meet once a month. (A schedule of all the meetings is available on our website at www.townofhaymarket.org/meetings).

6. *Is there a submission deadline?*

An application must be submitted to the Town Clerk and verified as complete one week prior to the meeting date for proper review.

7. *What happens at the ARB meeting?*

The ARB reviews any development project(s) to promote and maintain the historic architectural flavor of the Town consistent with the Town's Comprehensive Plan. The ARB reviews any proposal/project which currently or in the future could be visible from any public view.

8. *What should I present at my review?*

To facilitate a more streamlined review of an application, it is required that an applicant (or representative) be present at the meeting(s) during the review of their proposed project. A brief overview of the project, site, and architecture should be presented. Speak briefly to the design and landscaping features, parking and circulation, delivery routes/access, drainage, lighting, signage, and trash enclosures. Provide sample(s) of colors and materials. For larger development projects, you will need to be able to discuss traffic impacts.

9. *When can I submit my plans for a building permit?*

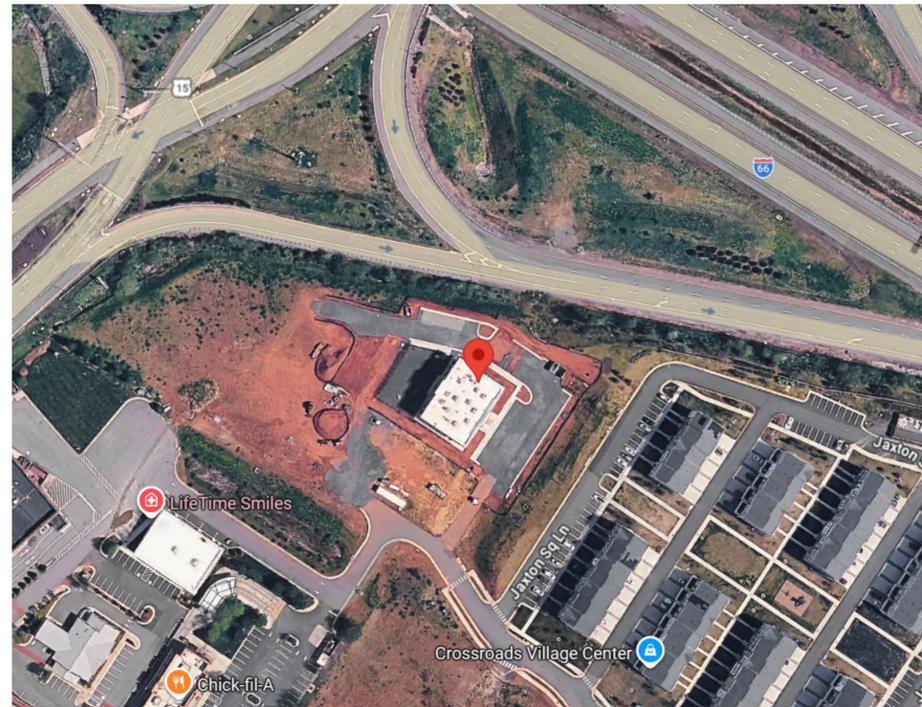
If the project is approved by all applicable Boards, the applicant can then receive their building permit (if a permit is required for the project).

GENERAL NOTES

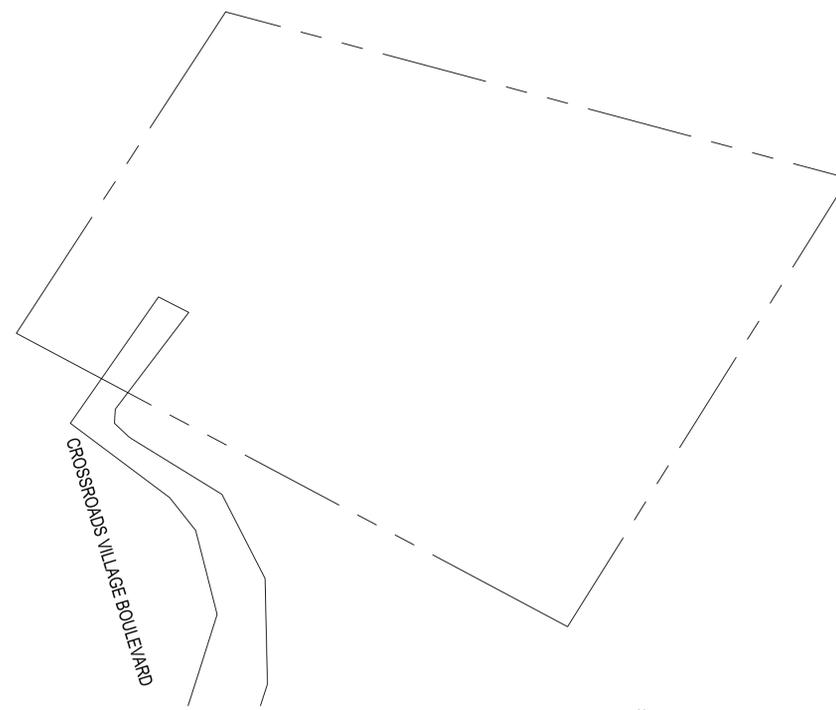
- 2.1.1 **SITE NOTES:**
- 2.1.2 A LADDER WILL BE IN PLACE FOR INSPECTION IN COMPLIANCE WITH OSHA REGULATIONS.
- 2.1.3 THE PV MODULES ARE CONSIDERED NON-COMBUSTIBLE AND THIS SYSTEM IS A UTILITY INTERACTIVE SYSTEM WITH NO STORAGE BATTERIES.
- 2.1.4 THE SOLAR PV INSTALLATION WILL NOT OBSTRUCT ANY PLUMBING, MECHANICAL, OR BUILDING ROOF VENTS.
- 2.1.5 PROPER ACCESS AND WORKING CLEARANCE AROUND EXISTING AND PROPOSED ELECTRICAL EQUIPMENT WILL BE PROVIDED AS PER SECTION NEC 110.26.
- 2.1.6 ROOF COVERINGS SHALL BE DESIGNED, INSTALLED, AND MAINTAINED IN ACCORDANCE WITH THIS CODE AND THE APPROVED MANUFACTURER'S INSTRUCTIONS SUCH THAT THE ROOF COVERING SERVES TO PROTECT THE BUILDING OR STRUCTURE.
- 2.2.1 **EQUIPMENT LOCATIONS:**
- 2.2.2 ALL EQUIPMENT SHALL MEET MINIMUM SETBACKS AS REQUIRED BY NEC 110.26.
- 2.2.3 WIRING SYSTEMS INSTALLED IN DIRECT SUNLIGHT MUST BE RATED FOR EXPECTED OPERATING TEMPERATURE AS SPECIFIED BY NEC 690.31 (A),(C) AND NEC TABLES 310.15 (B)(2)(A) AND 310.15 (B)(3)(C).
- 2.2.4 JUNCTION AND PULL BOXES PERMITTED INSTALLED UNDER PV MODULES ACCORDING TO NEC 690.34.
- 2.2.5 ADDITIONAL AC DISCONNECT(S) SHALL BE PROVIDED WHERE THE INVERTER IS NOT WITHIN SIGHT OF THE AC SERVICING DISCONNECT.
- 2.2.6 ALL EQUIPMENT SHALL BE INSTALLED ACCESSIBLE TO QUALIFIED PERSONNEL ACCORDING TO NEC APPLICABLE CODES.
- 2.2.7 ALL COMPONENTS ARE LISTED FOR THEIR PURPOSE AND RATED FOR OUTDOOR USAGE WHEN APPROPRIATE.
- 2.3.1 **STRUCTURAL NOTES:**
- 2.3.2 RACKING SYSTEM & PV ARRAY WILL BE INSTALLED ACCORDING TO CODE-COMPLIANT INSTALLATION MANUAL. TOP CLAMPS REQUIRE A DESIGNATED SPACE BETWEEN MODULES, AND RAILS MUST ALSO EXTEND A MINIMUM DISTANCE BEYOND EITHER EDGE OF THE ARRAY/SUBARRAY, ACCORDING TO RAI MANUFACTURER'S INSTRUCTIONS.
- 2.3.3 JUNCTION BOX WILL BE INSTALLED PER MANUFACTURERS' SPECIFICATIONS. IF ROOF-PENETRATING TYPE, IT SHALL BE FLASHED & SEALED PER LOCAL REQUIREMENTS.
- 2.3.4 ROOFTOP PENETRATIONS FOR PV RACEWAY WILL BE COMPLETED AND SEALED W/ APPROVED CHEMICAL SEALANT PER CODE BY A LICENSED CONTRACTOR.
- 2.3.5 ALL PV RELATED ROOF ATTACHMENTS TO BE SPACED NO GREATER THAN THE SPAN DISTANCE SPECIFIED BY THE RACKING MANUFACTURER.
- 2.3.6 WHEN POSSIBLE, ALL PV RELATED RACKING ATTACHMENTS WILL BE STAGGERED AMONGST THE ROOF FRAMING MEMBERS.
- 2.4.1 **WIRING & CONDUIT NOTES:**
- 2.4.2 ALL CONDUIT AND WIRE WILL BE LISTED AND APPROVED FOR THEIR PURPOSE. CONDUIT AND WIRE SPECIFICATIONS ARE BASED ON MINIMUM CODE REQUIREMENTS AND ARE NOT MEANT TO LIMIT UP-SIZING.
- 2.4.3 CONDUCTORS SIZED ACCORDING TO NEC 690.8, NEC 690.7.
- 2.4.4 VOLTAGE DROP LIMITED TO 1.5%.
- 2.4.5 DC WIRING LIMITED TO MODULE FOOTPRINT. MICROINVERTER WIRING SYSTEMS SHALL BE LOCATED AND SECURED UNDER THE ARRAY W/ SUITABLE WIRING CLIPS.
- 2.4.6 AC CONDUCTORS COLORED OR MARKED AS FOLLOWS:
 PHASE A OR L1- BLACK
 PHASE B OR L2- RED, OR OTHER CONVENTION IF THREE PHASE
 PHASE C OR L3- BLUE, YELLOW, ORANGE**, OR OTHER CONVENTION
 NEUTRAL- WHITE OR GREY
 IN 4-WIRE DELTA CONNECTED SYSTEMS THE PHASE WITH HIGHER VOLTAGE TO BE MARKED ORANGE [NEC 110.15].
- 2.5.1 **GROUNDING NOTES:**
- 2.5.2 GROUNDING SYSTEM COMPONENTS SHALL BE LISTED FOR THEIR PURPOSE, AND GROUNDING DEVICES EXPOSED TO THE ELEMENTS SHALL BE RATED FOR SUCH USE.
- 2.5.3 PV EQUIPMENT SHALL BE GROUNDED ACCORDING TO NEC 690.43 AND MINIMUM NEC TABLE 250.122.
- 2.5.4 METAL PARTS OF MODULE FRAMES, MODULE RACKING, AND ENCLOSURES CONSIDERED GROUNDED IN ACCORD WITH 250.134 AND 250.136(A).
- 2.5.5 EQUIPMENT GROUNDING CONDUCTORS SHALL BE SIZED ACCORDING TO NEC 690.45 AND MICROINVERTER MANUFACTURERS' INSTRUCTIONS.
- 2.5.6 EACH MODULE WILL BE GROUNDED USING WEBB GROUNDING CLIPS AS SHOWN IN MANUFACTURER DOCUMENTATION AND APPROVED BY THE AHJ. IF WEBBS ARE NOT USED, MODULE GROUNDING LUGS MUST BE INSTALLED AT THE SPECIFIED GROUNDING LUG HOLES PER THE MANUFACTURERS' INSTALLATION REQUIREMENTS.
- 2.5.7 THE GROUNDING CONNECTION TO A MODULE SHALL BE ARRANGED SUCH THAT THE REMOVAL OF A MODULE DOES NOT INTERRUPT A GROUNDING CONDUCTOR TO ANOTHER MODULE.
- 2.5.8 GROUNDING AND BONDING CONDUCTORS, IF INSULATED, SHALL BE COLORED GREEN OR MARKED GREEN IF #4 AWG OR LARGER [NEC 250.119]
- 2.5.9 THE GROUNDING ELECTRODE SYSTEM COMPLIES WITH NEC 690.47 AND NEC 250.50 THROUGH 250.106. IF EXISTING SYSTEM IS INACCESSIBLE, OR INADEQUATE, A GROUNDING ELECTRODE SYSTEM PROVIDED ACCORDING TO NEC 250, NEC 690.47 AND AHJ.
- 2.5.10 GROUND-FAULT DETECTION SHALL COMPLY WITH NEC 690.5 IN GENERAL AND

- NEC 690.5 (A)(1) SPECIFICALLY.
- 2.6.1 **DISCONNECTION AND OVER-CURRENT PROTECTION NOTES:**
- 2.6.2 DISCONNECTING SWITCHES SHALL BE WIRED SUCH THAT WHEN THE SWITCH IS OPENED THE CONDUCTORS REMAINING ENERGIZED ARE CONNECTED TO THE TERMINALS MARKED "LINE SIDE" (TYPICALLY THE UPPER TERMINALS).
- 2.6.3 DISCONNECTS TO BE ACCESSIBLE TO QUALIFIED UTILITY PERSONNEL, BE LOCKABLE, AND BE A VISIBLE-BREAK SWITCH
- 2.6.4 RAPID SHUTDOWN OF ENERGIZED CONDUCTORS BEYOND 10 FT OF PV ARRAY OR 5 FT INSIDE A BUILDING WITHIN 10 SECONDS. CONTROLLED CONDUCTORS ≤30V AND ≤240VA [NEC 690.12]. LOCATION OF LABEL ACCORDING TO AHJ.
- 2.6.5 ALL OCPD RATINGS AND TYPES SPECIFIED ACCORDING TO NEC 690.8, 690.9, AND 240.
- 2.6.6 MICROINVERTER BRANCHES CONNECTED TO A SINGLE BREAKER OR GROUPED FUSES IN ACCORDANCE WITH NEC 110.3(B).
- 2.6.7 IF REQUIRED BY AHJ, SYSTEM WILL INCLUDE ARC-FAULT CIRCUIT PROTECTION ACCORDING TO NEC 690.11 AND UL1699B.
- 2.7.1 **INTERCONNECTION NOTES:**
- 2.7.2 LOAD-SIDE INTERCONNECTION SHALL BE IN ACCORDANCE WITH [NEC 690.84 (B)]
- 2.7.3 THE SUM OF THE UTILITY OCPD AND INVERTER CONTINUOUS INPUT MAY NOT EXCEED 120% OF BUSBAR RATING [NEC 705.12(D)(2)(3)].
- 2.7.4 WHEN SUM OF THE PV SOURCES EQUALS >100% OF BUSBAR RATING, PV DEDICATED BACKFED BREAKERS MUST BE LOCATED OPPOSITE END OF THE BUS FROM THE UTILITY SOURCE OCPD [NEC 705.12(D)(2)(3)].
- 2.7.5 AT MULTIPLE PV OUTPUT COMBINER PANEL, TOTAL RATING OF ALL OVERCURRENT DEVICES SHALL NOT EXCEED AMPACITY OF BUSBAR. HOWEVER, THE COMBINED OVERCURRENT DEVICE MAY BE EXCLUDED ACCORDING TO NEC 705.12 (D)(2)(3)(C).
- 2.7.6 FEEDER TAP INTERCONNECTION (LOAD SIDE) ACCORDING TO NEC 705.12 (D)(2)(1)
- 2.7.7 SUPPLY SIDE TAP INTERCONNECTION ACCORDING TO NEC 705.12 (A) WITH SERVICE ENTRANCE CONDUCTORS IN ACCORDANCE WITH NEC 230.42
- 2.7.8 BACKFEEDING BREAKER FOR UTILITY-INTERACTIVE INVERTER OUTPUT IS EXEMPT FROM ADDITIONAL FASTENING [NEC 705.12 (D)(5)].

NEW PV SYSTEM: 20.640 kWp
HASSAN SAEED
 6515 CROSSROADS VILLAGE BOULEVARD,
 HAYMARKET, VA 20169
 ASSESSOR'S #: 7298-81-0546



01 AERIAL PHOTO
NOT TO SCALE



02 PLAT MAP
NOT TO SCALE

SYMBOL LEGEND

MAIN ENTRANCE DOOR	AUTOMATIC TRANSFER SWITCH	UTILITY METER	PROPERTY LINE
MAIN ELECTRICAL PANEL	TAP BOX	PV REVENUE METER	ROOF RAFTERS
JUNCTION BOX	GENERATOR	UTILITY POLE	MODULE STRINGING
AC DISCONNECT	MAIN SWITCHGEAR/ UTILITY METER	MODULE STRINGING	EQUIPMENT GROUND
DC/AC INVERTER	RAPID SHUTDOWN	MODULE STRINGING	CONDUIT
DC DISCONNECT	(C) COMBINER BOX	MODULE STRINGING	FIRE CLEARANCE
AC PANELBOARD	TRANSFORMER	MODULE STRINGING	

DISCLAIMER: PLEASE NOTE THAT THE ABBREVIATIONS, ANNOTATIONS, AND SYMBOLS LISTED ARE INTENDED TO ILLUSTRATE THOSE THAT ARE COMMONLY USED. NOT ALL ARE NECESSARILY UTILIZED WITHIN THIS SET OF DRAWINGS.

SHEET LIST TABLE	
SHEET NUMBER	SHEET TITLE
T-001	COVER PAGE
A-101	SITE PLAN
A-102	ELECTRICAL ROOF PLAN
A-103	ROOF FRAMING PLAN
E-601	SINGLE LINE DIAGRAM
E-602	PLACARDS
R-001	RESOURCE DOCUMENTS
R-002	RESOURCE DOCUMENTS
R-003	RESOURCE DOCUMENTS
R-004	RESOURCE DOCUMENTS
R-005	RESOURCE DOCUMENTS

PROJECT INFORMATION

OWNER: HASSAN SAEED

PROJECT MANAGER:
NAME:
PHONE:

CONTRACTOR:
NAME: LUMINASOLAR
PHONE: 800-971-6118

AUTHORITIES HAVING JURISDICTION:
BUILDING: PRINCE WILLIAM COUNTY
PRINCE WILLIAM COUNTY
UTILITY: DOMINION VIRGINIA POWER

DESIGN SPECIFICATIONS:
OCCUPANCY: I
CONSTRUCTION: I-B
ZONING: C-2 GENERAL COMMERCIAL
GROUND SNOW LOAD: 30 PSF
WIND EXPOSURE: B
WIND SPEED: 112 MPH

APPLICABLE CODES & STANDARDS:
BUILDING: IRC 2021
ELECTRICAL: NEC 2020
FIRE: IFC 2021

SCOPE OF WORK:
SYSTEM SIZE: STC: 48 x 430W = 20.640KW
PTC: 48 x 409 AW = 19.651KW
(48) REC SOLAR REC-430AA PURE 2
(48) IQBMC-72-M-US
(1) TESLA UNIVERSAL WALL CONNECTOR 40A 8.32 KW

ATTACHMENT TYPE: UNRAC RMS
MSP UPGRADE: NO



CONTRACTOR
LUMINASOLAR
ADDRESS: 3600 COMMERCE DR., SUITE 601, HALETHORPE, MD 21227
PHONE: 800-971-6118
LIC. NO.:

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REVISION / RELEASE

NO.	DESCRIPTION	DATE

PROJECT

NEW PV SYSTEM: 20.640 kWp
HASSAN SAEED
 6515 CROSSROADS VILLAGE BOULEVARD,
 HAYMARKET, VA 20169
 APN: 7298-81-0546

ENGINEER OF RECORD

PAPER SIZE: 36" x 24" (ARCH D)
SHEET TITLE:
 COVER PAGE
 (SHEET 1)
 DATE: 03.07.2025
 DESIGN BY: H.M.
 CHECKED BY: A.L.
SHEET NUMBER:
 T-001

GENERAL NOTES

1. FIELD VERIFY ALL MEASUREMENTS
2. SEE SHEET T-001 FOR LEGEND OF SYMBOLS



CONTRACTOR

LUMINASOLAR
 ADDRESS: 3600 COMMERCE DR., SUITE 601, HALETHORPE, MD 21227
 PHONE: 800-911-6118
 LIC. NO.:

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REVISION / RELEASE

NO.	DESCRIPTION	DATE

PROJECT

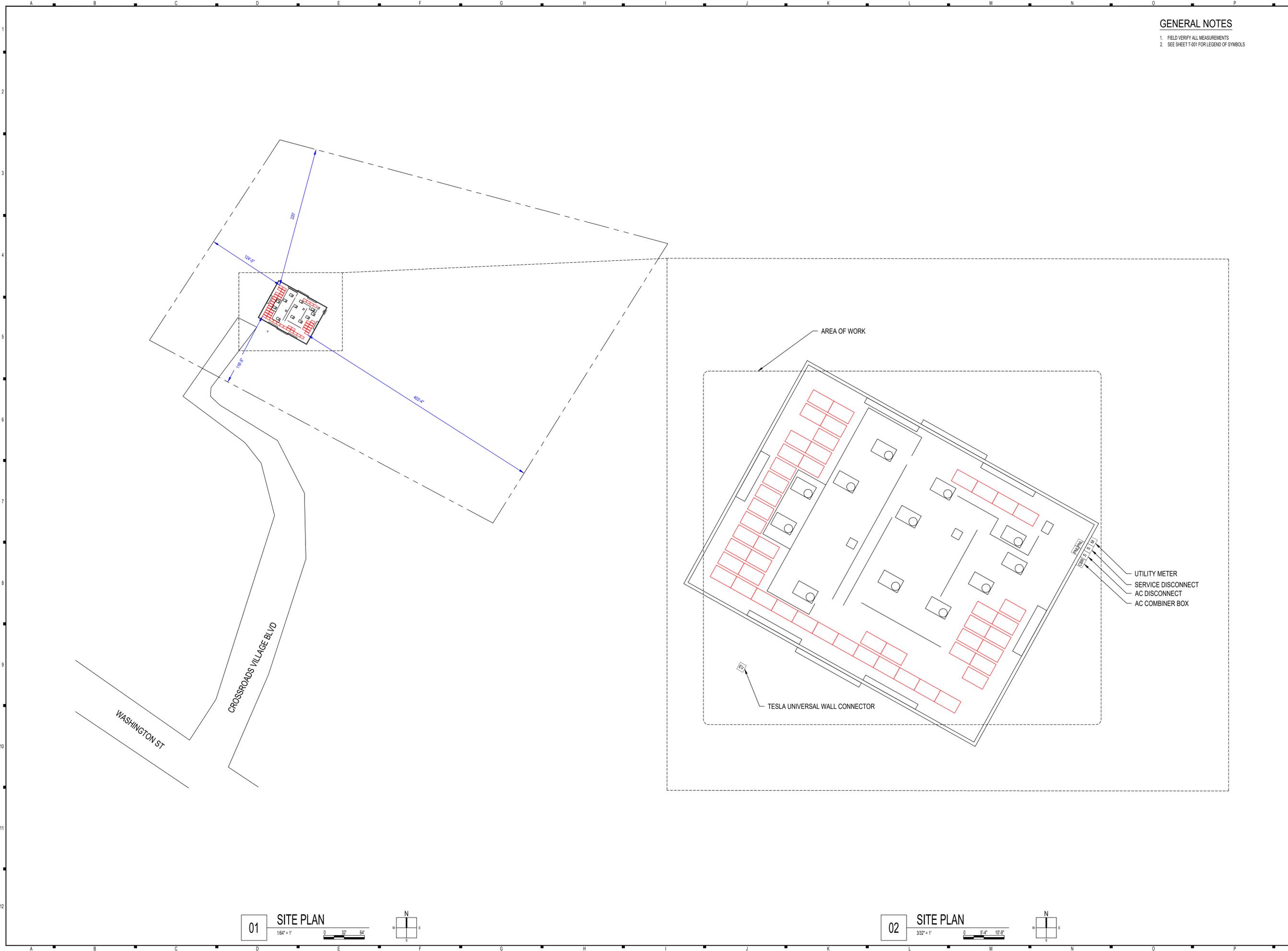
NEW PV SYSTEM: 20.640 kWp
HASSAN SAEED
 6515 CROSSROADS VILLAGE BOULEVARD,
 HAYMARKET, VA 20169
 APN: 7298-81-0546

ENGINEER OF RECORD

PAPER SIZE: 36" x 24" (ARCH D)

SHEET TITLE:
SITE PLAN
 (SHEET 2)
 DATE: 03.07.2025
 DESIGN BY: H.M.
 CHECKED BY: A.L.
 SHEET NUMBER:

A-101

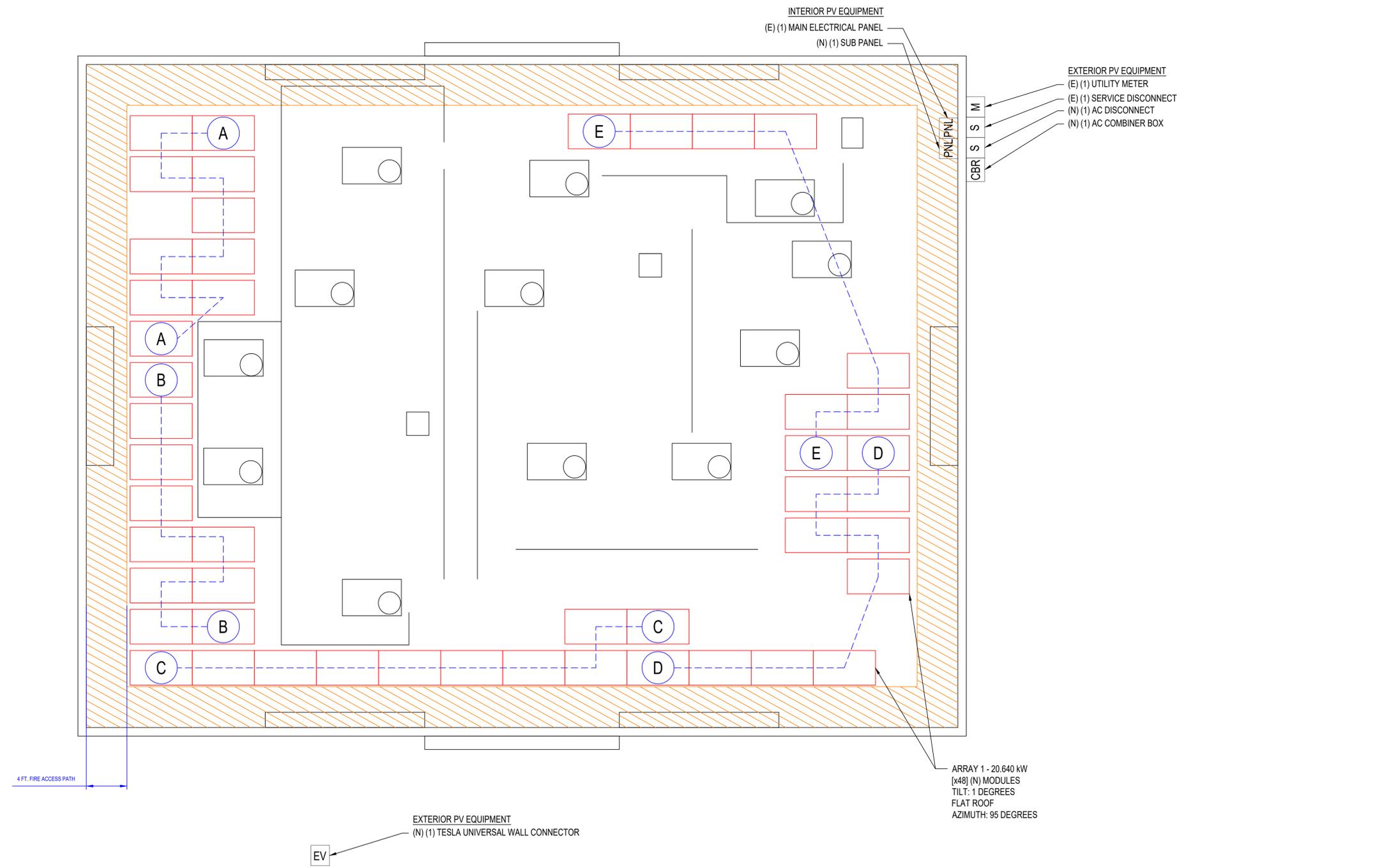


01 SITE PLAN
 1/64" = 1'

02 SITE PLAN
 3/32" = 1'

GENERAL NOTES

1. FIELD VERIFY ALL MEASUREMENTS
2. SEE SHEET T-001 FOR LEGEND OF SYMBOLS



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REVISION / RELEASE

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PROJECT

NEW PV SYSTEM: 20.640 kWp
HASSAN SAEED
 6515 CROSSROADS VILLAGE BOULEVARD,
 HAYMARKET, VA 20169
 APN: 7298-81-0546

ENGINEER OF RECORD

PAPER SIZE: 36" x 24" (ARCH D)

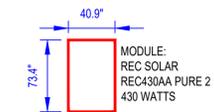
SHEET TITLE:
**ELECTRICAL PLAN
 (LAUNDRY BUILDING)**

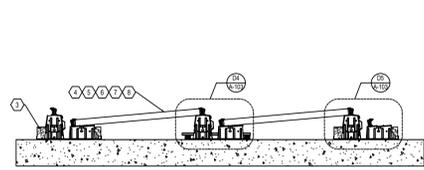
(SHEET 3)

DATE: 03.07.2025
 DESIGN BY: H.M.
 CHECKED BY: A.L.

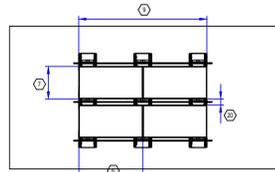
SHEET NUMBER:
A-102

01 ELECTRICAL PLAN
 3/16" = 1"
 0 2'-0" 5'-4"

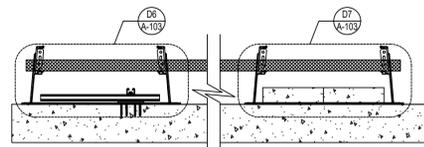




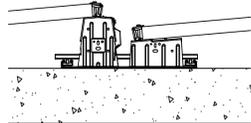
D1 RACKING DETAIL (TRANSVERSE)
NOT TO SCALE



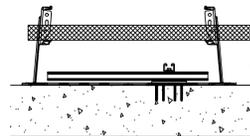
D2 RACKING DETAIL (TOP)
NOT TO SCALE



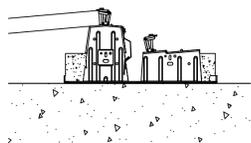
D3 RACKING DETAIL (LONGITUDINAL)
NOT TO SCALE



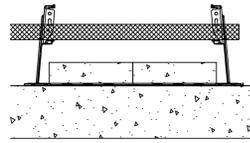
D4 DETAIL (TRANSVERSE)
NOT TO SCALE



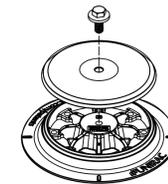
D5 DETAIL (LONGITUDINAL)
NOT TO SCALE



D6 DETAIL (TRANSVERSE)
NOT TO SCALE



D7 DETAIL (LONGITUDINAL)
NOT TO SCALE



D8 WATERPROOFING/FLASHING DETAIL
NOT TO SCALE

- GENERAL NOTES**
1. FIELD VERIFY ALL MEASUREMENTS
 2. SEE SHEET T-001 FOR LEGEND OF SYMBOLS
 3. RACKING SHOWN IS FOR REFERENCE ONLY. COORDINATE WITH RACKING MANUFACTURER FOR RACKING AND FOUNDATION DRAWINGS AND DETAILS

BAY WITH BALLASTS

SHEET KEYNOTES

1. ROOF MATERIAL: RUBBER MEMBRANE
2. ROOF STRUCTURE: TRUSS
3. ATTACHMENT TYPE: UNIRAC RM5
4. MODULE MANUFACTURER: REC SOLAR
5. MODULE MODEL: REC430AA PURE 2
6. MODULE LENGTH: 73.4"
7. MODULE WIDTH: 40.9"
8. MODULE WEIGHT: 47.6 LBS.
9. SEE SHEET A-103 FOR DIMENSION(S)
10. MIN. FIRE OFFSET: 4 FT. AROUND PERIMETR
11. TRUSS SPACING: 24 IN. O.C.
12. TRUSS SIZE: 2X4 NOMINAL
13. TOTAL AREA: 1257 SQ. FT.
14. TOTAL WEIGHT ON ROOF: 10291 LBS.
15. AVERAGE PSF: 8.19 LBS/FT²
16. RAIL MANUFACTURER: UNIRAC
17. RAIL MODEL: BALLASTED MOUNT RM5
18. MAX. TRUSS SPAN: N/A.
19. ARRAY MAX HEIGHT: 9".
20. ROW NOMINAL SPACING: 7.5".
21. BAY WEIGHT: 813 LBS
22. MODULE WEIGHT: 2294 LBS
23. BALLAST WEIGHT: 6656 LBS
24. MAX BAY LOAD (DEAD): 145 LBS
25. ANCHOR: UNIRAC FLASHLOC RM
26. STRUT CHANNEL
27. #15 X 4" ANCHOR SCREW: 8 PER ATTACHMENT



CONTRACTOR

LUMINASOLAR
ADDRESS: 3600 COMMERCE DR., SUITE 601, HALETHORPE, MD 21227
PHONE: 800-911-6118
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REVISION / RELEASE

NO.	DESCRIPTION	DATE

PROJECT

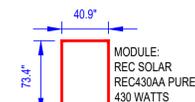
NEW PV SYSTEM: 20.640 kWp
HASSAN SAEED
6515 CROSSROADS VILLAGE BOULEVARD,
HAYMARKET, VA 20169
APN: 7298-81-0546

ENGINEER OF RECORD



11/19/2025

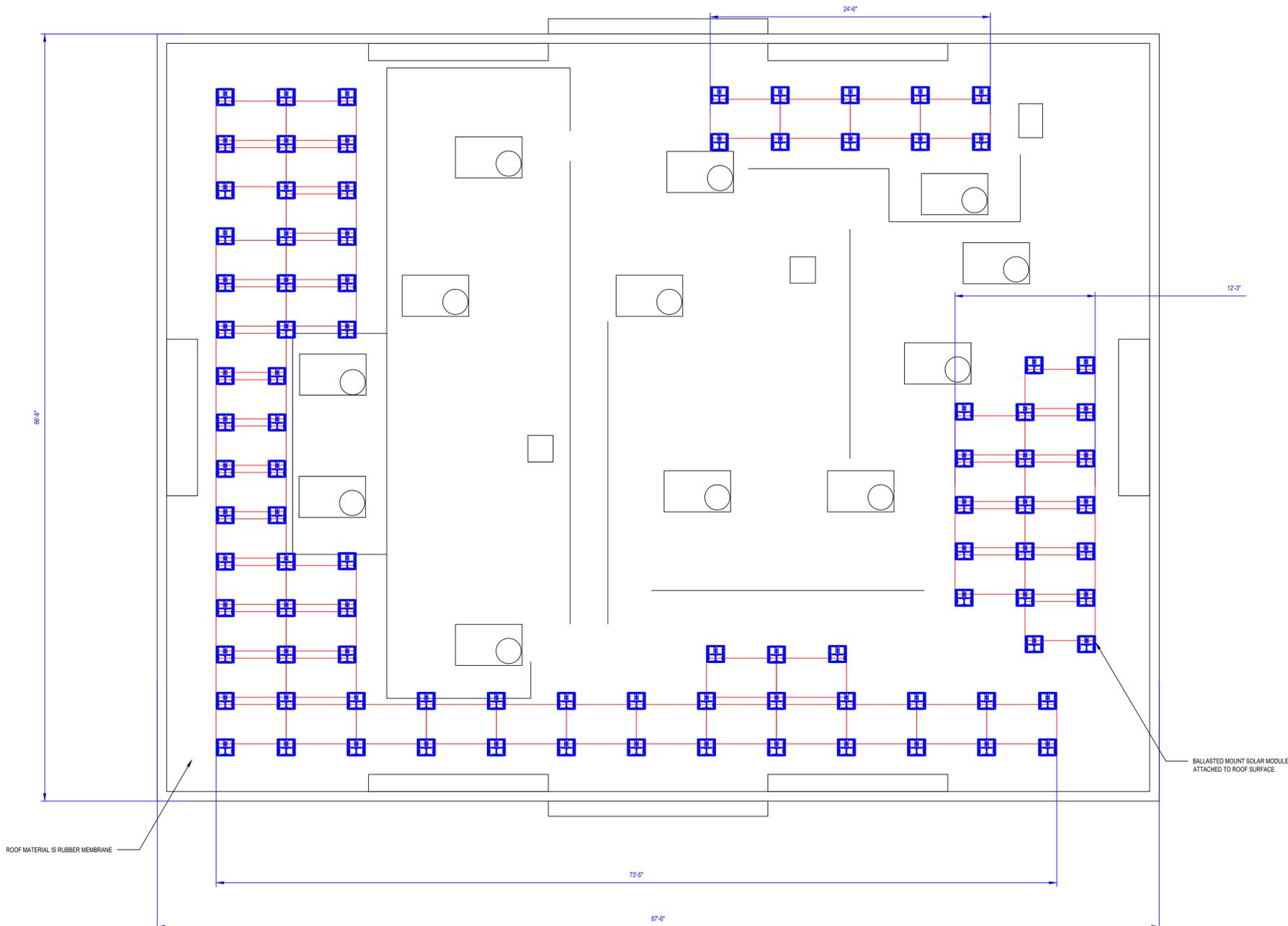
STAMPED AND SIGNED FOR STRUCTURAL ONLY. UNDERLYING STRUCTURE ONLY. ALL ARRAY ANCHORAGE DESIGN (BALLAST) SHALL BE PROVIDED BY THE RACKING MANUFACTURER. MECHANICAL ATTACHMENT TO UNDERLYING STRUCTURE FOR MANUFACTURER PROVIDED LOADS IS INCLUDED IN THE SCOPE OF OUR REVIEW.



MODULE:
REC SOLAR
REC430AA PURE 2
430 WATTS

PAPER SIZE: 36" x 24" (ARCH D)
SHEET TITLE: **ARRAY PLAN (LAUNDRY BUILDING)**
(SHEET 4)
DATE: 03.07.2025
DESIGN BY: H.M.
CHECKED BY: A.L.
SHEET NUMBER:

A-103



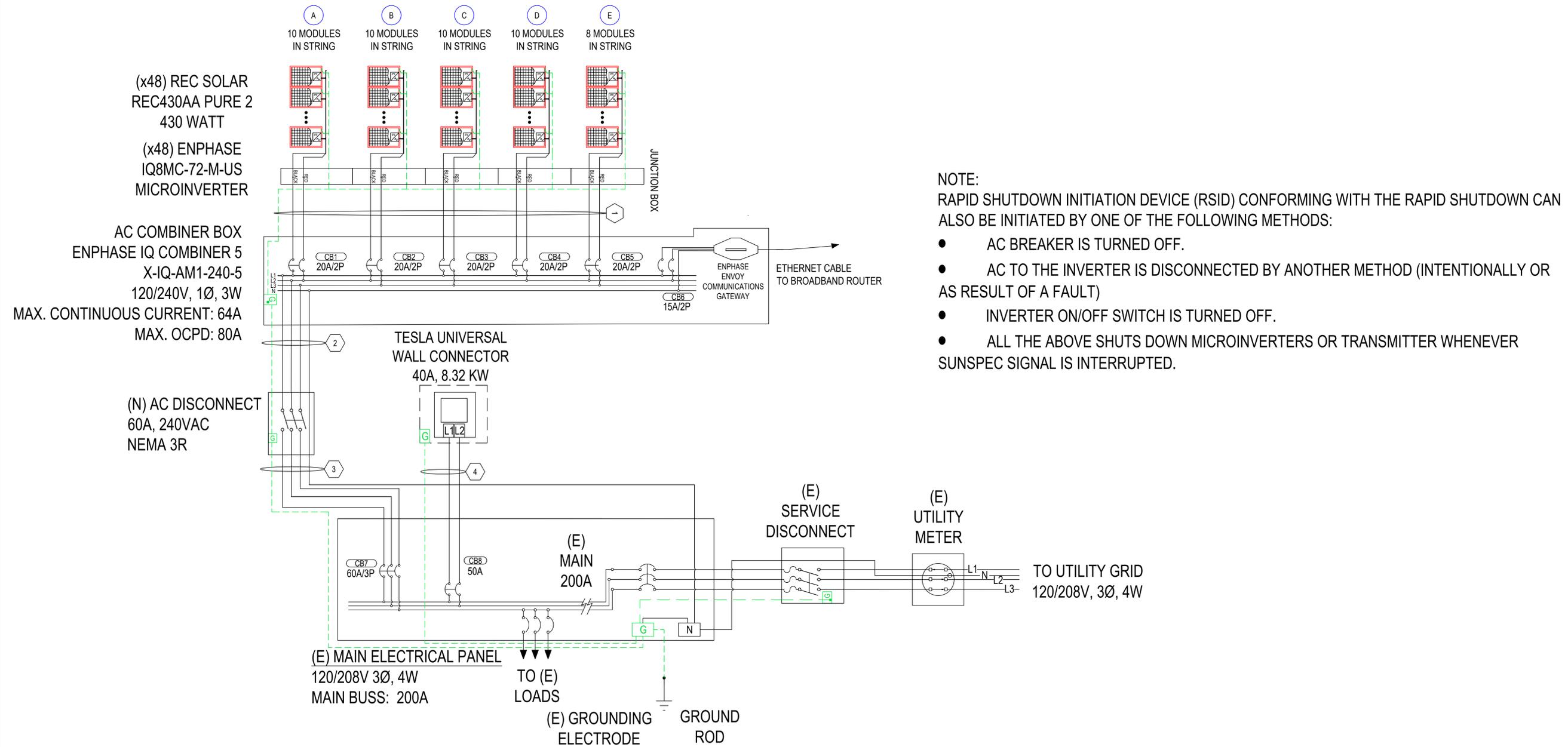
01 ARRAY PLAN
3/16" = 1"



CONDUCTOR AND CONDUIT SCHEDULE W/ELECTRICAL CALCULATIONS

ID	TYPICAL	CONDUCTOR	CONDUIT	CURRENT-CARRYING CONDUCTORS IN CONDUIT	OC PD	EGC	TEMP. CORR. FACTOR	CONDUIT FILL FACTOR	CONT. CURRENT	MAX. CURRENT (125%)	BASE AMP.	DERATED AMP.	TERM. TEMP. RATING	AMP. @ TERMINAL
1	2	10 AWG THWN-2, COPPER	1" DIA EMT	8	20A	10 AWG THWN-2, COPPER	0.96 (33.9 °C)	0.7	13.3A	16.63A	40A	26.88A	75°C	35A
2	1	4 AWG THWN-2, COPPER	1.25" DIA EMT	3+N	N/A	8 AWG THWN-2, COPPER	0.96 (33.9 °C)	1	41.97A	52.46A	95A	91.2A	75°C	85A
3	1	4 AWG THWN-2, COPPER	1.25" DIA EMT	3+N	80A	6 AWG THWN-2, COPPER	0.96 (33.9 °C)	1	41.97A	52.46A	95A	91.2A	75°C	85A
4	1	8 AWG THWN-2, COPPER	1" DIA EMT	2	60A	10 AWG THWN-2, COPPER	0.96 (33.9 °C)	1	40A	50A	55A	52.8A	75°C	50A

(A) - (E) MODULE STRINGING



NOTE:
 RAPID SHUTDOWN INITIATION DEVICE (RSID) CONFORMING WITH THE RAPID SHUTDOWN CAN ALSO BE INITIATED BY ONE OF THE FOLLOWING METHODS:

- AC BREAKER IS TURNED OFF.
- AC TO THE INVERTER IS DISCONNECTED BY ANOTHER METHOD (INTENTIONALLY OR AS RESULT OF A FAULT)
- INVERTER ON/OFF SWITCH IS TURNED OFF.
- ALL THE ABOVE SHUTS DOWN MICROINVERTERS OR TRANSMITTER WHENEVER SUNSPEC SIGNAL IS INTERRUPTED.



CONTRACTOR
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REVISION / RELEASE		
NO.	DESCRIPTION	DATE

PROJECT
 NEW PV SYSTEM: 20.640 kWp
HASSAN SAEED
 6515 CROSSROADS VILLAGE BOULEVARD,
 HAYMARKET, VA 20169
 APN: 7298-81-0546

ENGINEER OF RECORD

PAPER SIZE: 36" x 24" (ARCH D)
 SHEET TITLE:
 SINGLE LINE DIAGRAM
 (SHEET 5)
 DATE: 03.07.2025
 DESIGN BY: H.M.
 CHECKED BY: A.L.
 SHEET NUMBER:
E-601

SYSTEM SUMMARY		
	BRANCH #1-4	BRANCH #5
INVERTERS PER BRANCH	10	8
MAX AC CURRENT	14.9A	11.92A
MAX AC OUTPUT POWER	3,200W	2,560W
ARRAY STC POWER	20,640W	
ARRAY PTC POWER	19,651W	
MAX AC CURRENT	41.97A	
MAX AC POWER	15,360W	
DERATED (CEC) AC POWER	15,360W	

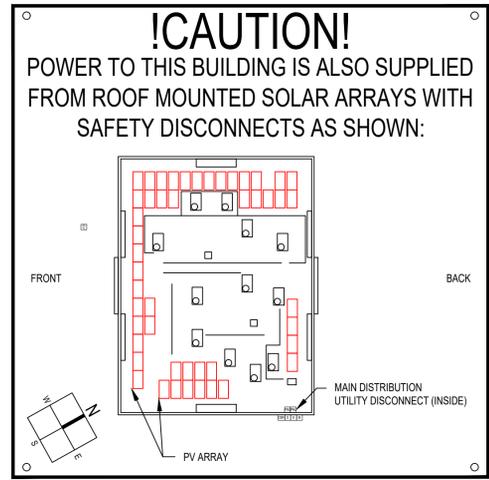
MODULES										
REF.	QTY.	MAKE AND MODEL	PMAX	PTC	ISC	IMP	VOC	VMP	TEMP. COEFF. OF VOC	FUSE RATING
PM1-48	48	REC SOLAR REC430AA PURE 2	430W	409.4W	10.81A	10.05A	49.3V	42.8V	-0.118V/°C (-0.24%/°C)	25A

INVERTERS										
REF.	QTY.	MAKE AND MODEL	AC VOLTAGE	GROUND	OCPD RATING	RATED POWER	MAX OUTPUT CURRENT	MAX INPUT CURRENT	MAX INPUT VOLTAGE	CEC WEIGHTED EFFICIENCY
I1-48	48	ENPHASE IQ8MC-72-M-US	208V	FLOATING	20A	310A	1.49A	25A	60V	97.0%

DISCONNECTS				
REF.	QTY.	MAKE AND MODEL	RATED CURRENT	MAX RATED VOLTAGE
SW1	1	SQUARE D HU362RB OR EQUIV.	60A	240VAC

OCPDS			
REF.	QTY.	RATED CURRENT	MAX VOLTAGE
CB1-5	5	20A	240VAC
CB6	1	15A	240VAC
CB7	1	60A	240VAC
CB8	1	50A	240VAC

ASHRAE EXTREME LOW	-20.7°C (-5.3°F), SOURCE: MANASSAS RGNL DAVIS (38.72°; -77.5°)
ASHRAE 2% HIGH	33.9°C (93°F), SOURCE: MANASSAS RGNL DAVIS (38.72°; -77.5°)



LUMINA SOLAR

CONTRACTOR
LUMINASOLAR

ADDRESS: 3600 COMMERCE DR., SUITE 601, HALETHORPE, MD 21227

PHONE: 800-911-6118

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- LABELING NOTES**
- 1.1 LABELING REQUIREMENTS BASED ON THE 2017 NATIONAL ELECTRICAL CODE, INTERNATIONAL FIRE CODE 605.11, OSHA STANDARD 1910.145, ANSI Z535
 - 1.2 MATERIAL BASED ON THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION.
 - 1.3 LABELS TO BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED.
 - 1.4 LABELS TO BE A MINIMUM LETTER HEIGHT OF 3/8" AND PERMANENTLY AFFIXED.
 - 1.5 ALERTING WORDS TO BE COLOR CODED. "DANGER" WILL HAVE RED BACKGROUND; "WARNING" WILL HAVE ORANGE BACKGROUND; "CAUTION" WILL HAVE YELLOW BACKGROUND. [ANSI Z535]
 - 1.6 ALL SIGNAGE MUST BE PERMANENTLY ATTACHED AND BE WEATHER RESISTANT/SUNLIGHT RESISTANT AND CANNOT BE HAND-WRITTEN PER NEC 110.21(B)

INTERACTIVE PHOTOVOLTAIC SYSTEM CONNECTED
PHOTOVOLTAIC SYSTEM DISCONNECT LOCATED
SE SIDE OF THE BUILDING

PERMANENT PLAQUE OR DIRECTORY PROVIDING THE LOCATION OF THE SERVICE DISCONNECTING MEANS AND THE PHOTOVOLTAIC SYSTEM DISCONNECTING MEANS IF NOT IN THE SAME LOCATION (5 3/4" X 1 1/8"). [NEC 690.56(B)]

WHERE THE INVERTERS ARE REMOTELY LOCATED FROM EACH OTHER, A DIRECTORY IN ACCORDANCE WITH 705.10 SHALL BE INSTALLED AT EACH DC PV SYSTEM DISCONNECTING MEANS, AT EACH AC DISCONNECTING MEANS, AND AT THE MAIN SERVICE DISCONNECTING MEANS SHOWING THE LOCATION OF ALL AC AND DC PV SYSTEM DISCONNECTING MEANS IN THE BUILDING. [NEC 690.4(H)]

WARNING
ELECTRICAL SHOCK HAZARD

THE DC CONDUCTORS OF THIS PHOTOVOLTAIC SYSTEM ARE UNGROUNDED AND MAY BE ENERGIZED

PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN

LABEL 5
AT RAPID SHUTDOWN SWITCH (5 1/4" X 2"). [NEC 690.56(C)].

WARNING
ELECTRICAL SHOCK HAZARD

DO NOT TOUCH TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

LABEL 2
AT EACH DISCONNECTING MEANS FOR PHOTOVOLTAIC EQUIPMENT (3" X 4"). [NEC 690.17]

WARNING
THREE POWER SUPPLY SOURCES: UTILITY GRID, BATTERY AND PV SOLAR ELECTRIC SYSTEM

LABEL 7
AT POINT OF INTERCONNECTION (2 3/4" X 1 5/8"). [NEC 705.12(D)(3)]

PHOTOVOLTAIC SYSTEM AC DISCONNECT

RATED AC OUTPUT CURRENT $\frac{41.97}{208}$ A
NOMINAL OPERATING AC VOLTAGE $\frac{208}{V}$

LABEL 3
AT POINT OF INTERCONNECTION, MARKED AT DISCONNECTING MEANS (4" X 2"). [NEC 690.54]

PHOTOVOLTAIC SOLAR AC DISCONNECT

LABEL 4
AT EACH AC DISCONNECTING MEANS (1" X 4"). [NEC 690.13(B)]

CAUTION
SOLAR ELECTRIC SYSTEM CONNECTED

LABEL 8
AT UTILITY METER (5 3/4" X 1 1/8"). [NEC 690.56(B)]

WARNING
ELECTRICAL SHOCK HAZARD
DO NOT RELOCATE THIS OVERCURRENT DEVICE

LABEL 9
AT POINT OF INTERCONNECTION OVERCURRENT DEVICE (2" X 4"). [NEC 705.12(D)(2)]

WARNING: PHOTOVOLTAIC POWER SOURCE

LABEL 10
AT EXPOSED RACEWAYS, CABLE TRAYS, AND OTHER WIRING METHODS; SPACED AT MAXIMUM 10 FT SECTION OR WHERE SEPARATED BY ENCLOSURES, WALLS, PARTITIONS, CEILINGS, OR FLOORS (5 3/4" X 1 1/8"). [CEC 690.31(G)]
LETTERS AT LEAST 3/8 INCH; WHITE ON RED BACKGROUND; REFLECTIVE [IFC 605.11.1.1]

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN ARRAY

LABEL 6
AT RAPID SHUTDOWN SYSTEM (3 3/4" X 5 1/4"). [NEC 690.56(C)(1)(A)].

REVISION / RELEASE		
NO.	DESCRIPTION	DATE

PROJECT

NEW PV SYSTEM: 20.640 kWp

HASSAN SAEED

6515 CROSSROADS VILLAGE BOULEVARD,
HAYMARKET, VA 20169
APN: 7298-81-0546

ENGINEER OF RECORD

PAPER SIZE: 36" x 24" (ARCH D)

SHEET TITLE: PLACARDS (SHEET 6)

DATE: 03.07.2025

DESIGN BY: H.M.

CHECKED BY: A.L.

SHEET NUMBER: E-602

Universal Wall Connector

The Tesla Universal Wall Connector is an efficient and convenient charging solution that lets you plug your electric vehicle in overnight and start your day fully charged. It is compatible with Tesla and non-Tesla electric vehicle models. It provides up to 48A of continuous current that offers 77 km or 44 miles of range per hour of charge. It is approved for indoor and outdoor installation. The Universal Wall Connector can support AC charging for vehicles with NACS or J1772 chargeports through the use of a J1772 adapter that docks into the side of the Wall Connector.



Tesla Wall Connector

2023-12-12

1

Wall Connector

Performance Specifications

Part Numbers	1734412-02-X; 1734412-03-X
Nominal Voltage	200-240 V L-L 1-phase
Current	Maximum 48A (adjustable by installer)
Grounding Scheme	TN/TT
Frequency	50/60 Hz
Means of Disconnect	External branch circuit breaker
Residual Current Detection	Integrated, CCID20
Short Circuit Current Rating	14kA
Connectors	NACS, J1772
Connectivity	Wi-Fi (2.4 GHz, 802.11b/g/n)

Compliance Information

Agency Approvals	cULus - E351001
Standards	UL 2594, UL 2231
Energy Star Certified (Applicable to U.S. only)	

Environmental Specifications

Operating Temperature	-22°F to 122°F (-30°C to 50°C)
Storage Temperature	-40°F to 185°F (-40°C to 85°C)
Enclosure Rating	Type 3R

Mechanical Specifications

Wall Connector Dimensions	13.6 in x 6.1 in x 5.9 in
Wire Box Bracket Dimensions	9.8 in x 4.7 in x 3.5 in
Weight (Including bracket)	15 lbs (6.8 kg)
Cable Length	1734412-02-X: 24 ft (7.3 m) 1734412-03-X: 13.1 ft. (4 m)



Tesla Wall Connector

2023-12-12



CONTRACTOR

LUMINASOLAR

ADDRESS: 3600 COMMERCE DR., SUITE 601, HALETHORPE, MD 21227

PHONE: 800-911-6118

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HAYMARKET, VA 20169
APN: 7298-81-0546

ENGINEER OF RECORD

PAPER SIZE: 36" x 24" (ARCH D)

SHEET TITLE:

RESOURCE DOCUMENTS

(SHEET 8)

DATE: 03.07.2025

DESIGN BY: H.M.

CHECKED BY: A.L.

SHEET NUMBER:

R-002



February 25, 2026

TO: Lumina Solar

SUBJECT: Roof-top Solar PV Addition - Kiddie Academy (Hassan Saeed)
6515 Crossroads Village Blvd., Haymarket, VA. 20169

SCOPE OF WORK:

AOstructures, Inc. was asked to provide a structural review for the project at the above subject location. The scope of this report is strictly limited to the items listed below and based on the design criteria listed below. See additional limitations in Appendix B.

- Analyze the existing structure(s) to see if it is/they are suitable to support the additional weight of the proposed roof mounted solar PV system.
- The scope of this review is strictly limited to an evaluation of the existing roof structures ability to support the static forces of the proposed roof mounted PV system. All array anchorage for wind and seismic forces shall be provided by the manufacturer (by others). This report is based on manufacturer provided specifications prepared by Unirac and dated November 10, 2025.
- See Supplement A - Evaluate the connection capacity of the proposed racking system to the existing roof structure.

PROVIDED INFORMATION:

As-built plans were not provided for our review. The findings of this report are based upon a jobsite evaluation of the existing condition of the existing framing system collected by Lumina Solar as requested by AOstructures, Inc.. All attached structural calculations are based on the provided information and are only deemed valid if the provided information is true and accurate.

OBSERVED CONDITIONS:

The observed roof framing is described below. If field conditions differ, the contractor shall notify the engineer prior to starting construction.

The roof framing system of (Roof A) consists of a built-up roof atop of plywood sheathing which is supported by pre-fabricated roof trusses spaced at 24" o.c.. The roof trusses are marginally sloped for drainage. See Appendix A for snippets of truss calcs for the governing trusses below the proposed ballast systems.

CONCLUSIONS:

The existing roof framing members of (Roof A) are judged to be adequate to withstand the loading imposed by the installation of the solar panels. No structural retrofits are required.

All hardware shall be installed per manufacturer specifications and within specified design limitations based on the design criteria of this report. AOstructures, Inc. assumes no responsibility for hardware installed outside the design & install specifications of the manufacturer. All waterproofing shall be provided by the contractor.

DESIGN CRITERIA:

- Applicable Codes = 2021 IBC/IRC, ASCE 7-16
- Ballast array (flush mounted) - Anchorage design shall be provided by manufacturer.
- Roof Dead Load = 10 psf (Roof A)
- Roof Live Load = 20 psf (reduced where allowed by ASCE7 - 1607.14.4.1)
- Wind Speed = 115 mph, Exposure C
- Ground Snow Load = 30 psf - Roof Snow Load (at PV) = 25.2 psf

Please contact me with any further questions or concerns regarding this project.

Sincerely,



02/25/2026

Andrew Oesterreicher, P.E.
Project Engineer



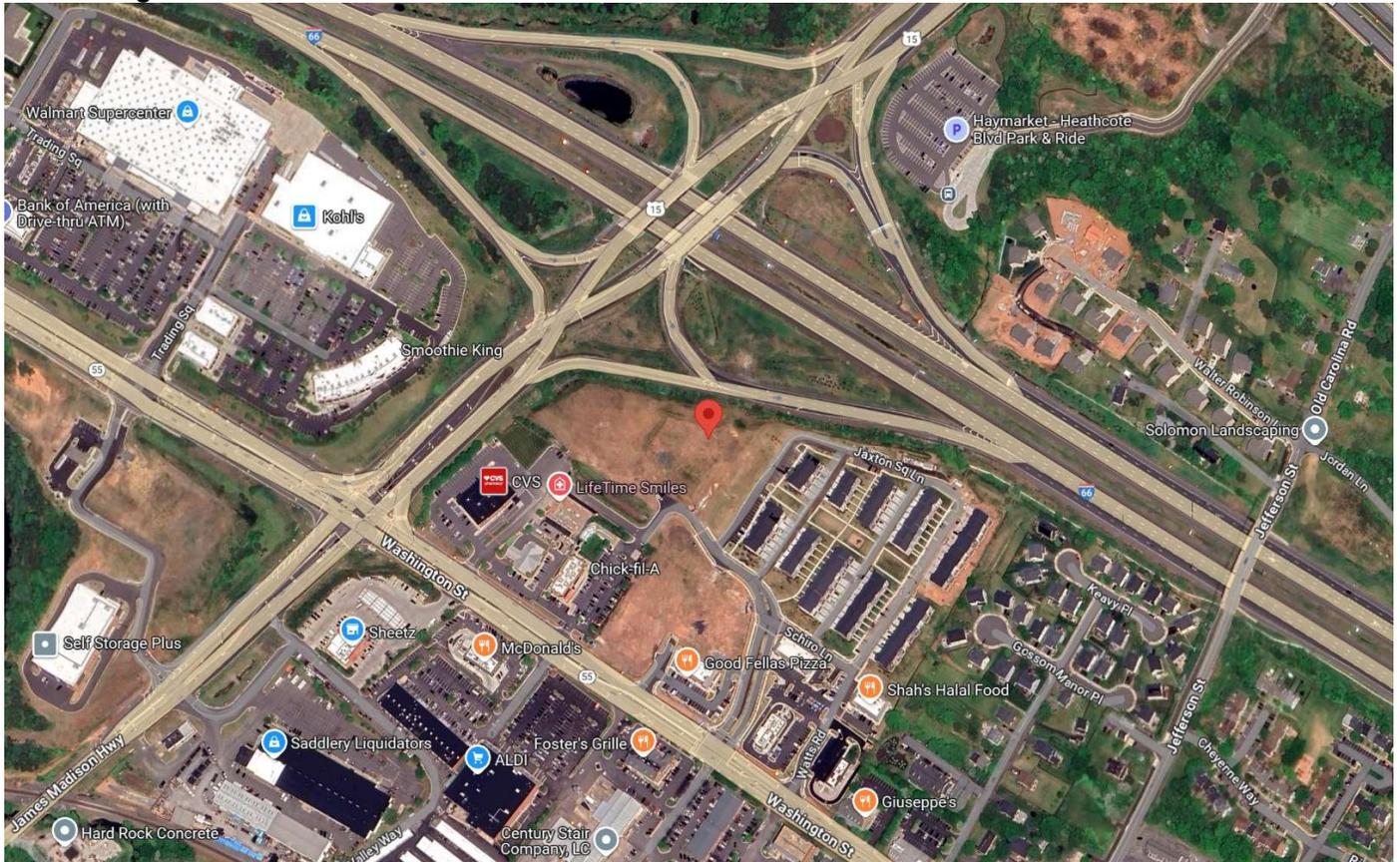
AOstructures Inc.
PO Box 413
Carnelian Bay, CA 96140
916.541.8586
www.AOstructures.com

Address: 6515 Crossroads Village Blvd., Haymarket, VA. 20169

Wind Design

Exposure: C
Wind Speed: 115 mph
Risk Category: II

Aerial Image





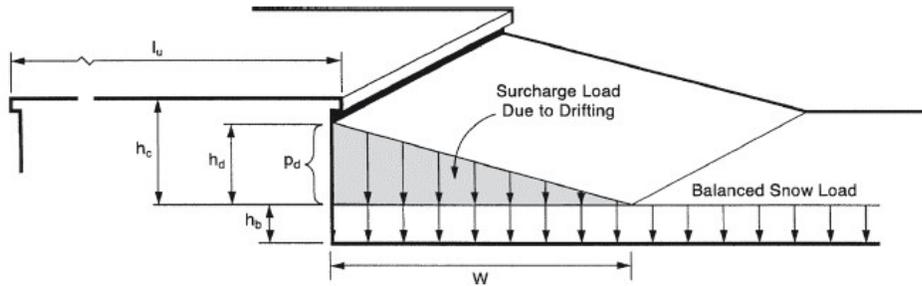
SNOW LOADS

Roof Snow Load Calculations (ASCE 7-16)

Unobstructed, Slippery Roof Surface?	no	
Roof Slope	0 degrees	
p_g = Ground Snow Load =	30.0 psf	
$p_f = 0.7 C_e C_t I p_g$		(ASCE7 - Eq 7-1)
C_e = Exposure Factor =	1.0	(ASCE7 - Table 7-2)
C_t = Thermal Factor =	1.2	(ASCE7 - Table 7-3)
I = Importance Factor =	1.0	(ASCE7 - 7.3.3)
p_f = Flat Roof Snow Load =	25.2 psf	
$p_s = C_s p_f$		(ASCE7 - Eq 7-2)
C_s = Slope Factor =	1.00	(ASCE7 - Fig. 7-2)
p_s = Sloped Roof Snow Load =	25.2 psf	

Drifting Snow Loads

Snow Drift Calculations



p_g = Ground Snow Load =	30 psf	
p_s = Sloped Roof Snow Load =	25.2 psf	
y = density of snow =	17.9 pcf	(ASCE 7 - Eq. 7.7-1)
h_b = height of sloped roof snow load =	1.41 feet	
h_c = height of parapet or obstruction =	10 feet	
h_c/h_b =	7.10	$h_c/h_b > 0.2$, Drift Required
l_u = upwind building projection =	86 feet	
h_d = height of Drifted Snow =	3.27 feet	(ASCE 7 - Fig 7.6-1)
$0.75 h_d$ for parapet use =	2.45 feet	(ASCE 7 - 7.8)
Drift Intensity =	43.94 psf	(ASCE 7 - Fig 7.6-1)
Drift Width =	13.1 feet	



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ROOF DEAD AND LIVE LOADS

Roof Live Load = 20 psf

Note: Per Section 1607.14.4.1 of 2021 IBC - roof live load is removed in area's covered by PV array when the PV array is less than 24" above the roof surface.

Roof Dead Load (Roof A)

Built Up Roof	4.00 psf
Roof Plywood	2.00
Truss top chord @ 24" o.c.	2.00
MEP/Miscellaneous	2.00
Total Roof DL (Roof A)	10.0 psf
DL Adjusted to 0 Degree Slope	10.0 psf

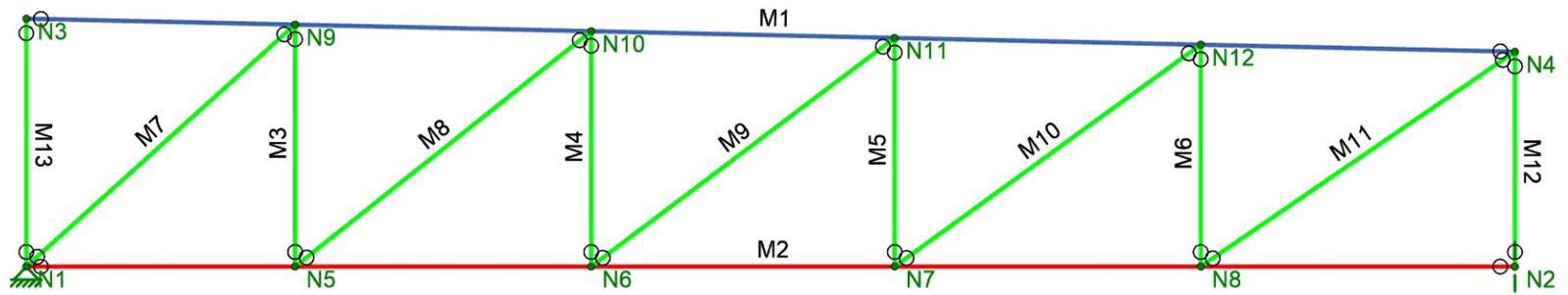
Truss RT-1

2D Lock ON



Section Sets

- Top Chords
- Webs
- Bottom Chord



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SK-1

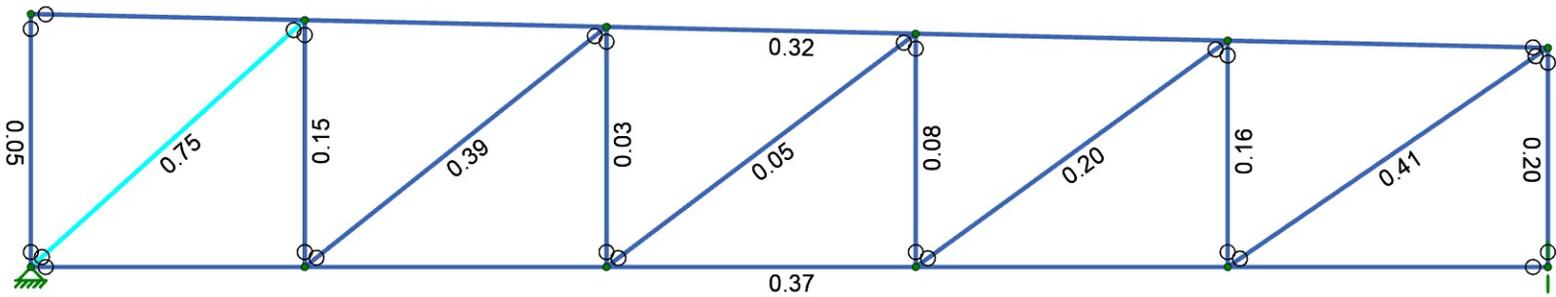
Nov 07, 2025 at 10:06 AM

Truss - RT1.r3d



2D Lock ON

Code Check (Env)	
Black	No Calc
Red	> 1.0
Magenta	.90-1.0
Green	.75-.90
Cyan	.50-.75
Blue	0-.50



Member Code Checks Displayed (Enveloped)
Envelope Only Solution

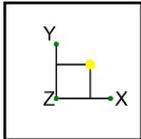


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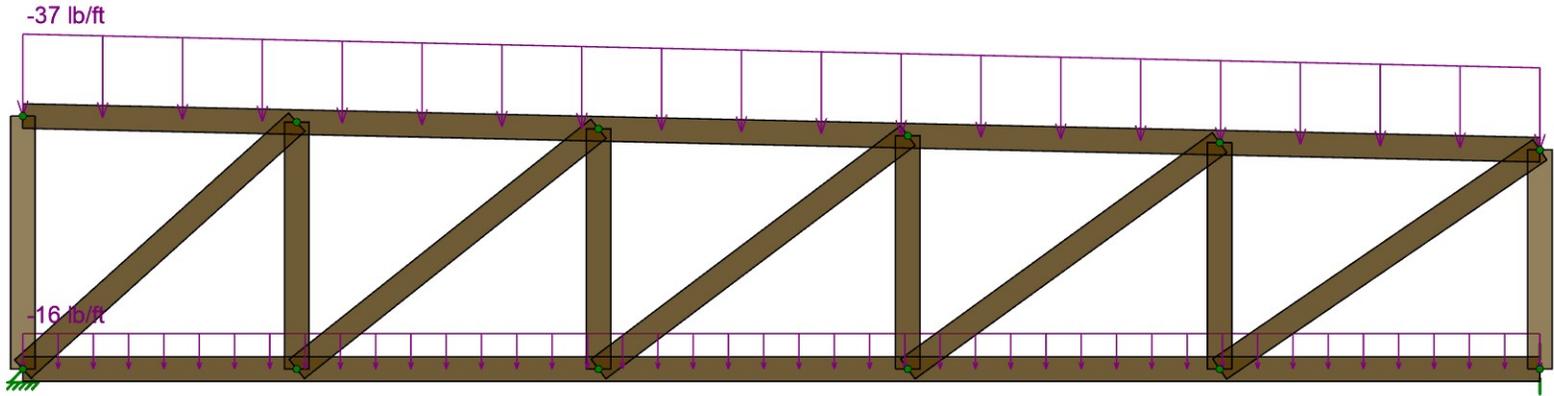
SK-2

Nov 07, 2025 at 10:06 AM

Truss - RT1.r3d



2D Lock ON



Loads: BLC 1, DL
Envelope Only Solution

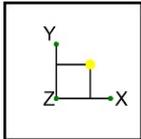


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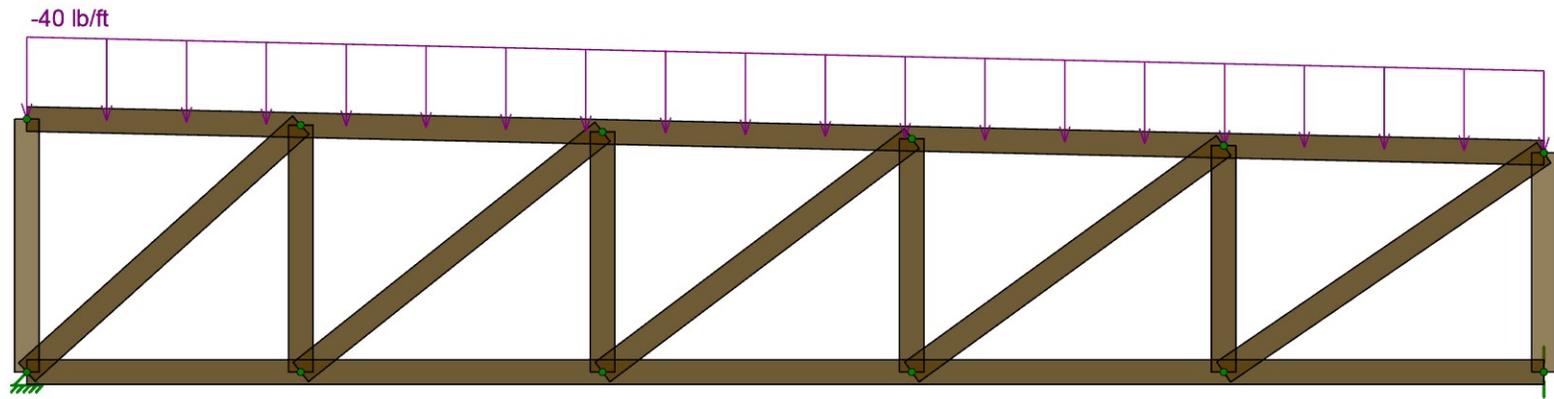
SK-3

Nov 07, 2025 at 10:07 AM

Truss - RT1.r3d



2D Lock ON

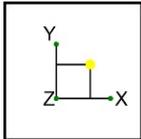


Loads: BLC 3, RLL
Envelope Only Solution

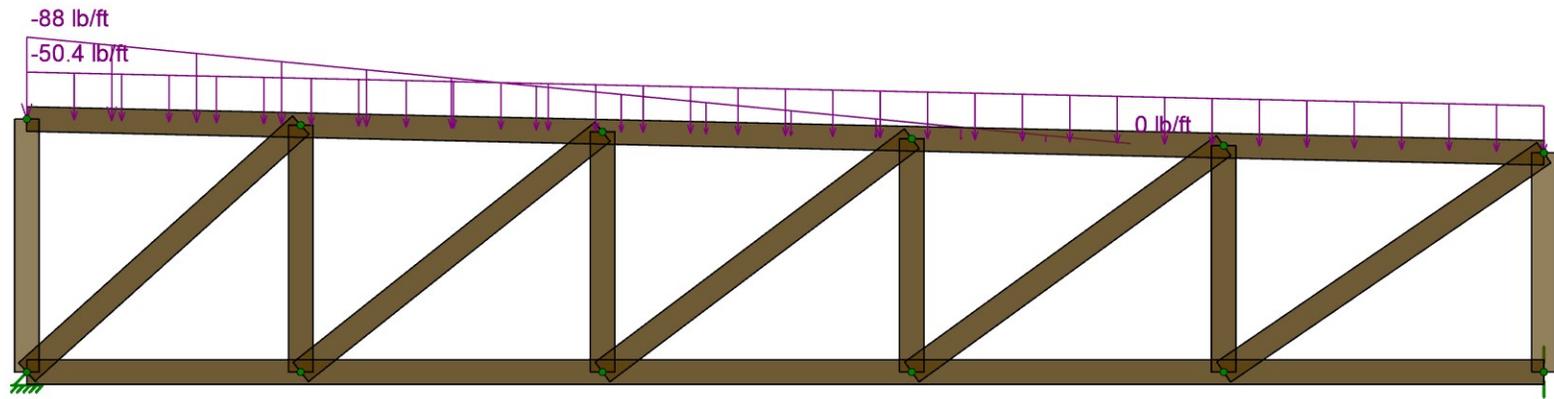


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SK-4
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Truss - RT1.r3d



2D Lock ON



Loads: BLC 5, SL
Envelope Only Solution



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SK-5
Nov 07, 2025 at 10:07 AM
Truss - RT1.r3d

Node Coordinates

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
1	N1	0	0	0	
2	N2	18	0	0	
3	N3	0	3	0	
4	N4	18	2.6	0	
5	N5	3.25	0	0	
6	N6	6.83	0	0	
7	N7	10.5	0	0	
8	N8	14.2	0	0	
9	N9	3.25	2.927778	0	
10	N10	6.83	2.848222	0	
11	N11	10.5	2.766667	0	
12	N12	14.2	2.684444	0	

Node Boundary Conditions

	Node Label	X [k/in]	Y [k/in]	Z [k/in]
1	ALL			Fixed
2	N1	Reaction	Reaction	Reaction
3	N2		Reaction	

Wood Properties

	Label	Type	Database	Species	Grade	Cm	Ci	Emod	Nu	Therm. Coeff. [1e ⁵ F ⁻¹]	Density [k/ft ³]
1	DF	Solid Sawn	Visually Graded	Douglas Fir-Larch	No.2			1	0.3	0.3	0.035
2	SP #2	Solid Sawn	Visually Graded	Southern Pine	No.2			1	0.3	0.3	0.035
3	HF	Solid Sawn	Visually Graded	Hem-Fir	No.2			1	0.3	0.3	0.035
4	SPF	Solid Sawn	Visually Graded	Spruce-Pine-fir	No.2			1	0.3	0.3	0.035
5	SPSS	Solid Sawn	Visually Graded	Southern Pine	Select Structural			1	0.3	0.3	0.035
6	SP #1	Solid Sawn	Visually Graded	Southern Pine	No.1			1	0.3	0.3	0.035

Wood Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in ²]	I _{yy} [in ⁴]	I _{zz} [in ⁴]	J [in ⁴]
1	Top Chords	2X4	None	None	SP #1	Typical	5.25	0.984	5.359	2.877
2	Webs	2X4	None	None	SP #2	Typical	5.25	0.984	5.359	2.877
3	Bottom Chord	2X4	None	None	SP #1	Typical	5.25	0.984	5.359	2.877

Wood Design Parameters

	Label	Shape	Length [ft]	le2 [ft]	le1 [ft]	le-bend top [ft]	le-bend bot [ft]	K y-y	K z-z	Cr	y sway	z sway
1	M1	Top Chords	18.004	1	1	1	Segment			Yes		
2	M2	Bottom Chord	18	1	1	Segment	1			Yes		
3	M3	Webs	2.928			Lbyy		0.85	0.85			
4	M4	Webs	2.848			Lbyy		0.85	0.85			
5	M5	Webs	2.767			Lbyy		0.85	0.85			
6	M6	Webs	2.684			Lbyy		0.85	0.85			
7	M7	Webs	4.374			Lbyy		0.85	0.85			
8	M8	Webs	4.575			Lbyy		0.85	0.85			
9	M9	Webs	4.596			Lbyy		0.85	0.85			
10	M10	Webs	4.571			Lbyy		0.85	0.85			
11	M11	Webs	4.604			Lbyy		0.85	0.85			
12	M12	Webs	2.6			Lbyy		0.85	0.85			
13	M13	Webs	3			Lbyy		0.85	0.85			

Load Combination Design

	Description	CD	Service	Hot Rolled	Cold Formed	Wood	Concrete	Masonry	Aluminum	Stainless	Connection
1	DL	0.9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	DL + RLL	1.25	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	DL + SL	1.15	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor
1	DL	Yes	Y	DL	1		
2	DL + RLL	Yes	Y	DL	1	RLL	1
3	DL + SL	Yes	Y	DL	1	SL	1

Basic Load Cases

	BLC Description	Category	Y Gravity	Distributed
1	DL	DL	-1	3
3	RLL	RLL		1
5	SL	SL		2

Member Distributed Loads (BLC 1 : DL)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	-20	-20	0	%100
2	M2	Y	-16	-16	0	%100
3	M1	Y	-17	-17	0	%100

Member Distributed Loads (BLC 3 : RLL)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	-40	-40	0	%100

Member Distributed Loads (BLC 5 : SL)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	-50.4	-50.4	0	%100
2	M1	Y	-88	0	0	13.1

Envelope Node Reactions

	Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]
1	N1	max	0	1	1416.364	3	0	3	0	3	0	3	LOCKED
2		min	0	3	526.158	1	0	1	0	1	0	1	LOCKED
3	N2	max	0	3	1118.035	3	0	3	0	3	0	3	LOCKED
4		min	0	1	524.417	1	0	1	0	1	0	1	LOCKED
5	N4	max	NC		NC		NC		NC		NC		LOCKED
6		min	NC		NC		NC		NC		NC		LOCKED
7	N3	max	NC		NC		NC		NC		NC		LOCKED
8		min	NC		NC		NC		NC		NC		LOCKED
9	Totals:	max	0	1	2534.399	3	0	3					
10		min	0	3	1050.575	1	0	1					

Envelope AWC NDS-18 / SDPWS-21 ASD Member Wood Code Checks

Member	Shape	Code Check	Loc[ft]	LC Shear Check	Loc[ft]	Dir	LC Fc' [ksi]	Ft' [ksi]	Fb1' [ksi]	Fb2' [ksi]	Fv' [ksi]	RB	CL	CP	Eqn			
1	M1	2X4	0.317	3.188	3	0.438	3.188	y	3	1.786	1.15	1.964	1.984	0.201	7.79	0.99	0.941	3.9-3
2	M2	2X4	0.373	8.625	3	0.067	14.25	y	1	1.786	1.15	1.961	1.984	0.158	8.277	0.988	0.941	3.9-1
3	M3	2X4	0.145	2.928	3	0	2.928	z	3	0.87	0.776	1.257	1.265	0.201	7.393	0.994	0.522	3.9-1
4	M4	2X4	0.033	2.848	1	0	2.848	z	3	0.83	0.608	0.985	0.99	0.201	7.292	0.995	0.636	3.9-1
5	M5	2X4	0.078	0	3	0	2.767	z	3	0.943	0.776	1.258	1.265	0.201	7.186	0.994	0.565	3.6.3
6	M6	2X4	0.164	0	3	0	2.684	z	3	0.981	0.776	1.258	1.265	0.201	7.079	0.994	0.588	3.6.3
7	M7	2X4	0.748	0	3	0.004	4.374	y	1	0.443	0.776	1.252	1.265	0.158	9.036	0.99	0.266	3.6.3
8	M8	2X4	0.394	0	3	0.004	4.575	y	1	0.408	0.776	1.252	1.265	0.158	9.241	0.99	0.245	3.6.3
9	M9	2X4	0.049	0	2	0.004	4.596	y	1	0.407	0.844	1.359	1.375	0.158	9.262	0.988	0.224	3.6.3
10	M10	2X4	0.195	2.333	3	0.004	4.571	y	1	0.409	0.776	1.252	1.265	0.158	9.237	0.99	0.245	3.9-1
11	M11	2X4	0.406	2.35	3	0.004	4.604	y	1	0.403	0.776	1.252	1.265	0.158	9.271	0.989	0.242	3.9-1
12	M12	2X4	0.203	2.6	3	0	2.6	z	3	1.022	0.776	1.258	1.265	0.201	6.967	0.995	0.613	3.6.3
13	M13	2X4	0.051	3	3	0	3	z	3	0.84	0.776	1.257	1.265	0.201	7.483	0.994	0.504	3.6.3

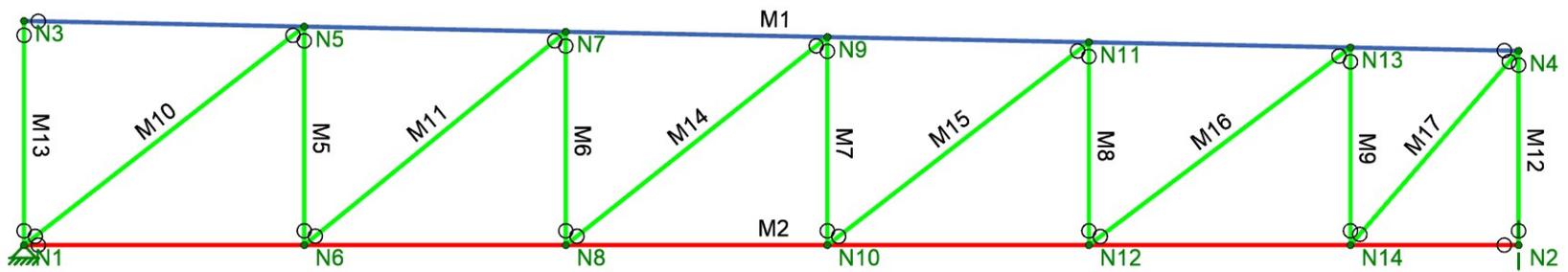
Truss RT-4

2D Lock ON



Section Sets

- Top Chords
- Webs
- Bottom Chord



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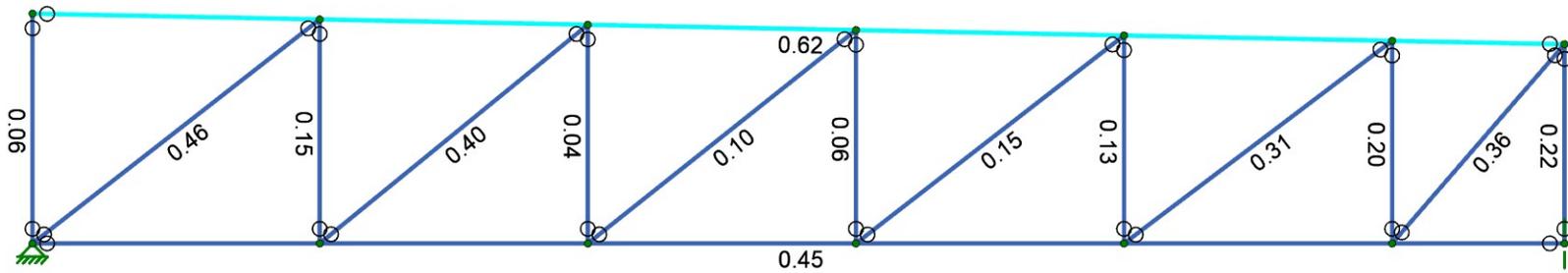
SK-1
Nov 07, 2025 at 10:08 AM
Truss - RT4.r3d



2D Lock ON

Code Check (Env)

Black	No Calc
Red	> 1.0
Magenta	.90-1.0
Green	.75-.90
Cyan	.50-.75
Blue	0-.50



Member Code Checks Displayed (Enveloped)
Envelope Only Solution



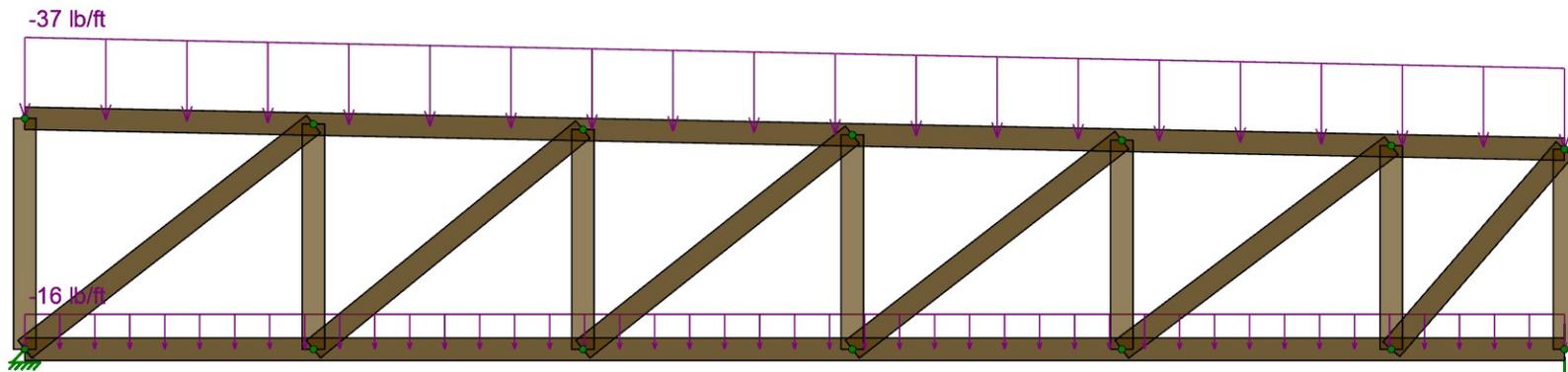
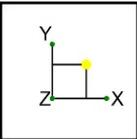
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SK-2

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2D Lock ON

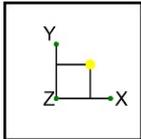


Loads: BLC 1, DL
Envelope Only Solution

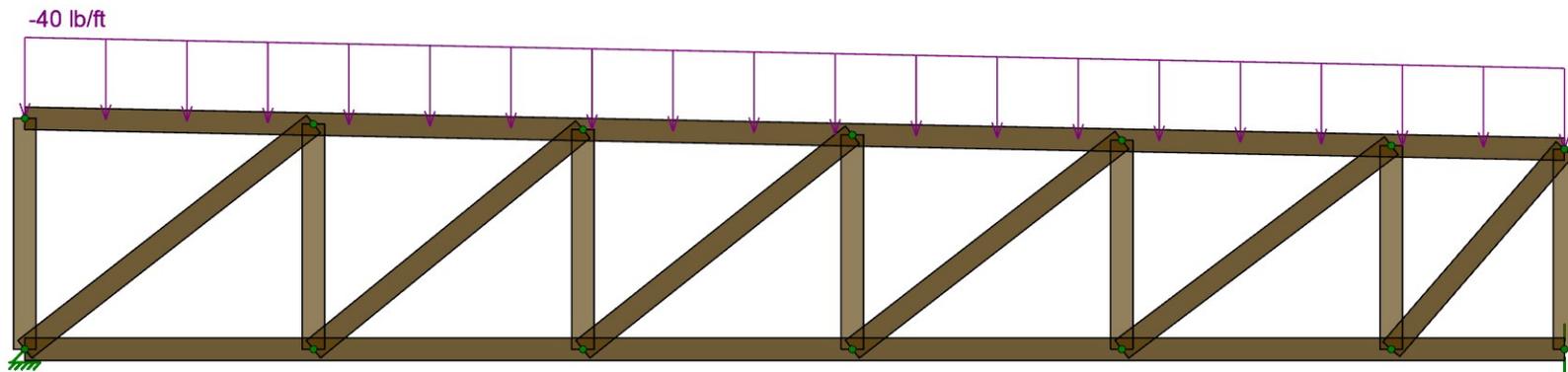


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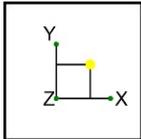


Loads: BLC 3, RLL
Envelope Only Solution

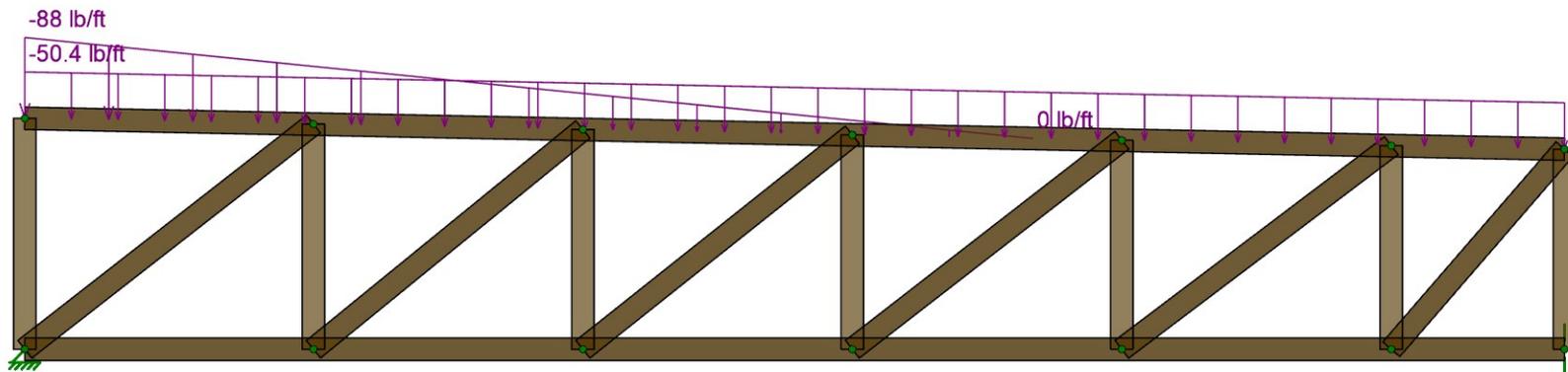


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Truss - RT4.r3d



2D Lock ON



Loads: BLC 5, SL
Envelope Only Solution

 A NEMETSCHKE COMPANY	AOstructures, Inc.	SK-5
	AO	
		Truss - RT4.r3d

Node Coordinates

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
1	N1	0	0	0	
2	N2	20	0	0	
3	N3	0	3	0	
4	N4	20	2.6	0	
5	N5	3.75	2.925	0	
6	N6	3.75	0	0	
7	N7	7.25	2.855	0	
8	N8	7.25	0	0	
9	N9	10.75	2.785	0	
10	N10	10.75	0	0	
11	N11	14.25	2.715	0	
12	N12	14.25	0	0	
13	N13	17.75	2.645	0	
14	N14	17.75	0	0	

Node Boundary Conditions

	Node Label	X [k/in]	Y [k/in]	Z [k/in]
1	ALL			Fixed
2	N1	Reaction	Reaction	Reaction
3	N2		Reaction	

Wood Properties

	Label	Type	Database	Species	Grade	Cm	Ci	Emod	Nu	Therm. Coeff. [1e ⁵ F ⁻¹]	Density [k/ft ³]
1	DF	Solid Sawn	Visually Graded	Douglas Fir-Larch	No.2			1	0.3	0.3	0.035
2	SP #2	Solid Sawn	Visually Graded	Southern Pine	No.2			1	0.3	0.3	0.035
3	HF	Solid Sawn	Visually Graded	Hem-Fir	No.2			1	0.3	0.3	0.035
4	SPF	Solid Sawn	Visually Graded	Spruce-Pine-fir	No.2			1	0.3	0.3	0.035
5	SPSS	Solid Sawn	Visually Graded	Southern Pine	Select Structural			1	0.3	0.3	0.035
6	SP #1	Solid Sawn	Visually Graded	Southern Pine	No.1			1	0.3	0.3	0.035

Wood Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in ²]	Iyy [in ⁴]	Izz [in ⁴]	J [in ⁴]
1	Top Chords	2X4	None	None	SP #2	Typical	5.25	0.984	5.359	2.877
2	Webs	2X4	None	None	SP #2	Typical	5.25	0.984	5.359	2.877
3	Bottom Chord	2X4	None	None	SP #1	Typical	5.25	0.984	5.359	2.877

Wood Design Parameters

	Label	Shape	Length [ft]	le2 [ft]	le1 [ft]	le-bend top [ft]	le-bend bot [ft]	K y-y	K z-z	Cr	y sway	z sway
1	M1	Top Chords	20.004	1	1	1	Segment			Yes		
2	M2	Bottom Chord	20	1	1	Segment	1			Yes		
3	M12	Webs	2.6			Lbyy		0.85	0.85			
4	M13	Webs	3			Lbyy		0.85	0.85			
5	M5	Webs	2.925			Lbyy		0.85	0.85			
6	M6	Webs	2.855			Lbyy		0.85	0.85			
7	M7	Webs	2.785			Lbyy		0.85	0.85			
8	M8	Webs	2.715			Lbyy		0.85	0.85			
9	M9	Webs	2.645			Lbyy		0.85	0.85			
10	M10	Webs	4.756	3	3	3		0.85	0.85			
11	M11	Webs	4.517			Lbyy		0.85	0.85			

Wood Design Parameters (Continued)

	Label	Shape	Length [ft]	le2 [ft]	le1 [ft]	le-bend top [ft]	le-bend bot [ft]	K y-y	K z-z	Cr	y sway	z sway
12	M14	Webs	4.473			Lbyy		0.85	0.85			
13	M15	Webs	4.43			Lbyy		0.85	0.85			
14	M16	Webs	4.387			Lbyy		0.85	0.85			
15	M17	Webs	3.438			Lbyy		0.85	0.85			

Load Combination Design

	Description	CD	Service	Hot Rolled	Cold Formed	Wood	Concrete	Masonry	Aluminum	Stainless	Connection
1	DL	0.9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	DL + RLL	1.25	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	DL + SL	1.15	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor
1	DL	Yes	Y	DL	1		
2	DL + RLL	Yes	Y	DL	1	RLL	1
3	DL + SL	Yes	Y	DL	1	SL	1

Basic Load Cases

	BLC Description	Category	Y Gravity	Distributed
1	DL	DL	-1	3
3	RLL	RLL		1
5	SL	SL		2

Member Distributed Loads (BLC 1 : DL)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	-20	-20	0	%100
2	M2	Y	-16	-16	0	%100
3	M1	Y	-17	-17	0	%100

Member Distributed Loads (BLC 3 : RLL)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	-40	-40	0	%100

Member Distributed Loads (BLC 5 : SL)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	-50.4	-50.4	0	%100
2	M1	Y	-88	0	0	13.1

Envelope Node Reactions

	Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]
1	N1	max	0	1	1538.642	3	0	3	0	3	0	3	LOCKED
2		min	0	3	584.095	1	0	1	0	1	0	1	LOCKED
3	N2	max	0	3	1215.25	3	0	3	0	3	0	3	LOCKED
4		min	0	1	585.195	1	0	1	0	1	0	1	LOCKED
5	N4	max	NC		NC		NC		NC		NC		LOCKED
6		min	NC		NC		NC		NC		NC		LOCKED

Envelope Node Reactions (Continued)

Node Label	X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]
7 N3 max	NC		NC		NC		NC		NC		LOCKED
8 min	NC		NC		NC		NC		NC		LOCKED
9 Totals: max	0	1	2753.892	3	0	3					
10 min	0	3	1169.29	1	0	1					

Envelope AWC NDS-18 / SDPWS-21 ASD Member Wood Code Checks

Member	Shape	Code Check	Loc[ft]	LC	Shear Check	Loc[ft]	Dir	LC	Fc' [ksi]	Ft' [ksi]	Fb1' [ksi]	Fb2' [ksi]	Fv' [ksi]	RB	CL	CP	Eqn	
1	M1	2X4	0.621	3.751	3	0.506	3.751	y	3	1.569	0.776	1.441	1.455	0.201	8.367	0.99	0.941	3.9-3
2	M2	2X4	0.447	8.958	3	0.068	3.75	y	1	1.786	1.15	1.962	1.984	0.158	8.083	0.989	0.941	3.9-1
3	M12	2X4	0.224	2.6	3	0	2.6	z	3	1.022	0.776	1.258	1.265	0.201	6.967	0.995	0.613	3.6.3
4	M13	2X4	0.06	3	3	0	3	z	3	0.84	0.776	1.257	1.265	0.201	7.483	0.994	0.504	3.6.3
5	M5	2X4	0.154	0	3	0	2.925	z	3	0.872	0.776	1.257	1.265	0.201	7.389	0.994	0.523	3.9-1
6	M6	2X4	0.045	0	1	0	2.855	z	3	0.828	0.608	0.985	0.99	0.201	7.3	0.995	0.634	3.9-1
7	M7	2X4	0.059	2.785	3	0	2.785	z	3	0.934	0.776	1.258	1.265	0.201	7.21	0.994	0.56	3.6.3
8	M8	2X4	0.134	2.715	3	0	2.715	z	3	0.967	0.776	1.258	1.265	0.201	7.119	0.994	0.58	3.6.3
9	M9	2X4	0.2	2.645	3	0	2.645	z	3	1	0.776	1.258	1.265	0.201	7.027	0.994	0.6	3.6.3
10	M10	2X4	0.458	0	3	0.004	4.756	y	1	0.84	0.776	1.251	1.265	0.158	9.422	0.989	0.504	3.6.3
11	M11	2X4	0.403	0	3	0.004	4.517	y	1	0.418	0.776	1.252	1.265	0.158	9.182	0.99	0.251	3.6.3
12	M14	2X4	0.096	0	2	0.004	4.473	y	1	0.428	0.844	1.36	1.375	0.158	9.137	0.989	0.236	3.6.3
13	M15	2X4	0.147	2.261	3	0.004	4.43	y	1	0.433	0.776	1.252	1.265	0.158	9.093	0.99	0.26	3.9-1
14	M16	2X4	0.309	2.239	3	0.004	4.387	y	1	0.441	0.776	1.252	1.265	0.158	9.049	0.99	0.264	3.9-1
15	M17	2X4	0.363	1.827	3	0.003	3.438	y	1	0.677	0.776	1.256	1.265	0.158	8.011	0.992	0.406	3.9-1

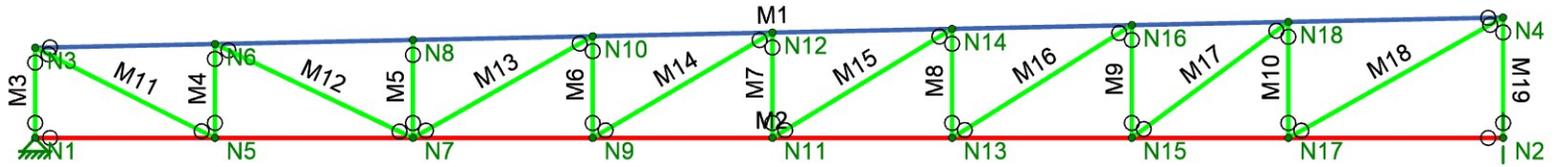
Truss RT-7

2D Lock ON



Section Sets

- Top Chords
- Webs
- Bottom Chord



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SK-1

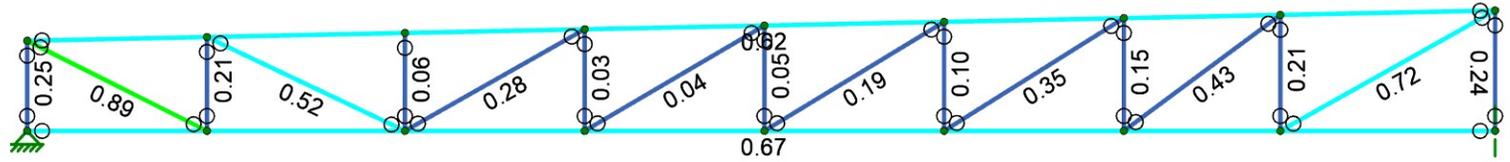
Nov 07, 2025 at 10:12 AM

Truss - RT7.r3d



2D Lock ON

Code Check (Env)	
Black	No Calc
Red	> 1.0
Magenta	.90-1.0
Green	.75-.90
Cyan	.50-.75
Blue	0-.50



Member Code Checks Displayed (Enveloped)
Envelope Only Solution

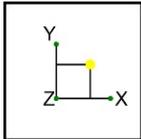


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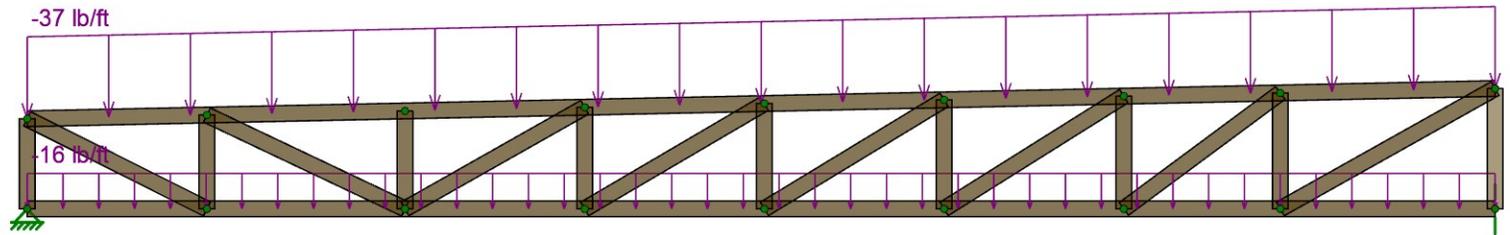
SK-2

Nov 07, 2025 at 10:12 AM

Truss - RT7.r3d



2D Lock ON

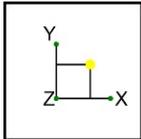


Loads: BLC 1, DL
Envelope Only Solution

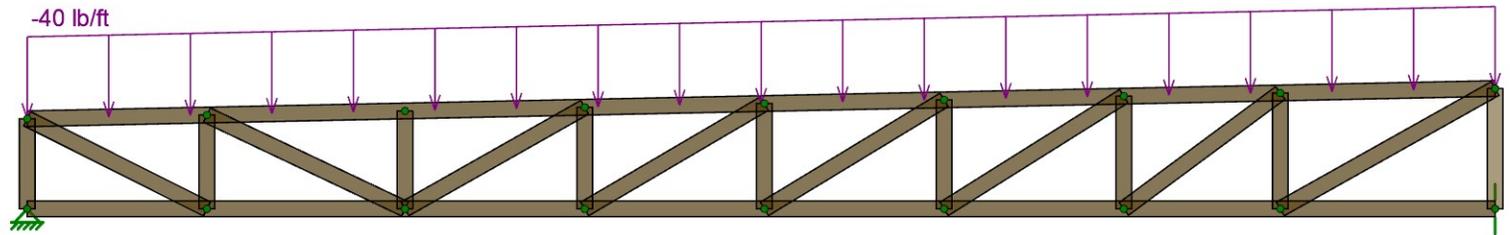


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SK-3
Nov 07, 2025 at 10:13 AM
Truss - RT7.r3d



2D Lock ON

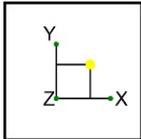


Loads: BLC 3, RLL
Envelope Only Solution

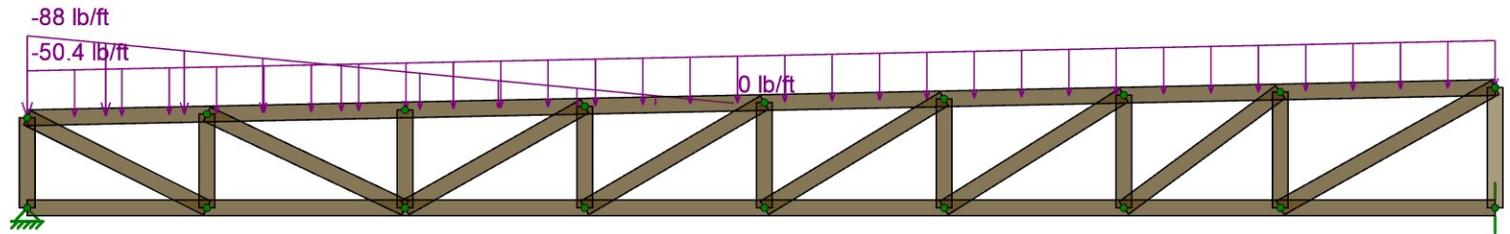


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SK-4
Nov 07, 2025 at 10:13 AM
Truss - RT7.r3d



2D Lock ON



Loads: BLC 5, SL
Envelope Only Solution



AOstructures, Inc.
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SK-5
Nov 07, 2025 at 10:13 AM
Truss - RT7.r3d

Node Coordinates

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
1	N1	0	0	0	
2	N2	27.2	0	0	
3	N3	0	1.67	0	
4	N4	27.2	2.23	0	
5	N5	3.33	0	0	
6	N6	3.33	1.738559	0	
7	N7	7	0	0	
8	N8	7	1.814118	0	
9	N9	10.33	0	0	
10	N10	10.33	1.882676	0	
11	N11	13.66	0	0	
12	N12	13.66	1.951235	0	
13	N13	16.99	0	0	
14	N14	16.99	2.019794	0	
15	N15	20.32	0	0	
16	N16	20.32	2.088353	0	
17	N17	23.22	0	0	
18	N18	23.22	2.148059	0	

Node Boundary Conditions

	Node Label	X [k/in]	Y [k/in]	Z [k/in]
1	ALL			Fixed
2	N1	Reaction	Reaction	Reaction
3	N2		Reaction	

Wood Properties

	Label	Type	Database	Species	Grade	Cm	Ci	Emod	Nu	Therm. Coeff. [1e ⁵ F ⁻¹]	Density [k/ft ³]
1	DF	Solid Sawn	Visually Graded	Douglas Fir-Larch	No.2			1	0.3	0.3	0.035
2	SP #2	Solid Sawn	Visually Graded	Southern Pine	No.2			1	0.3	0.3	0.035
3	HF	Solid Sawn	Visually Graded	Hem-Fir	No.2			1	0.3	0.3	0.035
4	SPF	Solid Sawn	Visually Graded	Spruce-Pine-fir	No.2			1	0.3	0.3	0.035
5	SPSS	Solid Sawn	Visually Graded	Southern Pine	Select Structural			1	0.3	0.3	0.035
6	SP #1	Solid Sawn	Visually Graded	Southern Pine	No.1			1	0.3	0.3	0.035

Wood Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in ²]	Iyy [in ⁴]	Izz [in ⁴]	J [in ⁴]
1	Top Chords	2X4	None	None	SP #1	Typical	5.25	0.984	5.359	2.877
2	Webs	2X4	None	None	SP #2	Typical	5.25	0.984	5.359	2.877
3	Bottom Chord	2X4	None	None	SPSS	Typical	5.25	0.984	5.359	2.877

Wood Design Parameters

	Label	Shape	Length [ft]	le2 [ft]	le1 [ft]	le-bend top [ft]	le-bend bot [ft]	K y-y	K z-z	Cr	y sway	z sway
1	M1	Top Chords	27.206	1	1	1	Segment			Yes		
2	M2	Bottom Chord	27.2	1	1	Segment	1			Yes		
3	M3	Webs	1.67			Lbyy		0.85	0.85			
4	M4	Webs	1.739			Lbyy		0.85	0.85			
5	M5	Webs	1.814			Lbyy		0.85	0.85			
6	M6	Webs	1.883			Lbyy		0.85	0.85			
7	M7	Webs	1.951			Lbyy		0.85	0.85			

Wood Design Parameters (Continued)

	Label	Shape	Length [ft]	le2 [ft]	le1 [ft]	le-bend top [ft]	le-bend bot [ft]	K y-y	K z-z	Cr	y sway	z sway
8	M8	Webs	2.02			Lbyy		0.85	0.85			
9	M9	Webs	2.088			Lbyy		0.85	0.85			
10	M10	Webs	2.148			Lbyy		0.85	0.85			
11	M11	Webs	3.725			Lbyy		0.85	0.85			
12	M12	Webs	4.061			Lbyy		0.85	0.85			
13	M13	Webs	3.825			Lbyy		0.85	0.85			
14	M14	Webs	3.86			Lbyy		0.85	0.85			
15	M15	Webs	3.895			Lbyy		0.85	0.85			
16	M16	Webs	3.931			Lbyy		0.85	0.85			
17	M17	Webs	3.609			Lbyy		0.85	0.85			
18	M18	Webs	4.562			Lbyy		0.85	0.85			
19	M19	Webs	2.23			Lbyy		0.85	0.85			

Load Combination Design

	Description	CD	Service	Hot Rolled	Cold Formed	Wood	Concrete	Masonry	Aluminum	Stainless	Connection
1	DL	0.9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	DL + RLL	1.25	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	DL + SL	1.15	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor
1	DL	Yes	Y	DL	1		
2	DL + RLL	Yes	Y	DL	1	RLL	1
3	DL + SL	Yes	Y	DL	1	SL	1

Basic Load Cases

	BLC Description	Category	Y Gravity	Distributed
1	DL	DL	-1	3
3	RLL	RLL		1
5	SL	SL		2

Member Distributed Loads (BLC 1 : DL)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	-20	-20	0	%100
2	M2	Y	-16	-16	0	%100
3	M1	Y	-17	-17	0	%100

Member Distributed Loads (BLC 3 : RLL)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	-40	-40	0	%100

Member Distributed Loads (BLC 5 : SL)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	-50.4	-50.4	0	%100
2	M1	Y	-88	0	0	13.1



Company : AOstructures, Inc.
 Designer : AO
 Job Number :
 Model Name :

11/7/2025
 10:13:40 AM
 Checked By : _____

Envelope Node Reactions

Node Label	X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]
1 N1 max	0	2	1955.342	3	0	3	0	3	0	3	LOCKED
2 min	0	1	786.026	1	0	1	0	1	0	1	LOCKED
3 N2 max	0	3	1566.009	3	0	3	0	3	0	3	LOCKED
4 min	0	1	787.754	1	0	1	0	1	0	1	LOCKED
5 N4 max	NC		NC		NC		NC		NC		LOCKED
6 min	NC		NC		NC		NC		NC		LOCKED
7 N3 max	NC		NC		NC		NC		NC		LOCKED
8 min	NC		NC		NC		NC		NC		LOCKED
9 Totals: max	0	2	3521.351	3	0	3					
10 min	0	1	1573.78	1	0	1					

Envelope AWC NDS-18 / SDPWS-21 ASD Member Wood Code Checks

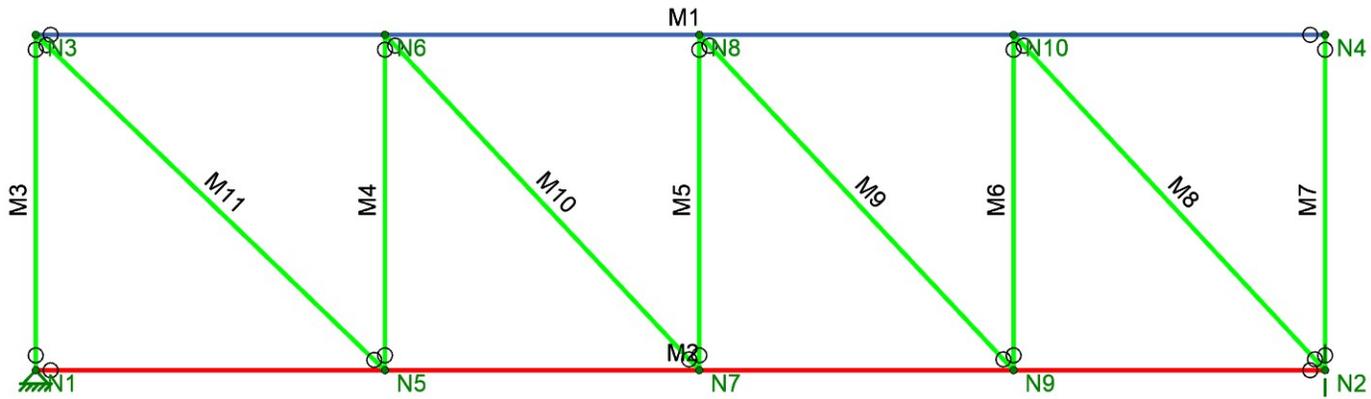
Member	Shape	Code Check	Loc[ft]	LC	Shear Check	Loc[ft]	Dir	LC	Fc' [ksi]	Ft' [ksi]	Fb1' [ksi]	Fb2' [ksi]	Fv' [ksi]	RB	CL	CP	Eqn	
1	M1	2X4	0.623	10.486	3	0.406	3.117	y	3	1.786	1.15	1.963	1.984	0.201	7.885	0.99	0.94	13.6.3
2	M2	2X4	0.667	8.5	3	0.065	23.233	y	1	2.053	1.898	3.059	3.108	0.158	7.884	0.984	0.94	3.9-1
3	M3	2X4	0.254	0	3	0	1.67	z	3	1.44	0.776	1.261	1.265	0.201	5.583	0.997	0.863	3.6.3
4	M4	2X4	0.21	0	3	0	1.739	z	3	1.416	0.776	1.26	1.265	0.201	5.697	0.996	0.849	3.6.3
5	M5	2X4	0.063	0	3	0	1.814	z	3	1.387	0.776	1.26	1.265	0.201	5.819	0.996	0.832	3.6.3
6	M6	2X4	0.03	1.883	1	0	1.883	z	3	1.128	0.608	0.987	0.99	0.201	5.928	0.997	0.864	3.9-1
7	M7	2X4	0.05	0	3	0	1.951	z	3	1.332	0.776	1.26	1.265	0.201	6.035	0.996	0.799	3.6.3
8	M8	2X4	0.102	0	3	0	2.02	z	3	1.302	0.776	1.26	1.265	0.201	6.14	0.996	0.781	3.6.3
9	M9	2X4	0.147	0	3	0	2.088	z	3	1.271	0.776	1.26	1.265	0.201	6.244	0.996	0.762	3.6.3
10	M10	2X4	0.209	0	3	0	2.148	z	3	1.243	0.776	1.259	1.265	0.201	6.332	0.996	0.745	3.6.3
11	M11	2X4	0.892	1.824	3	0.004	3.725	y	1	0.59	0.776	1.255	1.265	0.158	8.339	0.992	0.354	3.9-1
12	M12	2X4	0.522	1.988	3	0.004	4.061	y	1	0.507	0.776	1.254	1.265	0.158	8.707	0.991	0.304	3.9-1
13	M13	2X4	0.275	0	2	0.004	3.825	y	1	0.569	0.844	1.362	1.375	0.158	8.45	0.991	0.314	3.6.3
14	M14	2X4	0.043	0	2	0.004	3.86	y	1	0.56	0.844	1.362	1.375	0.158	8.488	0.991	0.309	3.6.3
15	M15	2X4	0.192	1.988	3	0.004	3.895	y	1	0.546	0.776	1.254	1.265	0.158	8.526	0.991	0.328	3.9-1
16	M16	2X4	0.351	2.006	3	0.004	3.931	y	1	0.537	0.776	1.254	1.265	0.158	8.566	0.991	0.322	3.9-1
17	M17	2X4	0.431	1.88	3	0.003	3.609	y	1	0.624	0.776	1.255	1.265	0.158	8.208	0.992	0.374	3.9-1
18	M18	2X4	0.724	2.329	3	0.005	4.562	y	1	0.41	0.776	1.252	1.265	0.158	9.228	0.99	0.246	3.9-1
19	M19	2X4	0.242	2.23	3	0	2.23	z	3	1.204	0.776	1.259	1.265	0.201	6.452	0.995	0.722	3.6.3

Truss RT-21

2D Lock ON



Section Sets
■ Top Chords
■ Webs
■ Bottom Chord



Envelope Only Solution

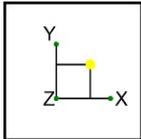


AOstructures, Inc.
AO

SK-1

Nov 07, 2025 at 10:15 AM

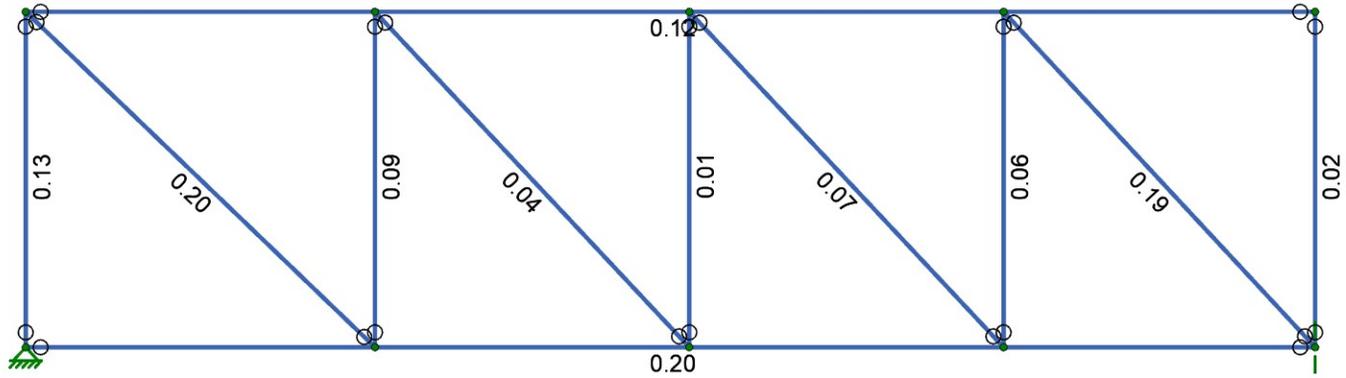
Truss - RT21.r3d



2D Lock ON

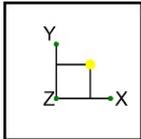
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- .90-1.0
- .75-.90
- .50-.75
- 0-.50

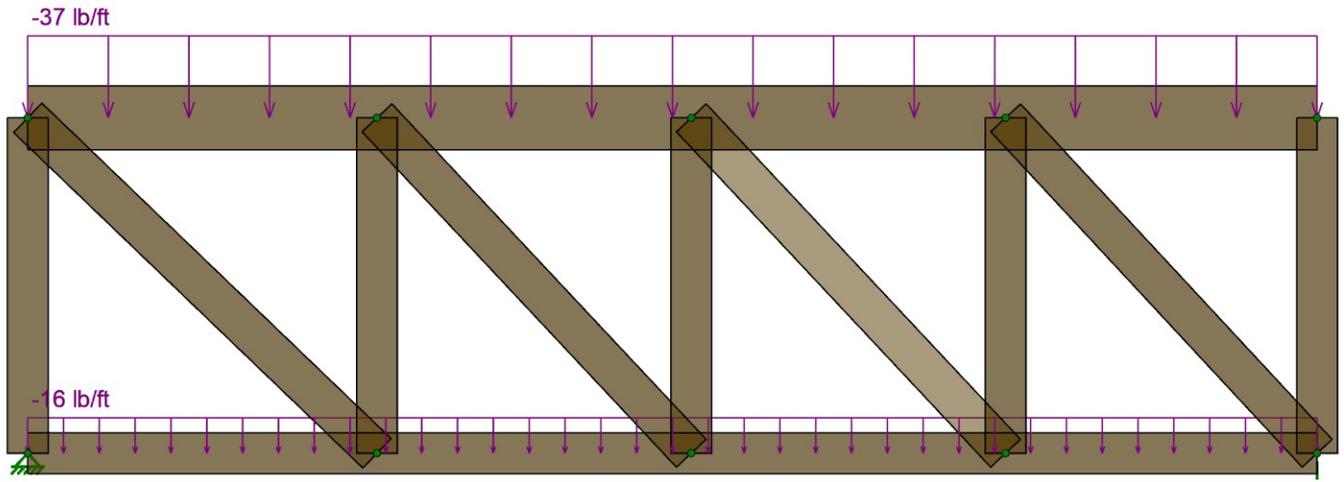


Member Code Checks Displayed (Enveloped)
Envelope Only Solution

	AOstructures, Inc.	SK-2	
	AO		Nov 07, 2025 at 10:15 AM
			Truss - RT21.r3d



2D Lock ON

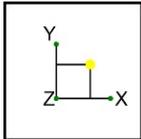


Loads: BLC 1, DL
Envelope Only Solution

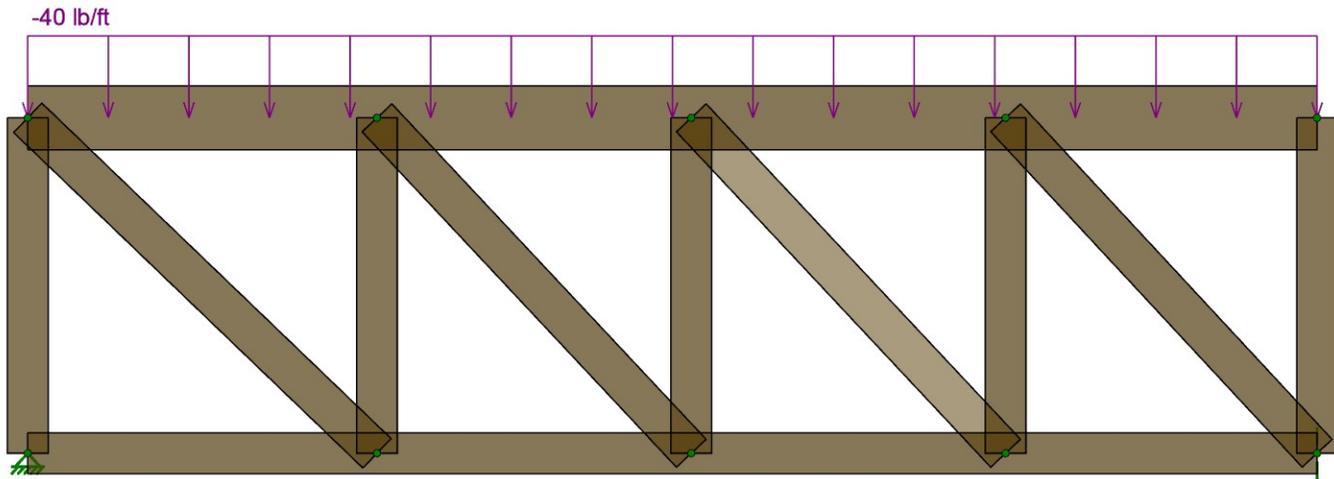


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SK-3
Nov 07, 2025 at 10:16 AM
Truss - RT21.r3d



2D Lock ON

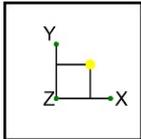


Loads: BLC 3, RLL
Envelope Only Solution

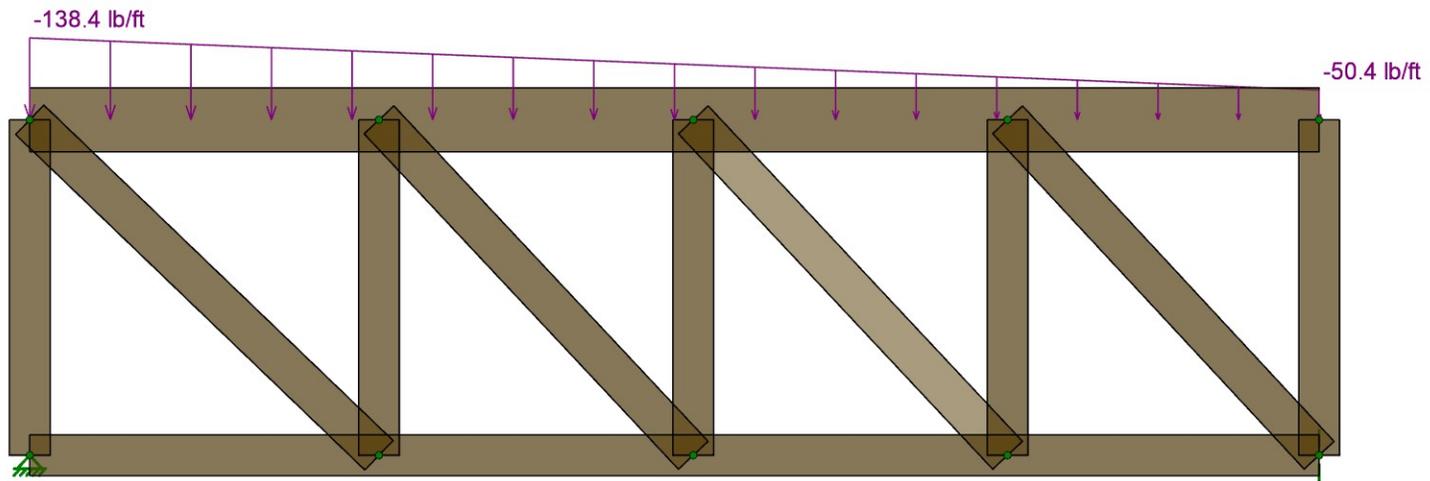


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SK-4
Nov 07, 2025 at 10:16 AM
Truss - RT21.r3d



2D Lock ON



Loads: BLC 5, SL
Envelope Only Solution



AOstructures, Inc.
AO

SK-5
Nov 07, 2025 at 10:16 AM
Truss - RT21.r3d

Node Coordinates

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
1	N1	0	0	0	
2	N2	9.23	0	0	
3	N3	0	2.4	0	
4	N4	9.23	2.4	0	
5	N5	2.5	0	0	
6	N6	2.5	2.4	0	
7	N7	4.75	0	0	
8	N8	4.75	2.4	0	
9	N9	7	0	0	
10	N10	7	2.4	0	

Node Boundary Conditions

	Node Label	X [k/in]	Y [k/in]	Z [k/in]
1	ALL			Fixed
2	N1	Reaction	Reaction	Reaction
3	N2		Reaction	

Wood Properties

	Label	Type	Database	Species	Grade	Cm	Ci	Emod	Nu	Therm. Coeff. [1e ⁵ F ⁻¹]	Density [k/ft ³]
1	DF	Solid Sawn	Visually Graded	Douglas Fir-Larch	No.2			1	0.3	0.3	0.035
2	SP #2	Solid Sawn	Visually Graded	Southern Pine	No.2			1	0.3	0.3	0.035
3	HF	Solid Sawn	Visually Graded	Hem-Fir	No.2			1	0.3	0.3	0.035
4	SPF	Solid Sawn	Visually Graded	Spruce-Pine-fir	No.2			1	0.3	0.3	0.035
5	SPSS	Solid Sawn	Visually Graded	Southern Pine	Select Structural			1	0.3	0.3	0.035
6	SP #1	Solid Sawn	Visually Graded	Southern Pine	No.1			1	0.3	0.3	0.035

Wood Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in ²]	Iyy [in ⁴]	Izz [in ⁴]	J [in ⁴]
1	Top Chords	2X6	None	None	SP #2	Typical	8.25	1.547	20.797	5.125
2	Webs	2X4	None	None	SP #2	Typical	5.25	0.984	5.359	2.877
3	Bottom Chord	2X4	None	None	SP #2	Typical	5.25	0.984	5.359	2.877

Wood Design Parameters

	Label	Shape	Length [ft]	le2 [ft]	le1 [ft]	le-bend top [ft]	le-bend bot [ft]	K y-y	K z-z	Cr	y sway	z sway
1	M1	Top Chords	9.23	1	1	1	Segment			Yes		
2	M2	Bottom Chord	9.23	1	1	Segment	1			Yes		
3	M3	Webs	2.4			Lbyy		0.85	0.85			
4	M4	Webs	2.4			Lbyy		0.85	0.85			
5	M5	Webs	2.4			Lbyy		0.85	0.85			
6	M6	Webs	2.4			Lbyy		0.85	0.85			
7	M7	Webs	2.4			Lbyy		0.85	0.85			
8	M8	Webs	3.276			Lbyy		0.85	0.85			
9	M9	Webs	3.29			Lbyy		0.85	0.85			
10	M10	Webs	3.29			Lbyy		0.85	0.85			
11	M11	Webs	3.466			Lbyy		0.85	0.85			

Load Combination Design

	Description	CD	Service	Hot Rolled	Cold Formed	Wood	Concrete	Masonry	Aluminum	Stainless	Connection
1	DL	0.9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	DL + RLL	1.25	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	DL + SL	1.15	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor
1	DL	Yes	Y	DL	1		
2	DL + RLL	Yes	Y	DL	1	RLL	1
3	DL + SL	Yes	Y	DL	1	SL	1

Basic Load Cases

	BLC Description	Category	Y Gravity	Distributed
1	DL	DL	-1	3
3	RLL	RLL		1
5	SL	SL		2

Member Distributed Loads (BLC 1 : DL)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	-20	-20	0	%100
2	M2	Y	-16	-16	0	%100
3	M1	Y	-17	-17	0	%100

Member Distributed Loads (BLC 3 : RLL)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	-40	-40	0	%100

Member Distributed Loads (BLC 5 : SL)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	-50.4	-50.4	0	%100
2	M1	Y	-88	0	0	13.1

Envelope Node Reactions

	Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]
1	N1	max	0	3	779.021	3	0	3	0	3	0	3	LOCKED
2		min	0	1	275.667	1	0	1	0	1	0	1	LOCKED
3	N2	max	0	3	644.08	3	0	3	0	3	0	3	LOCKED
4		min	0	1	276.122	1	0	1	0	1	0	1	LOCKED
5	N4	max	NC		NC		NC		NC		NC		LOCKED
6		min	NC		NC		NC		NC		NC		LOCKED
7	N3	max	NC		NC		NC		NC		NC		LOCKED
8		min	NC		NC		NC		NC		NC		LOCKED
9	N9	max	NC		NC		NC		LOCKED		NC		NC
10		min	NC		NC		NC		LOCKED		NC		NC
11	Totals:	max	0	3	1423.101	3	0	3					
12		min	0	1	551.789	1	0	1					



Company : AOstructures, Inc.
 Designer : AO
 Job Number :
 Model Name :

11/7/2025
 10:16:59 AM
 Checked By : _____

Envelope AWC NDS-18 / SDPWS-21 ASD Member Wood Code Checks

Member	Shape	Code Check	Loc[ft]	LC Shear Check	Loc[ft]	Dir	LC Fc' [ksi]	Ft' [ksi]	Fb1' [ksi]	Fb2' [ksi]	Fv' [ksi]	RB	CL	CP	Eqn			
1	M1	2X6	0.124	1.058	3	0.204	2.5	y	3	1.519	0.69	1.318	1.322	0.201	5.416	0.997	0.943	3.9-3
2	M2	2X4	0.197	5.769	3	0.045	2.5	y	1	1.569	0.776	1.447	1.455	0.158	6.481	0.995	0.941	3.9-1
3	M3	2X4	0.129	0	3	0	2.4	z	3	1.12	0.776	1.259	1.265	0.201	6.693	0.995	0.672	3.6.3
4	M4	2X4	0.088	0	3	0	2.4	z	3	1.12	0.776	1.259	1.265	0.201	6.693	0.995	0.672	3.6.3
5	M5	2X4	0.011	0	3	0	2.4	z	3	1.12	0.776	1.259	1.265	0.201	6.693	0.995	0.672	3.6.3
6	M6	2X4	0.062	2.4	3	0	2.4	z	3	1.12	0.776	1.259	1.265	0.201	6.693	0.995	0.672	3.9-1
7	M7	2X4	0.016	0	3	0	2.4	z	3	1.12	0.776	1.259	1.265	0.201	6.693	0.995	0.672	3.6.3
8	M8	2X4	0.189	3.276	3	0.003	3.276	y	1	0.732	0.776	1.256	1.265	0.158	7.82	0.993	0.436	3.6.3
9	M9	2X4	0.074	0	3	0.003	3.29	y	1	0.727	0.776	1.256	1.265	0.158	7.836	0.993	0.436	3.6.3
10	M10	2X4	0.039	1.576	3	0.003	3.29	y	1	0.727	0.776	1.256	1.265	0.158	7.836	0.993	0.436	3.9-1
11	M11	2X4	0.204	1.661	3	0.003	3.466	y	1	0.668	0.776	1.255	1.265	0.158	8.043	0.992	0.4	3.9-1

Steel Beam

Project File: Glrder.ec6

LIC# : KW-06014891, Build:20.24.10.30

AOstructures Inc.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: Beam 1

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021

Load Combination Set : ASCE 7-16

Material Properties

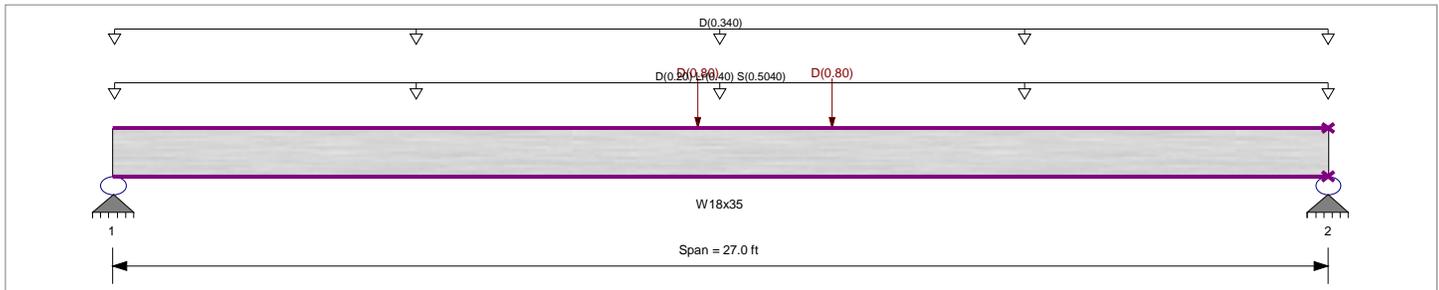
Analysis Method : Allowable Strength Design

Fy : Steel Yield : 50.0 ksi

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

E: Modulus : 29,000.0 ksi

Bending Axis : Major Axis Bending



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added

Loads on all spans...

Uniform Load on ALL spans : D = 0.010, Lr = 0.020, S = 0.02520 ksf, Tributary Width = 20.0 ft

Uniform Load on ALL spans : D = 0.0170 ksf, Tributary Width = 20.0 ft

Load(s) for Span Number 1

Point Load : D = 0.80 k @ 16.0 ft, (RTU1)

Point Load : D = 0.80 k @ 13.0 ft, (RTU2)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.631 : 1	Maximum Shear Stress Ratio =	0.141 : 1
Section used for this span	W18x35	Section used for this span	W18x35
Ma : Applied	104.736 k-ft	Va : Applied	14.953 k
Mn / Omega : Allowable	165.918 k-ft	Vn/Omega : Allowable	106.20 k
Load Combination	+D+S	Load Combination	+D+S
Span # where maximum occurs	Span # 1	Location of maximum on span	27.000 ft
		Span # where maximum occurs	Span # 1
Maximum Deflection			
Max Downward Transient Deflection	0.409 in Ratio = 791 >=360	Span: 1 : S Only	
Max Upward Transient Deflection	0 in Ratio = 0 <360	n/a	
Max Downward Total Deflection	0.923 in Ratio = 351 >=180	Span: 1 : +D+S	
Max Upward Total Deflection	0 in Ratio = 0 <180	n/a	

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values						Summary of Shear Values			
			M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx/Vnx/Omega	
D Only														
Dsgn. L =	27.00 ft	1	0.354	0.077	58.81		58.81	277.08	165.92	1.00	1.00	8.15	159.30	106.20
+D+Lr														
Dsgn. L =	27.00 ft	1	0.574	0.128	95.26		95.26	277.08	165.92	1.00	1.00	13.55	159.30	106.20
+D+S														
Dsgn. L =	27.00 ft	1	0.631	0.141	104.74		104.74	277.08	165.92	1.00	1.00	14.95	159.30	106.20
+D+0.750Lr														
Dsgn. L =	27.00 ft	1	0.519	0.115	86.15		86.15	277.08	165.92	1.00	1.00	12.20	159.30	106.20
+D+0.750S														
Dsgn. L =	27.00 ft	1	0.562	0.125	93.25		93.25	277.08	165.92	1.00	1.00	13.25	159.30	106.20
+0.60D														
Dsgn. L =	27.00 ft	1	0.213	0.046	35.29		35.29	277.08	165.92	1.00	1.00	4.89	159.30	106.20

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.9230	13.577		0.0000	0.000

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Glrder.ec6

LIC# : KW-06014891, Build:20.24.10.30

AOstructures Inc.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: Beam 1

Vertical Reactions

Support notation : Far left is #'

Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	14.835	14.953
Max Upward from Load Combinations	14.835	14.953
Max Upward from Load Cases	8.031	8.149
D Only	8.031	8.149
+D+Lr	13.431	13.549
+D+S	14.835	14.953
+D+0.750Lr	12.081	12.199
+D+0.750S	13.134	13.252
+0.60D	4.818	4.890
Lr Only	5.400	5.400
S Only	6.804	6.804

Steel Beam

Project File: Glrder.ec6

LIC# : KW-06014891, Build:20.24.10.30

AOstructures Inc.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: Beam 2

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021

Load Combination Set : ASCE 7-16

Material Properties

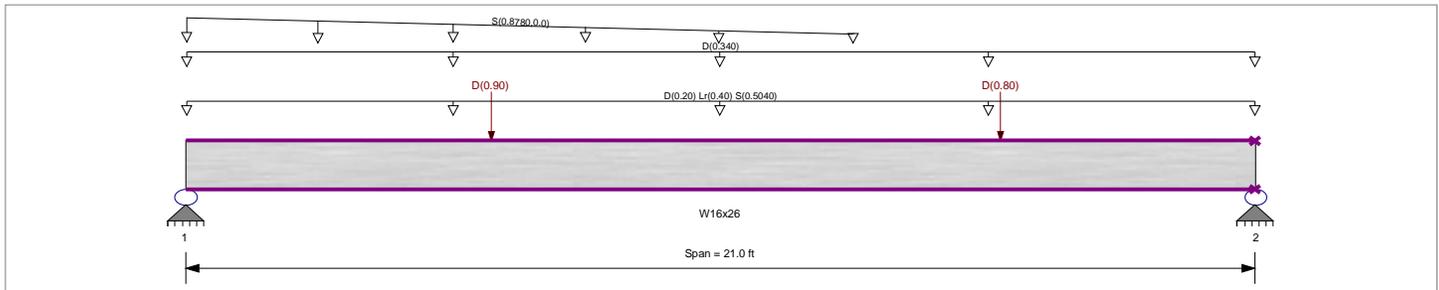
Analysis Method : Allowable Strength Design

Fy : Steel Yield : 50.0 ksi

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

E: Modulus : 29,000.0 ksi

Bending Axis : Major Axis Bending



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added

Loads on all spans...

Uniform Load on ALL spans : D = 0.010, Lr = 0.020, S = 0.02520 ksf, Tributary Width = 20.0 ft

Uniform Load on ALL spans : D = 0.0170 ksf, Tributary Width = 20.0 ft

Varying Uniform Load : S = 0.8780->0.0 k/ft, Extent = 0.0 -->> 13.10 ft

Load(s) for Span Number 1

Point Load : D = 0.80 k @ 16.0 ft, (RTU1)

Point Load : D = 0.90 k @ 6.0 ft, (RTU2)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.680 : 1	Maximum Shear Stress Ratio =	0.232 : 1
Section used for this span	W16x26	Section used for this span	W16x26
Ma : Applied	75.044 k-ft	Va : Applied	16.350 k
Mn / Omega : Allowable	110.279 k-ft	Vn/Omega : Allowable	70.509 k
Load Combination	+D+S	Load Combination	+D+S
Span # where maximum occurs	Span # 1	Location of maximum on span	0.000 ft
		Span # where maximum occurs	Span # 1
Maximum Deflection			
Max Downward Transient Deflection	0.370 in Ratio =	680 >=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in Ratio =	0 <360	n/a
Max Downward Total Deflection	0.689 in Ratio =	366 >=180	Span: 1 : +D+S
Max Upward Total Deflection	0 in Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values					Summary of Shear Values				
			M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx/Vnx/Omega	
D Only														
Dsgn. L = 21.00 ft		1	0.313	0.093	34.47		34.47	184.17	110.28	1.00	1.00	6.54	117.75	70.51
+D+Lr														
Dsgn. L = 21.00 ft		1	0.513	0.152	56.52		56.52	184.17	110.28	1.00	1.00	10.74	117.75	70.51
+D+S														
Dsgn. L = 21.00 ft		1	0.680	0.232	75.04		75.04	184.17	110.28	1.00	1.00	16.35	117.75	70.51
+D+0.750Lr														
Dsgn. L = 21.00 ft		1	0.463	0.137	51.01		51.01	184.17	110.28	1.00	1.00	9.69	117.75	70.51
+D+0.750S														
Dsgn. L = 21.00 ft		1	0.588	0.197	64.87		64.87	184.17	110.28	1.00	1.00	13.89	117.75	70.51
+0.60D														
Dsgn. L = 21.00 ft		1	0.188	0.056	20.68		20.68	184.17	110.28	1.00	1.00	3.92	117.75	70.51

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.6889	10.380		0.0000	0.000

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Glrder.ec6

LIC# : KW-06014891, Build:20.24.10.30

AOstructures Inc.

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: Beam 2

Vertical Reactions

Support notation : Far left is #'

Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	16.350	13.024
Max Upward from Load Combinations	16.350	13.024
Max Upward from Load Cases	9.847	6.537
D Only	6.503	6.537
+D+Lr	10.703	10.737
+D+S	16.350	13.024
+D+0.750Lr	9.653	9.687
+D+0.750S	13.889	11.403
+0.60D	3.902	3.922
Lr Only	4.200	4.200
S Only	9.847	6.488



LATERAL CHECK OF EXISTING LFRS

Per 10% lateral exemption of 2021 IBC - Existing Building Code - Section 503.4

Methodology: The proposed PV array will be uniformly distributed about the roof surface. Therefore, it is reasonable to assume that the seismic force applied from the PV array will be uniformly distributed back into the underlying roof diaphragm and existing lateral force resisting system. The increase in lateral load to the building will be held to a maximum increase of 10% as per the limitations of the 10% exemption of the existing building code. Due to the fact that seismic load is directly proportional to the weight of the building, the net increase in seismic mass of the roof diaphragm will be held to a 10% increase. The existing seismic mass at the roof diaphragm level is equivalent to the weight of the roof and 1/2 of the walls below.

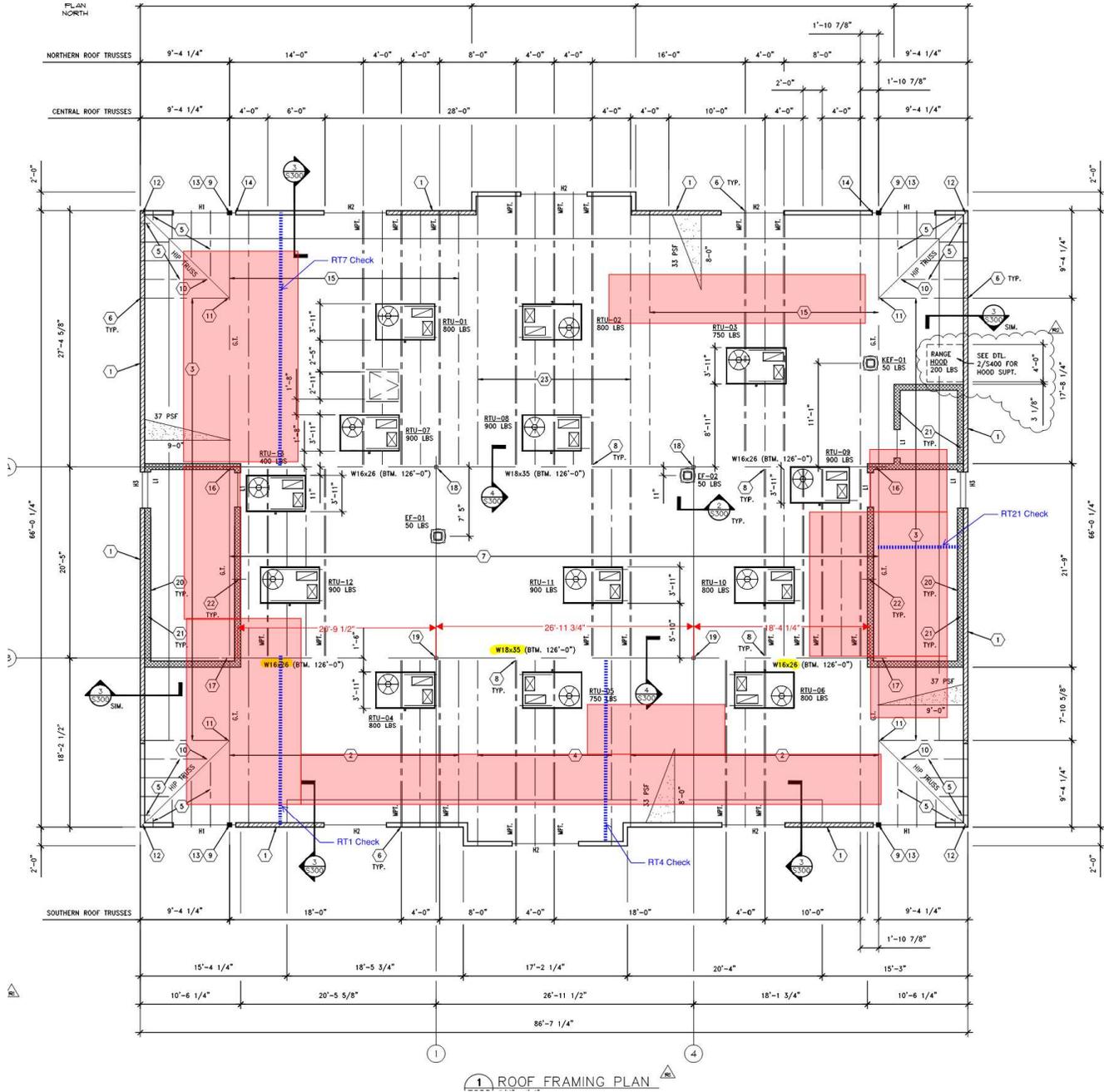
Existing Weight of Effected Building			
Level	Area	Weight (psf)	Weight (lb)
Roof	5,676 sf	12.0 psf	68,112 lb (As per asbuilt plans)
Ceiling	5,676 sf	8.0 psf	45,408 lb (As per asbuilt plans)
Ext. Walls	225 ft	15.0 psf	16,875 lb (10'-0" Wall Height)
Int. Walls	113 ft	10.0 psf	5,625 lb
Existing Weight of Effected Building			136,020 lb

Proposed Weight of PV System	
Approximate Total Weight of PV System	9,594 lb

10% Comparison	
10% of Existing Building Weight (Allowed)	13,602 lb
Approximate Weight of PV System (Actual)	9,594 lb
Percent Increase	7.1%
13602 lb > 9594 lb, Therefore OK	



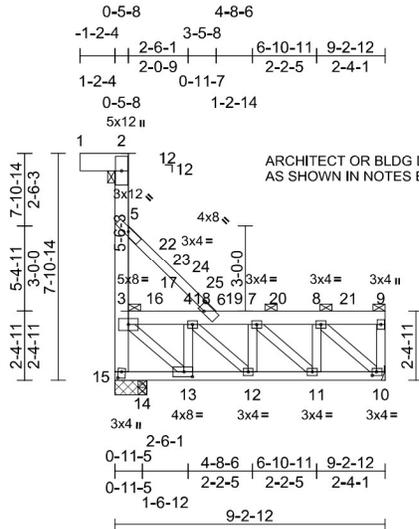
Appendix A: Framing Information & Site Specific Pictures





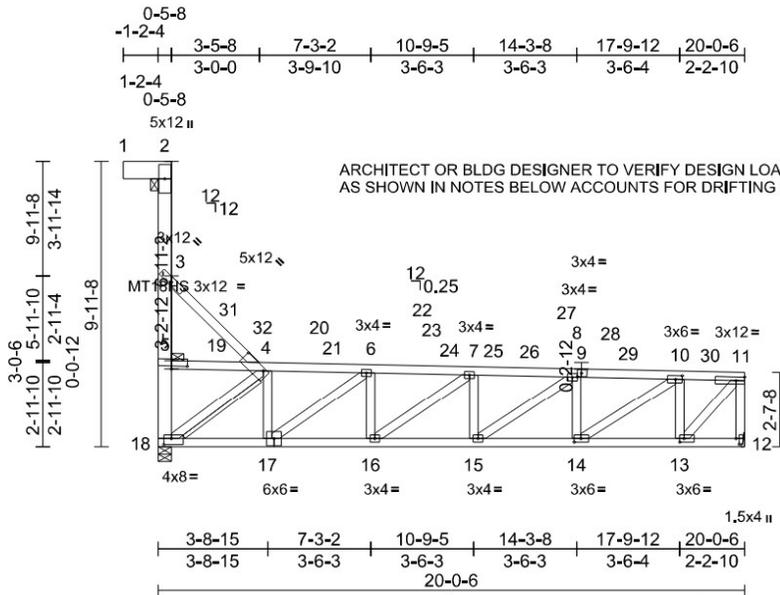
Appendix A: Framing Information & Site Specific Pictures

RT-21



LUMBER
 TOP CHORD 2x6 SP No.2 *Except* 2-1:2x8 SP No.2,
 6-5:2x4 SP No.2
 BOT CHORD 2x4 SP No.2
 WEBS 2x4 SP No.2 *Except* 2-15:2x6 SP No.2

RT-4

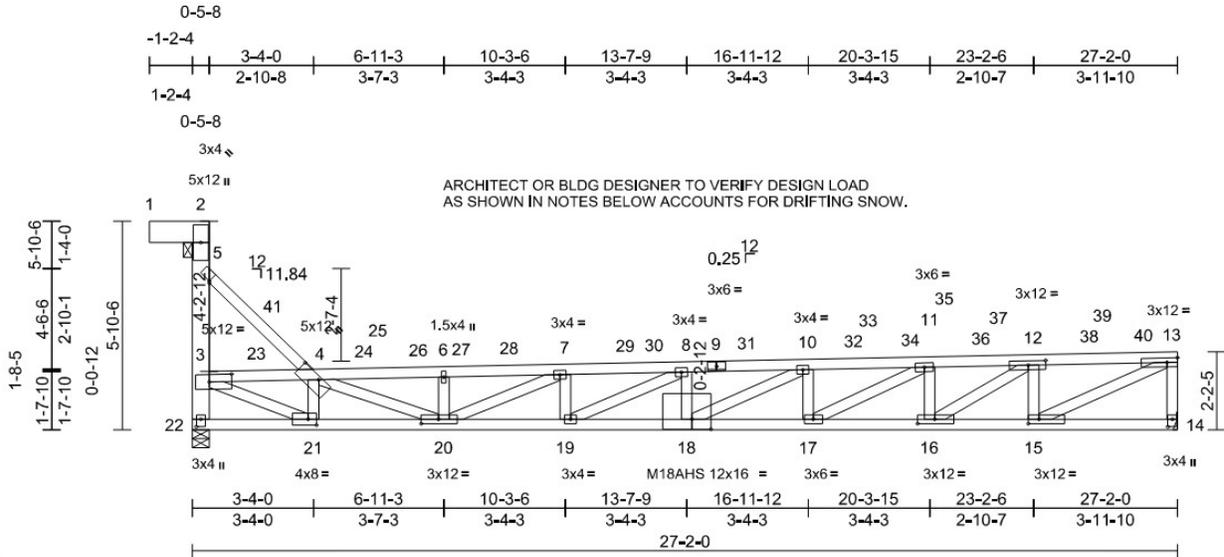


LUMBER
 TOP CHORD 2x8 SP No.2 *Except* 9-11:2x4 SP No.2,
 4-3,9-5:2x4 SP 2400F 2,0E
 BOT CHORD 2x4 SP 2400F 2,0E
 WEBS 2x4 SP No.2 *Except* 2-18:2x6 SP No.2
 OTHERS 2x4 SPF No.2(flat)



Appendix A: Framing Information & Site Specific Pictures

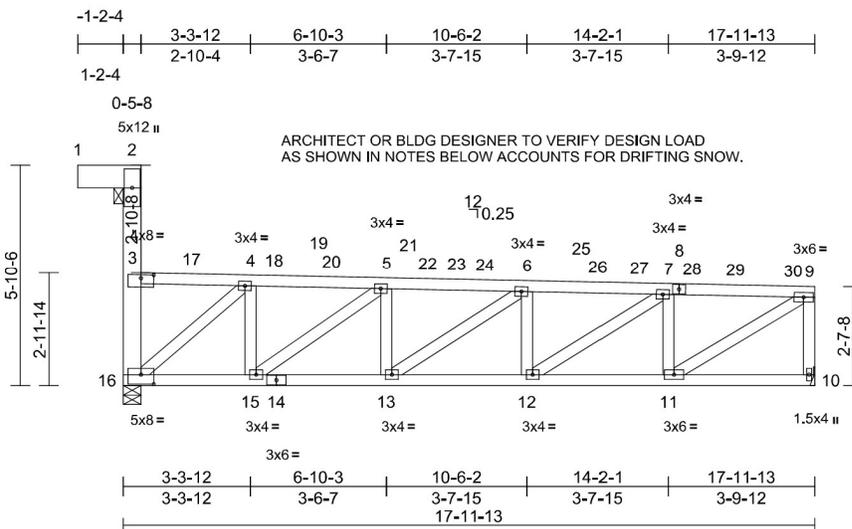
RT-7



LUMBER

TOP CHORD 2x4 SP 2400F 2.0E *Except* 0-0,2-1:2x8 SP No.2, 5-4:2x4 SP No.2
 BOT CHORD 2x4 SP 2400F 2.0E
 WEBS 2x4 SP No.2 *Except* 21-3:2x4 SP 2400F 2.0E, 2-22:2x6 SP No.2

RT-1



LUMBER

TOP CHORD 2x8 SP No.2 *Except* 3-8:2x4 SP 2400F 2.0E, 8-9:2x4 SP No.2
 BOT CHORD 2x4 SP 2400F 2.0E
 WEBS 2x4 SP No.2 *Except* 2-16:2x6 SP No.2



Appendix B: General Notes

GENERAL

- The contractor shall verify all dimensions, property setbacks, AHJ/HOA CC&R's, elevations and site conditions before starting work and shall notify AOstructure, Inc. (AOstructures) of any discrepancies.
- All report conclusions represent AOstructures, Inc.'s best professional judgment based upon industry standards.
- Resolve any conflicts on the drawings with AOstructures, Inc before proceeding with construction.
- The design criteria used for this project & listed on the first page of the report is based on the engineers best judgement and/or provided by the ATC council. AHJ specific requests may differ. Please contact our team if the design criteria needs to be modified.
- A site visit was not physically conducted by AOstructures. The accompanying calculations and certification are provided with the understanding that the building is in a good state of repair and was constructed to standard construction practice. It shall be the contractors responsibility to identify any framing irregularities including but not limited to inconsistent framing conditions, water, fire, pest or mold damage, cracked, split, deflecting, removed or otherwise compromised framing members and notify the EOR of any such findings prior to starting construction.
- AOstructures is not responsible for enforcing safety measures or regulations. The contractor shall design, construct, and maintain all safety devices including shoring and bracing, and shall be solely responsible for conforming to all local, state and federal safety and health standards, laws and regulations. The contractor shall take necessary precautions to maintain and insure the integrity of the structure during construction. If a lawsuit is filed by one of the contractor's or subcontractor's employees, or any one else, the contractor will indemnify, defend and hold the owner and AOstructures harmless of any and all such claims.
- Any and all waterproofing shall be provided by the contractor. AOstructures is not responsible for waterproofing.
- The anchorage design of miscellaneous equipment (including but not limited to conduit, inverters, batteries, transformers, etc.) is not included in the scope of this review. If required or requested, additional services can be provided from our team to include such elements.
- All hardware shall be installed per manufacturer specifications and within specified design limitations. AOstructures, Inc. assumes no responsibility for incorrectly installed hardware or hardware installed outside of the manufacturer specifications.

USER RELIANCE

- AOstructures was engaged by Lumina Solar (Client) to perform this assessment. This report and the information therein, are for the exclusive use of the Client. This report has no other purpose and shall not be relied upon, or used, by any other person or entity without the written consent of AOstructures. Third parties that obtain this report, or the information within shall have no rights of recourse or recovery against AOstructures, it's officers or employees.

ROOF MOUNTED ARRAY'S

- If an analysis of a supporting structure is included in our scope of work, the structural assessment only applies to the section of the roof that is directly supporting the proposed solar PV system. No existing solar system or other building components are certified by this report unless specifically mentioned as otherwise.
- No structural members can be cut for conduit, etc., unless specifically shown. Obtain prior written approval for installation of any additional conduit, etc. It is the contractors responsibility to field verify the location of any and all embedded or hidden rebar, mechanical, electrical or plumbing components prior to starting
- Provide staggered rails/struts/beams every 100'-0", min. or per manufacturer spec's, whichever is smaller to allow for thermal expansion of the array elements.
- It is assumed that a standard quality of construction care was used to construct the original building and any subsequent retrofits, additions, remodels or tenant improvements. Roof's are assumed to be installed per manufacturer specifications and in good condition. It is the contractors responsibility to field inspect any and all decking or framing members supporting the proposed PV array for sub-standard construction means, signs of dryrot or water damage, corrosion mold, fire damage, etc. and notify AOstructures in writing if any compromised material is found on site prior to starting construction.
- It is assumed that there have been no additional loads (HVAC or MEP equipment, additional layers of roofing, etc) added to the building over the course of the structures history. The contractor and/or client shall verify this with the property owner and notify AOstructures, Inc. if additional load has been added to the structure already.
- Flexible utility connections must be used at any building seismic joint.
- Care should be taken during installation to ensure that PV arrays and/or miscellaneous equipment does not preclude drainage of water.
- Unless otherwise noted, construction material shall be evenly distributed if placed on framed floors or roofs. Loads shall not exceed the allowable loading for the supporting members and their connections. A certification of the underlying building does not account for construction loads or construction staging unless specifically stated otherwise.
- All fasteners at the roof shall be stainless steel or otherwise be protected by a waterproofing membrane and installed withing the middle 1/3 of the dimensional width of the framing members.
- All fasteners shall be a minimum of 6" away from any truss panel or hinge joints, truss plates and/or member ends. Field verify location of fasteners prior to starting construction. All fasteners shall be pre-drilled to avoid splitting existing lumber.
- Unless otherwise noted, all lags installed in underlying roof framing members shall be embedded (threaded embed) a minimum of 2.5" into the underlying framing.
- AOstructures is not responsible for downslope effects of snow shedding or sliding off of the PV array nor any damage to downslope decks, roofs, walkways, landscaping, automobiles, pets, people, etc.. If snow guards are requested by the customer, notify AOstructures.



February 25, 2026

TO: King Energy

SUBJECT: Supplement A - Attachment Calcs - Kiddie Academy (Hassan Saeed)
6515 Crossroads Village Blvd., Haymarket, VA. 20169

SCOPE OF WORK:

AOstructures, Inc. was asked to provide a supplementary review to evaluate the capacity of the roof fasteners for the project at the above subject location. The scope of this report is strictly limited to the items listed below and based on the design criteria listed below.

- Evaluate the fastener connection capacity of the proposed racking system to the existing roof structure based on manufacturer provided demand values listed below in the design criteria. All array anchorage (ballast) for wind and seismic forces shall be provided by the manufacturer (by others) and is not included in our scope of work.

PROVIDED INFORMATION:

Unirac provided racking calculations which specify the standoff capacity shear and uplift values of 194 lb and 355 lb respectively. It is our understanding that these values are the maximum uplift and shear forces applied to the roof attachments.

STRUCTURE DESCRIPTION:

The roof framing system of (Roof A) consists of a built-up roof atop of plywood sheathing which is supported by pre-fabricated roof trusses spaced at 24" o.c.. The roof trusses are marginally sloped for drainage.

DESIGN CRITERIA:

- Applicable Codes = 2021 IBC/IRC, ASCE 7-16
- Governing Shear = 194lb
- Governing Uplift = 355lb

CONCLUSIONS:

The Unirac Flashloc RM attachments may be connected to the underlying plywood roof sheathing using a minimum of (8) #14 wood screws per attachment. All screws shall penetrate the sheathing by a minimum of 3/4". The fasteners shall be stainless steel or otherwise protected by a waterproofing membrane. The attachments shall be fastened to the roof diaphragm sheathing and not to built-up roof sheathing. The contractor shall field verify sheathing location and core through roof build up as necessary. If roof build-up exceeds 6", notify EOR prior to starting installation.

Please contact me with any further questions or concerns regarding this project.

Sincerely,



02/25/2026

Andrew Oesterreicher, P.E.

Project Engineer



Fastener & Standoff Uplift Capacity Check

Input Variables

Demand Uplift =	355.0 lb	Per Unirac
Fastener Type =	#14 Wood Screw	
Attachment material =	Plywood decking	

Fastener Capacity Check - Uplift

Uplift Demand =	355.0 lb	
Fastener Type =	#14 Wood Screw	
Number of Fasteners =	8	
Ultimate Capacity of Individual Fastener =	350 lb	(Per APA table below)
Group Ultimate Capacity =	2800 lb	
Factor of Safety =	4.0	
Group Allowed Capacity =	700 lb	
Demand / Capacity Ratio =	51%	

Results: 700 lb capacity > 355 lb demand **Therefore, OK**

Standoff Capacity Check - Uplift

Uplift Demand =	355.0 lb	
Ultimate Standoff Uplift Capacity =	6670.0 lb	(See Appendix A)
Factor of Safety =	4.0	
Allowed Standoff Uplift Capacity =	1668 lb	
Demand / Capacity Ratio =	21%	

Results: 1667.5 lb capacity > 355 lb demand **Therefore, OK**

APA Ultimate Capacity Tables

Wood and Sheet Metal Screws: Metal-to-Plywood Connections^(a)

Depth of Threaded Penetration (in.)	Average Ultimate Withdrawal Load (lb)					
	Screw Size					
	#6	#8	#10	#12	#14	#16
3/8	150	180	205	–	350	–
1/2	200	240	275	315	440	–
5/8	250	295	345	390	525	–
3/4	300	355	415	470	700	–
1	–	–	–	625	790	775
1-1/8	–	–	–	705	1580	875
2-1/4	–	–	–	–	–	–



Fastener & Standoff Shear Capacity Check

Input Variables

Demand Shear =	194.0 lb	Per Unirac
Fastener Type =	#14 Wood Screw	
Attachment material =	Plywood decking	

Fastener Capacity Check - Shear

Shear Demand =	194.0 lb	
Fastener Type =	#14 Wood Screw	
Number of Fasteners =	8	
Ultimate Capacity of Individual Fastener =	590 lb	(Per APA table below)
Group Ultimate Capacity =	4720 lb	
Factor of Safety =	4.0	
Group Allowed Capacity =	1180 lb	
Demand / Capacity Ratio =	16%	

Results: 1180 lb capacity > 194 lb demand **Therefore, OK**

Standoff Capacity Check - Shear

Shear Demand =	194.0 lb	
Ultimate Standoff Shear Capacity =	5760.0 lb	(See Appendix A)
Factor of Safety =	4.0	
Allowed Standoff Shear Capacity =	1440 lb	
Demand / Capacity Ratio =	13%	

Results: 1440 lb capacity > 194 lb demand **Therefore, OK**

APA Ultimate Capacity Tables

TABLE 1.
 Screws: Metal-to-Plywood Connections^(a)

Depth of Threaded Penetration (in.)	Ultimate Lateral Load (lb) ^(b)					
	Wood Screws			Sheet Metal Screws		
	#8	#10	#12	#8	#10	#12
1/2	415	(500)	590	465	(565)	670
5/8	–	–	–	500	(600)	705
3/4	–	–	–	590	(655)	715

(a) Plywood was C-D grade with exterior glue (all plies Group 1), face grain parallel to load. Side plate was 3/16"-thick steel.

(b) Values in parentheses are estimates based on other tests.



Plywood Bending Capacity Check

Assumptions

- Plywood is laid perpendicular to rafter span direction
- Plywood is a continuous 8'-0" member
- Plywood is in good repair with no damage from moisture/dryrot/fire/etc.
- Plywood has a minimum span rating of 24/0 and a minimum thickness of 15/32"

Input Variables

Demand Uplift (P) =	355.0 lb	Per Unirac
Purlin/Joist Spacing =	24.0 in	
Plywood Span Rating =	24/0	(Assumed)
Plywood Thickness =	15/32	(Assumed)

Plywood Bending Capacity Check

Uplift Demand =	355.0 lb	
Demand Moment =	$(5 * P * L) / 32$	Pinned/Fixed Condition
	1331.3 lb-in	
FbS =	275.0 lbf-in/ft	(Per APA Table 9 - See Below)
Cd =	1.6	(Per APA Table 6)
FbS * Cd =	440.0 lbf-in/ft	
Rail Spacing =	37.0 in	(Half of a PV Module)
Tributary area over which load is applied =	Rail Spacing or 4'-0", whichever is less	
	37.0 in	
Plywood Moment Capacity =	1356.7 lbf-in	
Demand / Capacity Ratio =	98%	

Results: 1356.7 lb-in capacity > 1331.3 lb-in demand

Therefore, OK

APA Design Capacity Tables

PANEL BENDING STRENGTH, F _b S (lbf-in./ft of panel width)									
W24	NA	NA	NA	300	NA	NA	NA	97	
24/0	250	275	300	300	54	65	97	97	
24/16	320	350	385	385	64	77	115	115	
32/16	370	405	445	445	92	110	165	165	
40/20	625	690	750	750	150	180	270	270	
48/24	NA	930	1,000	1,000	NA	270	405	405	
16 oc	415	455	500	500	100	120	180	180	
20 oc	480	530	575	575	140	170	250	250	
24 oc	NA	705	770	770	NA	260	385	385	
32 oc	NA	NA	1,050	1,050	NA	NA	685	685	
48 oc	NA	NA	1,900	1,900	NA	NA	1,200	1,200	



Plywood Punching Shear Capacity Check

Input Variables

Demand Uplift (Punching Shear) =	355.0 lb	Per Unirac
Purlin/Joist Spacing =	24.0 in	
Plywood Span Rating =	24/0	(Assumed)
Plywood Thickness =	15/32	(Assumed)
Standoff Diameter =	7.25 in	

Plywood Shear Capacity Check

Punching Shear Demand =	355.0 lb	
$F_v * t_v =$	69.0 lbf/in	(Per APA Table 9 - See Below)
$C_d =$	1.6	(Per APA Table 6)
$(F_v * t_v) * C_d =$	110.4 lbf/in	
Allowed Shear (punching) =	= $(F_v * t_v) * C_d * \text{Standoff diameter}$	
	800.4 lb	
Demand / Capacity Ratio =	44%	

Results: 800.4 lb capacity > 355 lb demand

Therefore, OK

APA Design Capacity Tables

PANEL SHEAR THROUGH THE THICKNESS, F_v (lbf/in. of shear-resisting panel length)									
W24	NA	NA	NA	145	NA	NA	NA	145	
24/0	53	69	80	155	53	69	80	155	
24/16	57	74	86	165	57	74	86	165	
32/16	62	81	93	180	62	81	93	180	
40/20	68	88	100	195	68	88	100	195	
48/24	NA	98	115	220	NA	98	115	220	
16 oc	56	75	87	170	56	75	87	170	
20 oc	67	87	100	195	67	87	100	195	
24 oc	NA	96	110	215	NA	96	110	215	
32 oc	NA	NA	120	230	NA	NA	120	230	
48 oc	NA	NA	160	305	NA	NA	160	305	



AOstructures Inc.
PO Box 413
Carnelian Bay, CA 96140
916.541.8586
www.AOstructures.com

Appendix A: Manufacturer Specifications

ATTACHMENT TYPE	UNIRAC FLASHLOC RM
ATTACHMENT CAPACITY UPLIFT	355.0 lbs
ATTACHMENT CAPACITY SHEAR	194.0 lbs

Manufacturer Specifications - For Reference



U-Builder[®] PROJECT REPORT

APPLICATION VERSION: 6.7.2
PROJECT VERSION: 0.0.69

PROJECT TITLE	PROJECT ID	LAST UPDATED
ROOFMOUNT RM5	D1325FFE	Nov. 10, 2025
		ORIGINALLY CREATED
		Oct. 28, 2025

NAME	Jon Snow	Designed by david@luminasolar.com
ADDRESS	6515 Crossroads Village Boulevard	ROOFMOUNT RM5
CITY, STATE	Haymarket, VA	REC SOLAR
MODULE	REC SOLAR REC420AA PURE 2 v1	48 - REC420AA PURE 2 v1
		1257 ft ²
		20.16 KW

NOTE: Designing on a "blank page" in the U-Builder[®] design tool may not provide accurate wind engineering results because the roof outline is not provided. It is the user's responsibility to verify building dimensions, site criteria, array distance from roof edges. When designing a construction-ready project, it is always recommended to "Design On Map".

NOTE: Installation of the project is intended to happen within the year of project designed in U-Builder[®]. If it's past one year please rerun the design or contact Unirac Engineering Services.

Use TPO primer before installation of Flashloc RM.

ENGINEERING INPUTS

Plan Review

AVERAGE PSF	7.63 psf
TOTAL NUMBER OF MODULES	48
TOTAL KW	20.16 KW
TOTAL STRUCTURE AREA	~1257 ft ²
TOTAL WEIGHT ON ROOF	9594 lbs
RACKING WEIGHT	1441 lbs
MODULE WEIGHT	2294 lbs
BALLAST WEIGHT	5696 lbs
MAX BAY LOAD (DEAD)	132 lbs
TOTAL ATTACHMENT COUNT	23
ATTACHMENT KIT WEIGHT	162.38 lbs

Loads Used for Design

BUILDING CODE	ASCE 7-16
WIND SPEED	115.00 mph
GROUND SNOW LOAD	30.00 psf
SEISMIC, S _s	0.152
ELEVATION	488 ft
WIND EXPOSURE	C
RISK CATEGORY	II
VELOCITY PRESSURE, Q _z	27.77 psf

Inspection

PRODUCT	ROOFMOUNT RM5
MODULE MANUFACTURER	REC SOLAR
MODEL	REC420AA PURE 2 v1
MODULE WATTS	420 watts
MODULE LENGTH	73.4"
MODULE WIDTH	40.9"
MODULE THICKNESS	1.2"
MODULE WEIGHT	47.8 lbs
ADD CENTRAL SUPPORT FOR MODULE	No
SETBACK DISTANCE	3.0 ft
HALF BLOCK ALLOWED	No
BALLAST BLOCK (CMU) WEIGHT	32.0 lbs
MAX BLOCKS PER BAY	2
BUILDING HEIGHT	30.0 ft
ROOF TYPE	TPO
LONGEST BUILDING LENGTH	88.0 ft
SHORTEST BUILDING LENGTH	67.0 ft
PARAPET HEIGHT	24.0"
WIND DEFLECTORS	EVERYWHERE
ATTACHMENTS OPTIMIZATION CRITERIA	Psf Limit
ROOF PSF LIMIT	8.00 psf
ATTACHMENT TYPE	UNIRAC FLASHLOC RM
ATTACHMENT CAPACITY UPLIFT	355.0 lbs
ATTACHMENT CAPACITY SHEAR	194.0 lbs
CONTROLLING COMPONENT UPLIFT CAPACITY	RACKING
CONTROLLING COMPONENT SHEAR CAPACITY	RACKING

ENGINEERING OUTPUTS

Roof Area 1 - Array 1

AVERAGE PSF

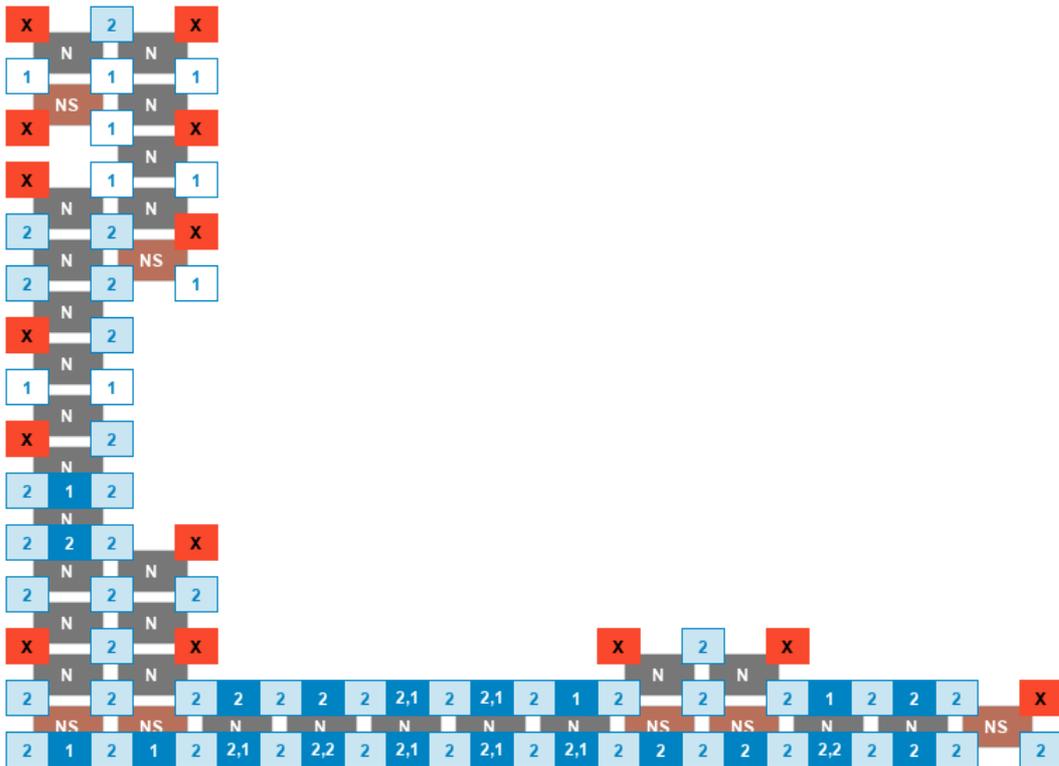
7.99 psf

TOTAL NUMBER OF MODULES	34
ROOF SLOPE	1 degrees
ROW SPACING	7.5"
TOTAL KW	14.28 KW
TOTAL AREA	890 ft ²
TOTAL WEIGHT ON ROOF	7107 lbs
RACKING WEIGHT	1031 lbs
MODULE WEIGHT	1625 lbs
BALLAST WEIGHT	4352 lbs
MID SUPPORT KIT WEIGHT	0 lbs
TOTAL ATTACHMENT COUNT	14
ATTACHMENT KIT WEIGHT	98.84 lbs
CONTROLLING COMPONENT UPLIFT CAPACITY	RACKING
CONTROLLING COMPONENT SHEAR CAPACITY	RACKING
ATTACHMENT CAPACITY UPLIFT	355.0 lbs
ATTACHMENT CAPACITY SHEAR	194.0 lbs

BOM

PART	QTY
RM5 BAY	92
BALLAST BLOCK	136
RM5 84" WIND DEFLECTOR	55
RM END CLAMP 30-40MM	267
KIT 1/4 20 CLIP ON NUT SS 18-8	393
KIT, WIND DEFLECTOR ATTACHMENT	126
FLASHLOC RM KIT	14
RM5/RMDT H-ATTACHMENT KIT	14
MLPE TIGER CLIP	34

Roof Area 1 - Array 1 - Ballast Map with Attachment And Deflectors



LEGEND

	Module with north wind deflector (for uplift)		Standard corner bay with CMU block count
	Module with south wind deflector (for fire requirements - type 2)		Supplemental bay with CMU block count
	Module with both deflector types		Mid Support
	Module with no deflectors		

NOTE

Bays in the space above and below modules are supplemental bays. You can fit a maximum of 2 blocks in each bay. If the number of blocks in these bays is more than 2, you will need to add an additional supplemental bay.

Roof Area 1 - Array 2

AVERAGE PSF

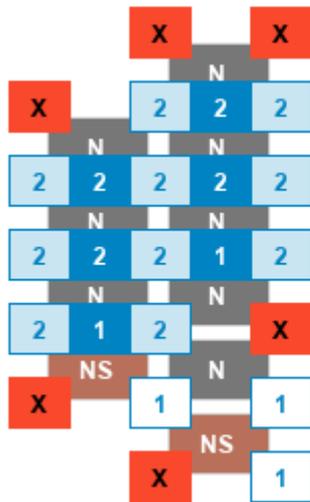
7.36 psf

TOTAL NUMBER OF MODULES	10
ROOF SLOPE	1 degrees
ROW SPACING	7.5"
TOTAL KW	4.20 KW
TOTAL AREA	254 ft ²
TOTAL WEIGHT ON ROOF	1867 lbs
RACKING WEIGHT	291 lbs
MODULE WEIGHT	478 lbs
BALLAST WEIGHT	1056 lbs
MID SUPPORT KIT WEIGHT	0 lbs
TOTAL ATTACHMENT COUNT	6
ATTACHMENT KIT WEIGHT	42.36 lbs
CONTROLLING COMPONENT UPLIFT CAPACITY	RACKING
CONTROLLING COMPONENT SHEAR CAPACITY	RACKING
ATTACHMENT CAPACITY UPLIFT	355.0 lbs
ATTACHMENT CAPACITY SHEAR	194.0 lbs

BOM

PART	QTY
RM5 BAY	25
BALLAST BLOCK	33
RM5 84" WIND DEFLECTOR	18
RM END CLAMP 30-40MM	86
KIT 1/4 20 CLIP ON NUT SS 18-8	127
KIT, WIND DEFLECTOR ATTACHMENT	41
FLASHLOC RM KIT	6
RM5/RMDT H-ATTACHMENT KIT	6
MLPE TIGER CLIP	10

Roof Area 1 - Array 2 - Ballast Map with Attachment And Deflectors



LEGEND



Module with north wind deflector (for uplift)



Module with south wind deflector (for fire requirements - type 2)



Module with both deflector types



Module with no deflectors



Standard corner bay with CMU block count



Supplemental bay with CMU block count



Mid Support

NOTE

Bays in the space above and below modules are supplemental bays. You can fit a maximum of 2 blocks in each bay. If the number of blocks in these bays is more than 2, you will need to add an additional supplemental bay.

Roof Area 1 - Array 3

AVERAGE PSF

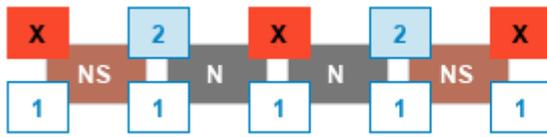
5.45 psf

TOTAL NUMBER OF MODULES	4
ROOF SLOPE	1 degrees
ROW SPACING	7.5"
TOTAL KW	1.68 KW
TOTAL AREA	114 ft ²
TOTAL WEIGHT ON ROOF	619 lbs
RACKING WEIGHT	119 lbs
MODULE WEIGHT	191 lbs
BALLAST WEIGHT	288 lbs
MID SUPPORT KIT WEIGHT	0 lbs
TOTAL ATTACHMENT COUNT	3
ATTACHMENT KIT WEIGHT	21.18 lbs
CONTROLLING COMPONENT UPLIFT CAPACITY	RACKING
CONTROLLING COMPONENT SHEAR CAPACITY	RACKING
ATTACHMENT CAPACITY UPLIFT	355.0 lbs
ATTACHMENT CAPACITY SHEAR	194.0 lbs

BOM

PART	QTY
RM5 BAY	10
BALLAST BLOCK	9
RM5 84" WIND DEFLECTOR	7
RM END CLAMP 30-40MM	20
KIT 1/4 20 CLIP ON NUT SS 18-8	30
KIT, WIND DEFLECTOR ATTACHMENT	10
FLASHLOC RM KIT	3
RM5/RMDT H-ATTACHMENT KIT	3
MLPE TIGER CLIP	4

Roof Area 1 - Array 3 - Ballast Map with Attachment And Deflectors



LEGEND

<div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="background-color: #444; color: white; padding: 5px 10px; margin-right: 10px;">N</div> <div>Module with north wind deflector (for uplift)</div> </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="background-color: #e67e22; color: white; padding: 5px 10px; margin-right: 10px;">S</div> <div>Module with south wind deflector (for fire requirements - type 2)</div> </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="background-color: #8e6c5a; color: white; padding: 5px 10px; margin-right: 10px;">NS</div> <div>Module with both deflector types</div> </div> <div style="display: flex; align-items: center;"> <div style="background-color: #808080; width: 20px; height: 15px; margin-right: 10px;"></div> <div>Module with no deflectors</div> </div>	<div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid #0070c0; padding: 5px 10px; margin-right: 10px;">1</div> <div>Standard corner bay with CMU block count</div> </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="background-color: #0070c0; color: white; padding: 5px 10px; margin-right: 10px;">4</div> <div>Supplemental bay with CMU block count</div> </div> <div style="display: flex; align-items: center;"> <div style="width: 10px; height: 10px; background-color: #e67e22; margin-right: 10px;"></div> <div>Mid Support</div> </div>
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NOTE

Bays in the space above and below modules are supplemental bays. You can fit a maximum of 2 blocks in each bay. If the number of blocks in these bays is more than 2, you will need to add an additional supplemental bay.

WIND DESIGN DETAIL

Terrain Category	C	Section 26.7 (ASCE 7-16)
Basic Wind Speed	115.00 mph	
Elevation	488.00 ft	
Risk Category	II	Table 1.5-1 (ASCE 7-16)
Mean Roof Height	30.0 ft	
Numerical Coefficient	0.002560	Section C26.10.2 (ASCE 7-16)
Topographic Factor, K_{zt}	1.00	Section 26.8.2 (ASCE 7-16)
Wind Directionality Factor, K_d	0.85	Table 26.6-1 (ASCE 7-16)
Ground Elevation Factor, K_e	0.982	Table 26.9-1 (ASCE 7-16)
Velocity Pressure Exposure Coefficient, K_z	0.98	Table 26.10-1 (ASCE 7-16)
Velocity Pressure at Height, Q_z	27.77 psf	Equation 26.10.1 (ASCE 7-16)

SEISMIC DESIGN PER ASCE 7-16

Site Classification	D_DEFAULT	Section 11.4.3 (ASCE 7-16)
S_s	0.152 g	Section 11.4.2 (ASCE 7-16)
S_1	0.000 g	Section 11.4.2 (ASCE 7-16)
Risk Category	II	
Coefficient of Friction, μ_0	0.41	TT 516003
Site Coefficient, F_a (Minimum 1.2)	1.600	Table 11.4-1 (ASCE 7-16)
Site Coefficient, F_v	2.400	Table 11.4-2 (ASCE 7-16)
S_{MS}	0.243 g	Section 11.4.4 (ASCE 7-16)
S_{DS}	0.162 g	Section 11.4.5 (ASCE 7-16)
Module Weight	47.80 lbs	
Racking and Ballast Weight to One Module	100.96 lbs	
Capacity of Connections to One Module (N/S)	348.00 lbs	UTR 272
Capacity of Connections to One Module (E/W)	284.00 lbs	UTR 272
W1 (Module, Racking, and Ballast Weight to One Module)	148.76 lbs	
0.2 S_{DS} W1	4.82 lbs	Section 13.6.12 (ASCE 7-16)
Maximum Number of Modules per Row (N-S)	72	
Maximum Number of Modules per Column (E-W)	58	
Building Importance Factor, I_e	1.00	Table 1.5-2 (ASCE 7-16)
Importance Factor of Array, I_p	1.00	Section 13.1.3 (ASCE 7-16)
Seismic Design Category	A	Section 11.6 (ASCE 7-16)
Seismic Design Displacement	12.00"	

NOTE

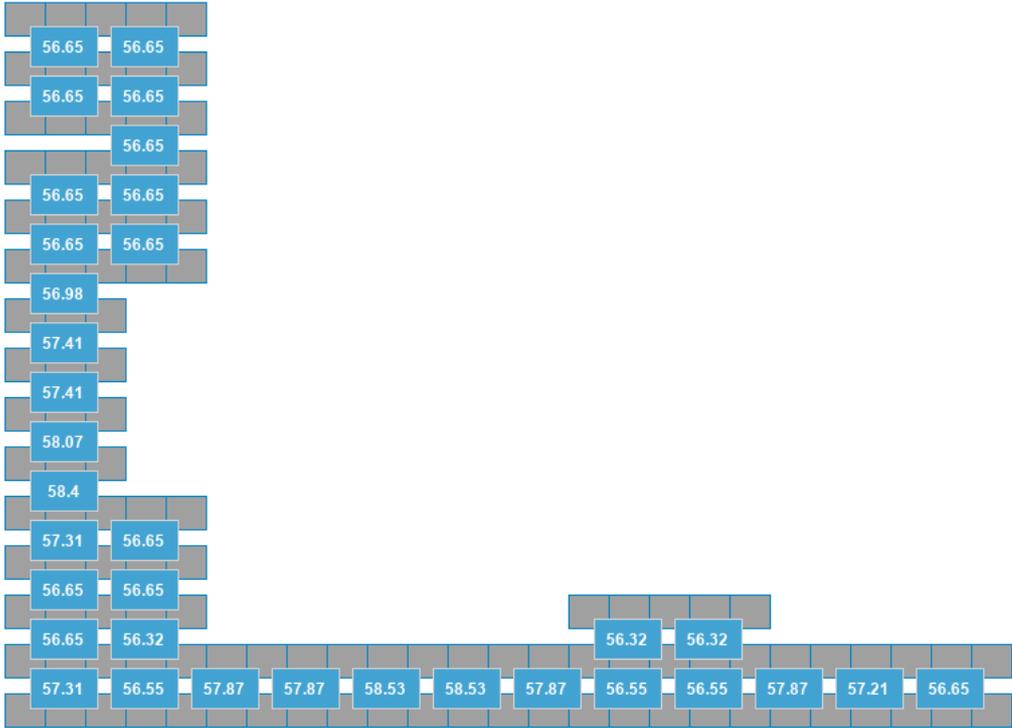
SDCA and B designs are exempt from the ASCE 7-16 seismic requirements under the section 13.1.4: Exemptions - Point 4: Mechanical and electrical components in Seismic Design Category A and B

SNOW DESIGN

Risk Category	II	Table 1.5-1 (ASCE 7-16)
Importance Factor, I_s	1.00	Table 1.5-2 (ASCE 7-16)
Exposure Category	C	Section 26.7 (ASCE 7-16)
Exposure Factor, C_e	1.00	Table 7.3-1 (ASCE 7-16)
Thermal Factor, C_t	1.00	Table 7.3-2 (ASCE 7-16)
Ground Snow, p_g	30.00 psf	
Tilt Angle	5°	
Minimum Snow Load, p_m		
$p_m = I_s p_g$, For $p_g \leq 20$ psf	30.00 psf	Section 7.3.4 (ASCE 7-16)
$p_m = 20 I_s$, For $p_g > 20$ psf	20.00 psf	Section 7.3.4 (ASCE 7-16)
Flat Roof Snow Load, $p_f = \text{Max}(0.7 C_e C_t I_s p_g, p_m)$	21.00 psf	Equation 7.3-1 (ASCE 7-16)
Slope Factor, C_s	1.0	Figure 7-2a (ASCE 7-16)*
Sloped Roof Snow Load, $p_s = C_s p_f$	21.00 psf	Equation 7.4-1 (ASCE 7-16)*

*Section C7.8 states "collectors should be designed to sustain a load calculated by using the "unobstructed slippery surfaces" curve in Figure 7.4-1." This indicates that $C_t \leq 1.0$. Per Figure 7-2a for a roof slope of 5° with the unobstructed slippery surfaces graph, $C_s = 1.0$.

DEAD LOAD PER MODULE(D) - Roof Area 1 - Array 1



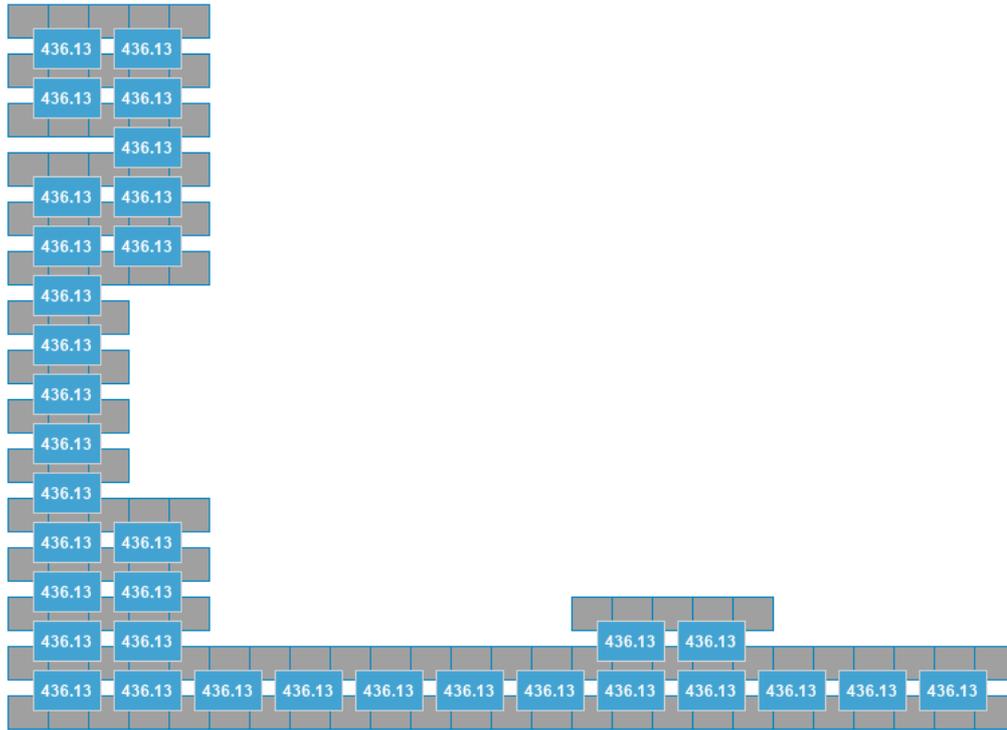
Units: lbs

Dead Load = Module Wt. + Clamp & Bolt Wt. + Deflector Wt.

LEGEND

 Module

SNOW LOAD PER MODULE(S) - Roof Area 1 - Array 1



Units: lbs

X $\text{Snow Load Per Module} = \text{Module Area} * \text{Flat Roof Snow Load}$

LEGEND

 Module

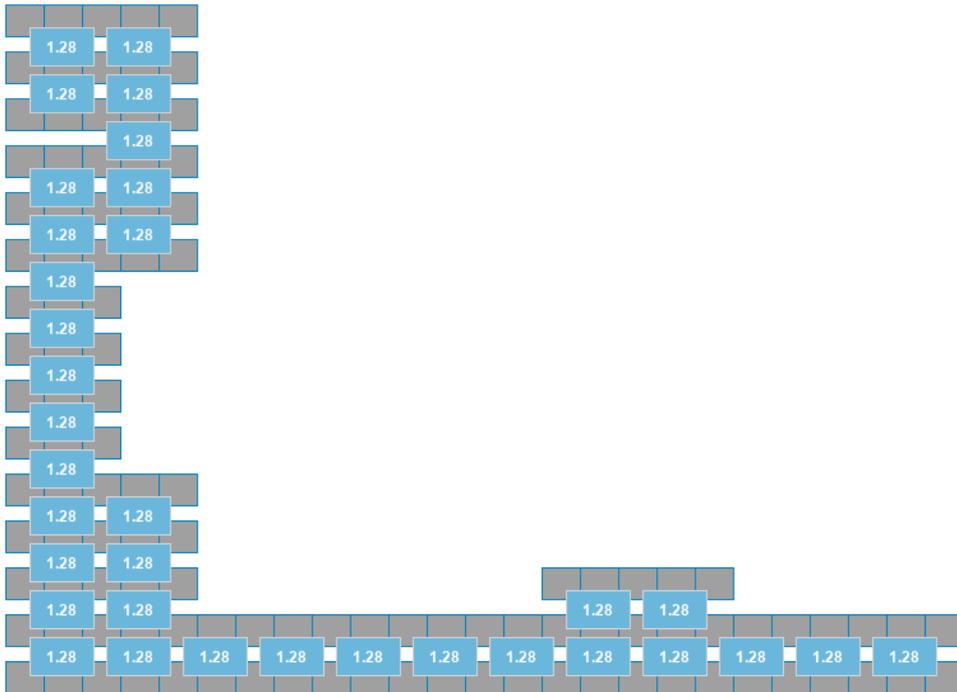
LEGEND

Module

X Utilised attachment capacity on uplift

DRAG CALCULATIONS

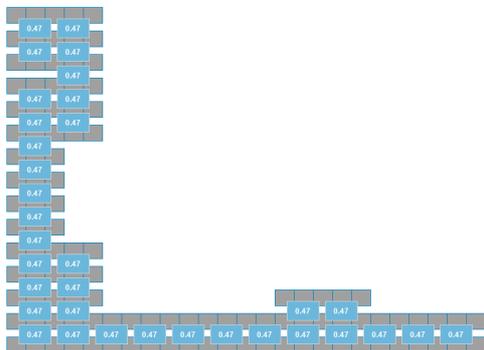
Drag Gcp factor per module - Roof Area 1 - Array 1



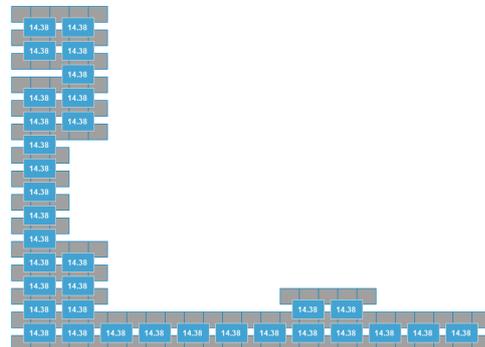
LEGEND

Module

Modified Gcp factor per module (drag effect) - Roof Area 1 - Array 1



Drag load- Roof Area 1 - Array 1

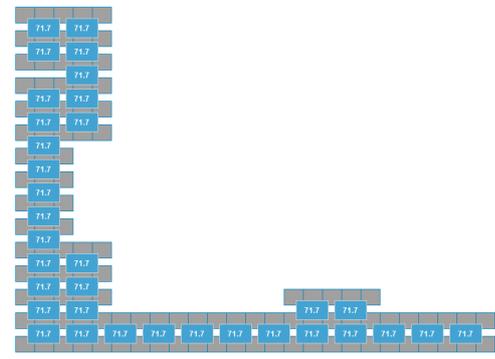


Units: lbs
 X Total Uplift with Factor = 0.6 * Qz * gcp * uplift area

Modified Gcp factor per module (uplift effect) - Roof Area 1 - Array 1

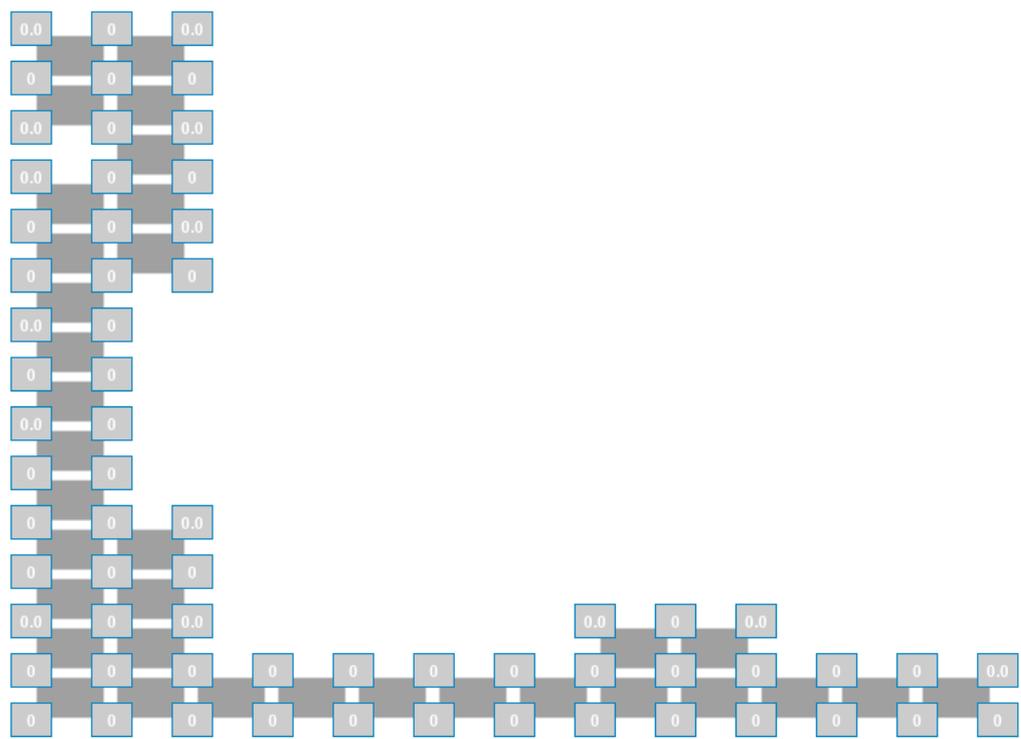


Uplift for drag load- Roof Area 1 - Array 1



Units: lbs
 X Total Uplift with Factor = 0.6 * Qz * gcp * uplift area

Shear load on attachments (Sliding) - Roof Area 1 - Array 1



Units: lbs

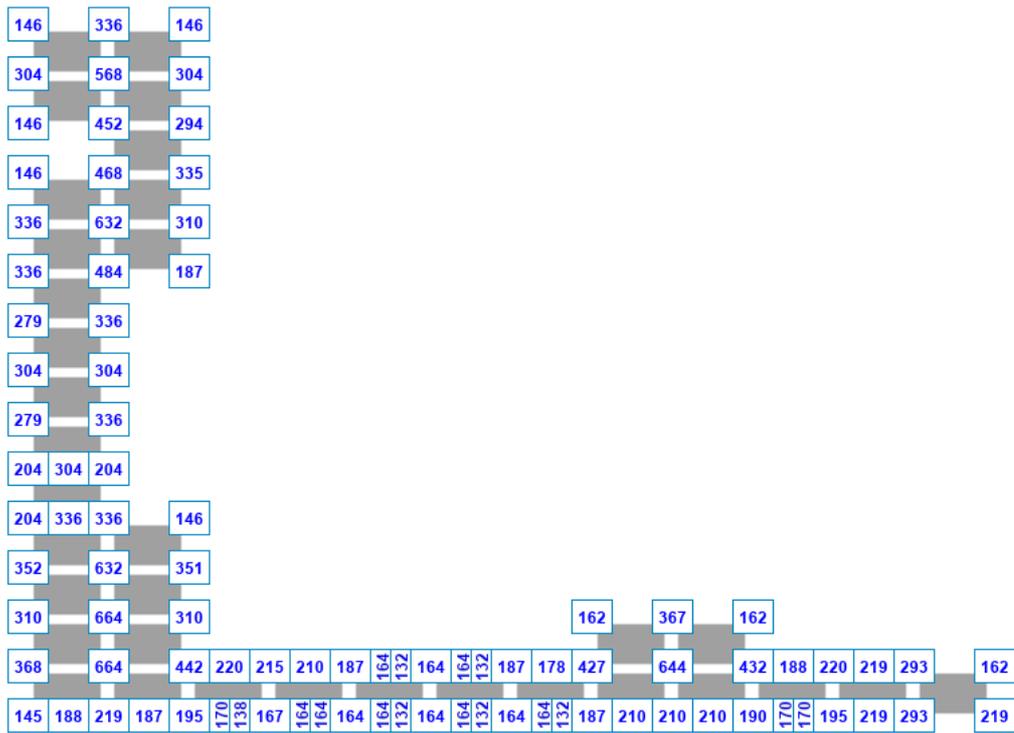
LEGEND

Module

X Utilised attachment capacity on shear

TOTAL DOWNLOAD CALCULATIONS

Total downpoint load per bay - Roof Area 1 - Array 1



Units: lbs

X Down Point Load = Down point load on module contribution+ bay weight with ballast

LEGEND

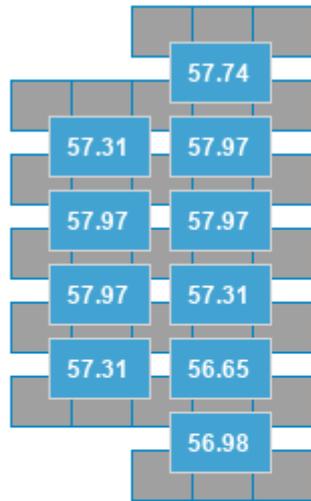
 Module

 Bay - Downpoint load

NOTE

For exact values please check DXF file.

DEAD LOAD PER MODULE(D) - Roof Area 1 - Array 2



Units: lbs



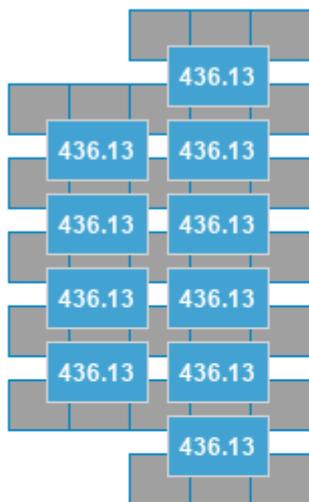
Dead Load = Module Wt. + Clamp & Bolt Wt. + Deflector Wt.

LEGEND



Module

SNOW LOAD PER MODULE(S) - Roof Area 1 - Array 2



Units: lbs

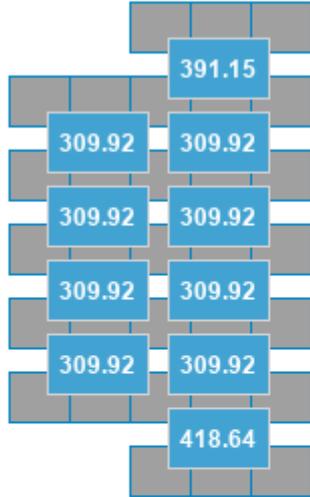


Snow Load Per Module = Module Area * Flat Roof Snow Load

LEGEND

 Module

WIND LOAD (UPWARD) PER MODULE - Roof Area 1 - Array 2



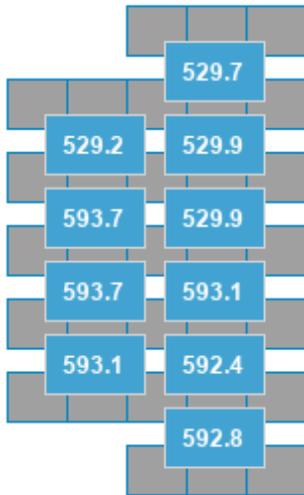
Units: lbs

 Total uplift = $Q_z * g_{cp} * \text{uplift area}$

LEGEND

 Module

FINAL DOWNLOAD PER MODULE MAP (max(D + 0.75(0.6W) + 0.75S, D + 0.6W, D + S)) - Roof Area 1 - Array 2



Units: lbs

X Downward Force = MAX(DL + SL, DL + 0.6WL, DL + 0.45WL + 0.75SL)

Where:

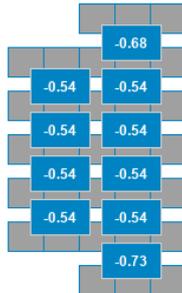
- DL = Dead Load
- SL = Snow Load
- WL = Wind Load(Downward)

LEGEND

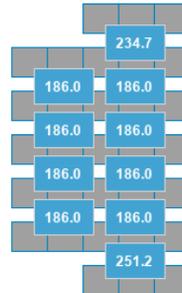
 Module

UPLIFT CALCULATIONS

Modified Gcp factor per module (uplift) map - Roof Area 1 - Array 2



Factored total wind uplift map - Roof Area 1 - Array 2



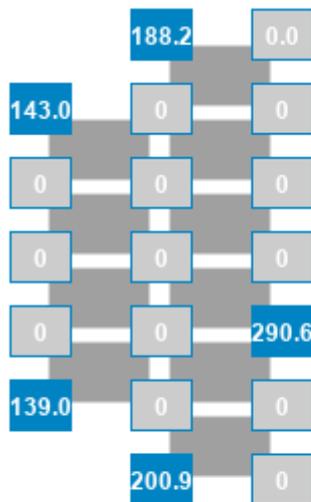
Units: lbs

X Total Uplift with Factor = $0.6 * Qz * gcp * \text{uplift area}$

LEGEND

Module

Uplift load on attachments - Roof Area 1 - Array 2



Units: lbs

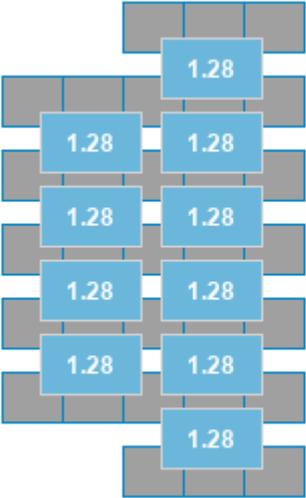
LEGEND

Module

X Utilised attachment capacity on uplift

DRAG CALCULATIONS

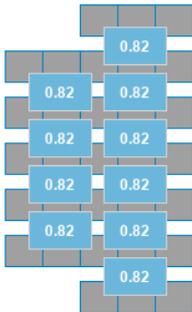
Drag Gcp factor per module - Roof Area 1 - Array 2



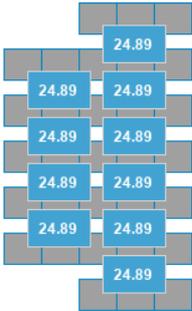
LEGEND

Module

Modified Gcp factor per module (drag effect) - Roof Area 1 - Array 2



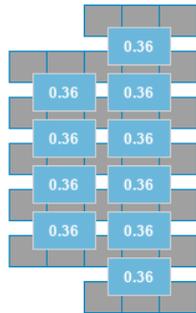
Drag load- Roof Area 1 - Array 2



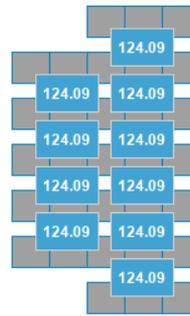
Units: lbs

X Total Uplift with Factor = $0.6 * Qz * gcp * \text{uplift area}$

Modified Gcp factor per module (uplift effect) - Roof Area 1 - Array 2



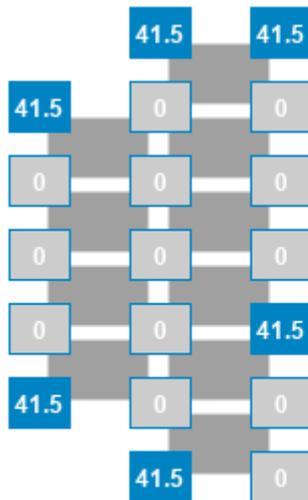
Uplift for drag load- Roof Area 1 - Array 2



Units: lbs

X Total Uplift with Factor = $0.6 * Qz * gcp * \text{uplift area}$

Shear load on attachments (Sliding) - Roof Area 1 - Array 2



Units: lbs

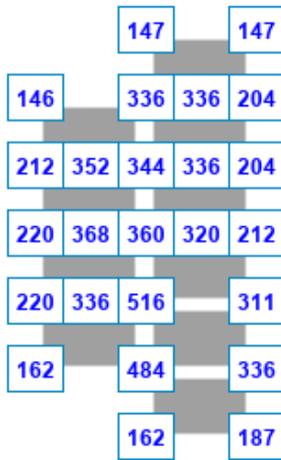
LEGEND

 Module

 Utilised attachment capacity on shear

TOTAL DOWNLOAD CALCULATIONS

Total downpoint load per bay - Roof Area 1 - Array 2



Units: lbs

X Down Point Load = Down point load on module contribution+ bay weight with ballast

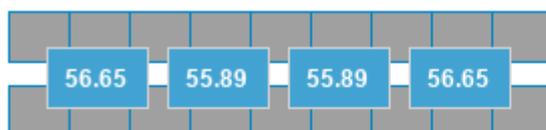
LEGEND

-  Module
-  Bay - Downpoint load

NOTE

For exact values please check DXF file.

DEAD LOAD PER MODULE(D) - Roof Area 1 - Array 3



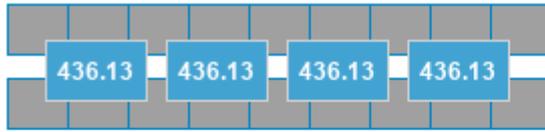
Units: lbs

X Dead Load = Module Wt. + Clamp & Bolt Wt. + Deflector Wt.

LEGEND

-  Module

SNOW LOAD PER MODULE(S) - Roof Area 1 - Array 3



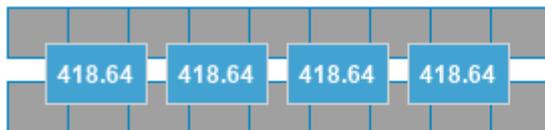
Units: lbs

X $\text{Snow Load Per Module} = \text{Module Area} * \text{Flat Roof Snow Load}$

LEGEND

 Module

WIND LOAD (UPWARD) PER MODULE - Roof Area 1 - Array 3



Units: lbs

X $\text{Total uplift} = Q_z * g_{cp} * \text{uplift area}$

LEGEND

 Module

FINAL DOWNLOAD PER MODULE MAP (max(D + 0.75(0.6W) + 0.75S, D + 0.6W, D + S)) - Roof Area 1 - Array 3



Units: lbs

X Downward Force = MAX(DL + SL, DL + 0.6WL, DL + 0.45WL + 0.75SL)

Where:

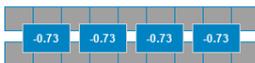
- DL = Dead Load
- SL = Snow Load
- WL = Wind Load(Downward)

LEGEND

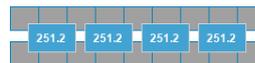
Module

UPLIFT CALCULATIONS

Modified Gcp factor per module (uplift) map - Roof Area 1 - Array 3



Factored total wind uplift map - Roof Area 1 - Array 3



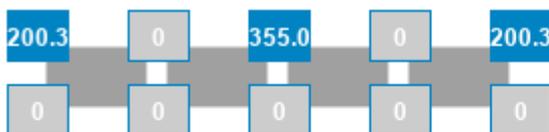
Units: lbs

X Total Uplift with Factor = 0.6 * Qz * gcp * uplift area

LEGEND

Module

Uplift load on attachments - Roof Area 1 - Array 3



Units: lbs

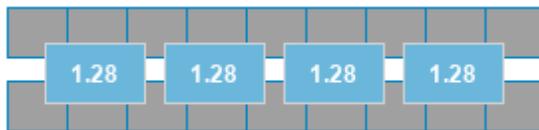
LEGEND

 Module

 Utilised attachment capacity on uplift

DRAG CALCULATIONS

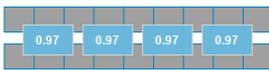
Drag Gcp factor per module - Roof Area 1 - Array 3



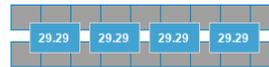
LEGEND

 Module

Modified Gcp factor per module (drag effect) - Roof Area 1 - Array 3



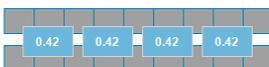
Drag load- Roof Area 1 - Array 3



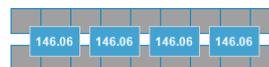
Units: lbs

 Total Uplift with Factor = $0.6 * Qz * gcp * \text{uplift area}$

Modified Gcp factor per module (uplift effect) - Roof Area 1 - Array 3



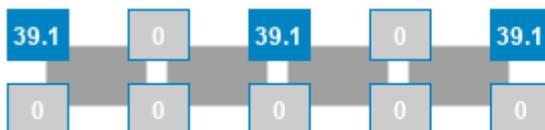
Uplift for drag load- Roof Area 1 - Array 3



Units: lbs

 Total Uplift with Factor = $0.6 * Qz * gcp * \text{uplift area}$

Shear load on attachments (Sliding) - Roof Area 1 - Array 3



Units: lbs

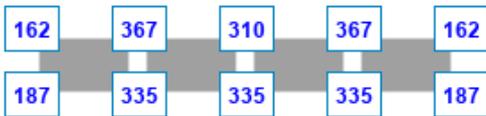
LEGEND

 Module

 Utilised attachment capacity on shear

TOTAL DOWNLOAD CALCULATIONS

Total downpoint load per bay - Roof Area 1 - Array 3



Units: lbs

 Down Point Load = Down point load on module contribution+ bay weight with ballast

LEGEND

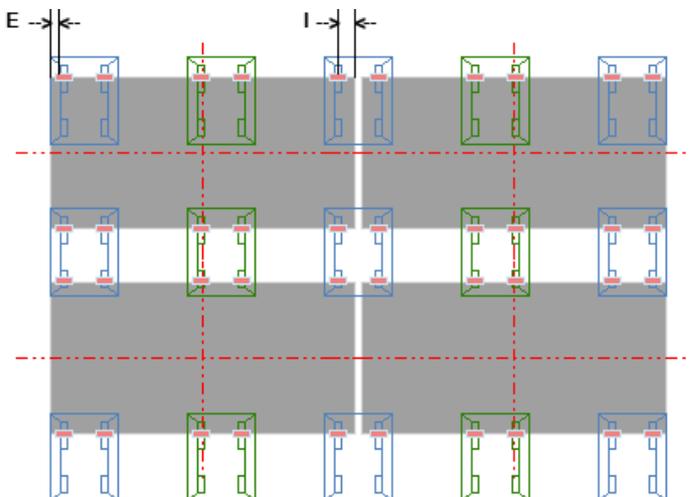
 Module

 Bay - Downpoint load

NOTE

For exact values please check DXF file.

CLAMPS LOCATIONS AND MAX MODULE PRESSURES



NOTE :

1. Supplemental bays are placed symmetric to the module.
2. Edge cantilever distance to clamp(E) = **1.63"** approx.
3. Edge of module to clamp center(I) = **8.28"**.
4. Possible cases for RM5 mid support and supplemental bays combinations.
 - a. Kits = 4
 - b. 1 Kit 1 Bay
 - c. 2 Kits 1 Bay
 - d. 2 Bays 1 Kit
 - e. 1 Bay
 - f. 2 Bays

LEGEND



Module



Primary bay



Supplemental bay



Clamp

FACTORED MAX UPWARD PRESSURE ON MODULE : 12.10 psf

FACTORED MAX DOWNWARD PRESSURE ON MODULE: 28.59 psf

NOTE

1. Unirac testing was performed as per AISI S100-2007 standards
1. Terrapin testing report roof mount ballast support coefficient of friction testing RM 2.0 family (July 13, 2016) (Static,Kinetic,Wet and Dry testing performed)

RM5 U-Builder® PRODUCT ASSUMPTIONS

RM5 – Ballasted Flat Roof Systems

Limitations of Responsibility: It is the user's responsibility to ensure that inputs are correct for your specific project.

Unirac is not the solar, electrical, or building engineer of record and is not responsible for the solar, electrical, or building design for this project.

Building Assumptions

1. Risk Category I to IV
2. Minimum allowed setback distance is 1.00 ft
3. Building Height \leq 150.00 ft
4. Building Height > 50.00 ft: only where (longest length of building x building height)^{0.5} \leq 100.00 ft
5. Roof Slope \geq 0° (0:12) and \leq 3° (5/8:12) for Seismic Design Category C, D, E and F. For low seismic regions Seismic Design Category A and B (provided Array Importance factor = 1.0), Roof Slope \geq 0° (0:12) and \leq 7° (1 1/2:12).
6. Roofing Material Types: EDPM, PVC, TPO, or Mineral Cap
7. Surrounding Building Grade: Level
8. Building Height > 60.00 ft requires attachments

Ballast Blocks

The installer is responsible for procuring the ballast blocks (Concrete Masonry Units – CMU) and verifying the required minimum weight needed for this design. CMU should comply with ASM standard specification for concrete roof pavers designation (C1491 or C90 with an integral water repellent suitable for the climate it is placed. It is recommended that the blocks are inspected periodically for any signs of degradation. If degradation of the block is observed, the block should immediately be replaced.

The CMU ballast block should have nominal dimensions of 4.00" x 8.00" x 16.00". The actual block dimensions are 0.37" less than the nominal dimensions. Ballast blocks should have a weight as specified for the project in the "Inspection" section of this report.

Design Parameters

1. Risk Category I to IV
2. Wind Design
 - a. Basic Wind Speed: 85.00 mph - 120.00 mph (ASCE 7-05)/110.00 mph - 150.00 mph (ASCE 7-10)/90.00 mph - 180.00 mph (ASCE 7-16)
 - b. Exposure: B, C or D (ASCE 7-05/ASCE 7-10)
 - c. 25 year Design Life/50 year Design Life for ASCE 7-16
 - d. Elevation: Insertion of the project at - grade elevation can result in a reduction of wind pressure. If your project is in a special case study region or in an area where wind studies have been performed, please verify with your jurisdiction to ensure that elevation effects have not already been factored into the wind speed. If elevation effects have been included in your wind speed, please select 0.00 ft as the project site elevation.
 - e. Wind Tunnel Testing: Wind tunnel testing coefficients have been utilized for design of the system.
3. Snow Design
 - a. Ground Snow Load: 0 - 100.00 psf (ASCE 7-10/ASCE 7-16)
 - b. Roof Snow Load: Calculation per Section 7.3 (ASCE 7-05/ASCE 7-10/ASCE 7-16)
 - c. Unbalanced/Drifting/Sliding: Results are based on the uniform snow loading and do not consider unbalanced, drifting, and sliding conditions
4. Seismic Design
 - a. Report: *SEAO PV1-2012/ASCE 7-16 SECTION 13.6.12 – Structural Seismic Requirements and Commentary for Rooftop Solar Photovoltaic Arrays*
 - b. Seismic Site Class: A, B, C, or D (ASCE 7-05/ASCE 7-10/ASCE 7-16)

Properties

1. Bay Weight: 7.20 lbs
2. Wind Deflector Weight: 525.44 lbs
3. Module Gaps (E/W) = 0.25"
4. Wind Deflectors: Wind deflectors on the east and west edges of the array should overhang the east and west modules by six inches for Type 1 modules on the north rows only. Wind deflectors on the east and west edges of the array should overhang the east and west modules by six inches for Type II modules.
5. Bays: North row bays overhang the module by ~6.50" and south row bays overhang the module by ~12.25"

Testing

1. Coefficient of Friction
2. Wind Tunnel
3. UL 2703
4. Component Testing (Bay and Clamp)

Setbacks

For the wind tunnel recommendations in U-Builder® to apply, the following setbacks should be observed/ followed for U-Builder® wind design:

1. Modules should be placed a minimum of 3.00 ft from the edge of the building in any direction.
2. If the array is located near an obstruction that is 3.50 ft wide and 3.50 ft high or larger, the nearest module of the array must be located a distance from the obstruction that is greater than or equal to the height of the obstruction. Exception: When using ASCE 7-16 Building Code and using the obstruction feature in the module editor to accurately model the size and location of obstruction
3. Installations within the setbacks listed above require site specific engineering.
4. The setbacks above are for wind. High seismic areas, fire access isles, mechanical equipment, etc., may require larger setbacks than listed above for wind.

Site Specific Engineering

Conditions listed below are beyond the current capabilities of U-Builder[®]. Site specific engineering is required.

1. Building assumptions and design parameters outside of U-Builder[®] assumptions
2. Wind tunnel testing reduction factors are not permitted by the Authority Having Jurisdiction (AHJ).
3. Seismic designs that fall outside SEAOC PV1-2012/ASCE 7-16 SECTION 13.6.12 recommendations (>3% roof slope, or AHJ's that require shake table testing or non-linear site-specific response history analysis)
4. Signed and sealed site-specific calculations, layouts, and drawings
5. Building that is not enclosed and categorized as open structures, carport or others

Notes:

- Please contact Engineering.Services@unirac.com for more information.