24-108332 REV 01 RS

Purelight Power

March 12, 2025

Subject: Proposed Solar Panel Installation
Susan Sealy Residence, 2030 NE 58th Ave, Portland, OR

To Whom it May Concern,

Our engineering department has reviewed information, gathered by our field crews, related to the proposed solar panel installation at the above-referenced address. The purpose of our review was to determine the structural adequacy of the existing roof for the proposed installation. Based on our review and analysis of the available information, it is our professional opinion that the existing structure requires a retrofit to ensure structural adequacy to support the proposed installation.

Add new 2x4 knee wall @ 24" O.C. on roof 1 with 3-16d nails attached to each ends. Please refer to PV03.1 of the plans.

Design Parameter Summary

Governing Building Code: 2022 Oregon Structural Specialty Code (2022 OSSC)
Risk Category: II
Design Wind Speed: 98 mph (per ASCE 7-16)
Ground Snow Load: 20 psf
Roof Snow Load: 20 psf (city/county requirement)

Roof Information

Roof Structure: 2x4 Rafters @ 24" O.C., 2x4 Manufactured Trusses @ 24" O.C.
Roofing Material: Asphalt Shingles (2 layers)
Roof Slope: 27°, 30°

Roof Connection Details

Lag Screws: (1) 5/16" diameter min., with min. 2.5" embedment into framing members, at 48" O.C. max,
Locations per design drawings
Note: Required embedment length excludes the tapered tip of the screw, and embedment into sheathing.

Analysis

The proposed installation - including weight of panels, racking, and mounts - will be approximately 2.7 psf. The attached calculations show that the existing roof structure is adequate to support the proposed installation. Therefore, the structure need not be altered for gravity loading.

The proposed installation will be 6" max. above the roof surface (flush mounted) and parallel to the roof surface. Therefore, any increase in wind loading on the building structure from the solar panel installation is expected to be negligible. Wind is the governing lateral load case. Because the increase in lateral loading is not increased by more than 10%, per provisions in the adopted building codes, the structure need not be altered for lateral loading.

Wind uplift on the panels has been calculated in accordance with the relevant provisions of ASCE 7-16. This loading has been used to verify the adequacy of the connection specified above. Connection locations should be in accordance with design drawings.

Conclusion

When the retrofits detailed in this letter's opening paragraph are performed, the structure will have adequate strength to support the proposed installation. Connections to the roof must be made per the "Roof Connection Details" section above. Copies of all relevant calculations are enclosed.

Limitations and Disclaimers

The opinion expressed in this letter is made in reliance on the following assumptions: the existing structure is in good condition (apart from the damage which shall be repaired or retrofit per the above); the existing structure is free from defects in design or workmanship; and the existing structure was code-compliant at the time of its design and construction. These assumptions have not been independently verified, and we have relied on representations made by the property owner and his or her agents with respect to the foregoing. The undersigned has not inspected the structure for patent or latent defects.

Electrical engineering and waterproofing are beyond the scope of this analysis. Solar panels must be installed per manufacturer specifications. Structural design and analysis of the adequacy of solar panels, racks, mounts, rails, and other components is performed by each component's respective manufacturer and the undersigned makes no statement of opinion regarding such components. This letter and the opinions expressed herein are rendered solely for the benefit of the permitting authority (city or county building department), and may not be utilized or relied on by any other party.

If you have any questions or concerns, please contact our office at (855)-709-1181, or email Austen.Morfin@purelightpower.com.

Sincerely,

Trevor A. Jones, P.E.
12/03/2025

Purelight Power

Note: Design per NDS and ASCE 7
Note: This tab is not applicable for trusses
Note: Member is assumed fully restrained by attachment to sheathing

Beam Calculation

The purpose of this calculation is to justify the additional solar load by demonstating beam capacity is adequate for the increased demand.

Roof Information

Beam Span	6	ft
Beam Member Size	2x4	
Wood Species	DFL #2 (Assumed)	
Beam Spacing	2	ft
Retrofit member (where applies)	--	

Deflection Criteria

LL :	L /	240
DL + LL:	L /	120
DL + SL:	L /	120

Sawn Lumber Properties

F_b	900	psi
F_v	180	psi
Load Duration Factor, C_D	1.15	
Size Factor, C_F	1.5	
Repetitive Member Factor, C_r	1.15	
F'_b	1785	psi
F'_v	207	psi
E	1600000	psi

(Note: $C_M = C_t = C_L = C_{fu} = C_i = 1.0$)

Member Properties

Main member:

Width, b	1.5	in
Depth, d	3.5	in
Area, A	5.25	in^2
Moment of Inertia, I	5.36	in^4
Section Modulus, S	3.06	in^3

Retrofit member (where applies):

Width, b	--	in
Depth, d	--	in
Area, A	--	in^2
Moment of Inertia, I	--	in^4
Section Modulus, S	--	in^3

Loading

Dead Load

Asphalt Shingles	5	psf
1/2" Plywood	1	psf
Framing	1	psf
Insulation	--	psf
1/2" Gypsum Ceiling	--	psf
M,E, & Misc	1	psf
Solar Panel	2.7	psf
Total Dead Load	**10.7**	**psf**
Roof Live Load	**20.0**	**psf**

Snow Load

Ground Snow Load, P_g	20.0	psf
Exposure Factor, C_e	0.9	
Thermal Factor, C_t	1.1	
Importance Factor, I_s	1.0	
Flat Roof Snow Load	20	psf
Slope	27	degrees
Unobstructed Slippery Surface?	No	
Slope Factor, C_s	1.00	
Sloped Roof Snow Load	**20.0**	**psf**

Load Combination

DL + LL	**30.7**	**psf**
DL + SL	**30.7**	**psf**

Member Checks

Moment Capacity	**455.6**	lb*ft	Moment Demand (max.)	**276.3**	lb*ft
Shear Capacity	**1086.8**	lbs	Shear Demand (max.)	**276.3**	lbs
Allowable Deflection, LL	**0.3**	in	Deflection Calculated, LL	**0.14**	in
Allowable Deflection, DL + LL	**0.6**	in	Deflection Calculated, DL + LL	**0.19**	in
Allowable Deflection, DL + SL	**0.6**	in	Deflection Calculated, DL + SL	**0.21**	in

Result: **Since moment, shear, and deflection capacities are equal to or greater than calculated moment, shear, and deflection demands, the beam capacity is adequate for the increased demand, and the existing roof structure is permitted to remain unaltered.**

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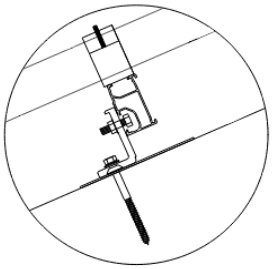
Pegasus Comp Mount Connection Calculation

This calculation justifies the connection of the solar panels to existing roof members, by showing the connection capacity is equal to or greater than the uplift force demands.

Connection Demand

Spacing perpendicular to rail	32.5	in	1/2 panel length
Roof Angle	27	degrees	
Roof Layout	Gable		
Wind Speed	98	mph	
Exposure Coefficient, K_z	0.57		
Topographic Factor, K_{zt}	1		
Directionality Factor, K_d	0.85		
Elevation Factor, K_e	0.99		
Velocity Pressure, q_z	16.0	psf	
Prying Coefficient	1		



	Zone 1	Zone 2r	Zone 3		
Spacing parallel to rail	48	48	48	in	Max spacing
Effective Wind Area on each connection	10.8	10.8	10.8	ft^2	
GC_p (max)	1.90	1.97	1.97		
Exposed Panels? (γ_E = 1.5)	No	No	No		
Pressure Equalization Factor, γ_a	0.79	0.79	0.79		
Uplift Force	23.9	24.8	24.8	psf	
Max. Uplift Force / Connection (0.6 WL)	155.0	161.3	161.3	lbs	
Solar Dead Load (0.6 DL)	17.6	17.6	17.6	lbs	
Max. Uplift Force (0.6 WL - 0.6 DL)	**137.5**	**143.8**	**143.8**	**lbs**	

Connection Capacity

Pegasus Comp Mount

Fastener Type	Lag Screw		
Fastener Diameter	0.3125	in	
Embedment Length, min	2.5	in	
Lumber Species & Grade	DFL #2 (Assumed)		
Lumber Specific Gravity	0.5		
Nominal Withdrawal Capacity, W	665.0	lbs	NDS 12.2-1
# of Screws	1		
Load Duration Factor, C_D	1.6		
Adjusted Withdrawal Capacity, W'	**1064.0**	**lbs**	

Compare Adjusted Withdrawal Capacity to ASD Factored Demand

Zone 1	Zone 2r	Zone 3
O.K.	O.K.	O.K.

SOLAR WORKSHEET

Site Address 2030 NE 58th Ave

Section 1: Firefighter Access and Escape

Required for all solar permit applications.

Is the solar array located on a non-occupied accessory structure that is separated from occupied structures by a 6-foot minimum separation distance or by a minimum two-hour fire rated assembly?

- [ ] YES – **STOP!** Firefighter pathways are not required. You have completed this section.
- [x] NO – Follow the **General Requirements**:

On your plans, provide a 36" wide pathway along three sides of the solar roof, located over a structurally supported area. Refer to **Figure 1** and **Figure 3**.

- Any roof with a slope greater than 2:12 cannot use the bottom roof edge as a pathway.
- Pathways and solar panels shall be located outside 12" of the low point of a valley.
- If the array is greater than 150 feet in length or width, additional 36" wide intermediate pathways and cutouts are required. See code for details.
- If the roof has smoke and/or heat vents, a 36" pathway shall be provided to and around each vent.

Don't have enough space for a 36" wide pathway? Continue to determine if you qualify for an exception.

Reduced Access and Escape Pathway

[x] Yes	[ ] No	Is the roof slope greater than 2:12?
[x] Yes	[ ] No	Is the array area 1,000 sq. ft. or less?
[X] Yes	[ ] No	Is there an intersecting adjacent roof without a PV array?
[x] Yes	[ ] No	Is the array 150 feet or less in length or width?

If **"NO" to any** of the questions above, **STOP!** Provide the **general requirements** of a 36" wide pathway on three sides.

SOLAR WORKSHEET

Section 1: Firefighter Access and Escape, continued

If **"YES" to all** of the questions in the section above, continue.

Is the array 25% or less of the roof area?

[X] Yes	Provide a 12" pathway along each side of any horizontal ridge.
[ ] No	Provide a 12" pathway along each side of any horizontal ridge and a minimum of one 36" pathway from ridge to eave over a structurally supported area.

You have completed the Firefighter Access and Escape.
Continue onto Section 2: Prescriptive Path Eligibility.

SOLAR WORKSHEET

Section 2: Prescriptive Path Eligibility

System Information

☐ YES ☒ NO Is this a ballasted roof system?

Continue if you answered "NO" to the question above.
If "YES", STOP! Take the engineered path.

☒ YES ☐ NO Is the weight of the PV modules and racking less than 4.5 pounds per square foot?

☒ YES ☐ NO Is the module parallel to the plane of the roof with a height 18" or less above the roof at any point?

Continue if you answered "YES" to the two questions above.
If "NO", STOP! Take the engineered path.

Roof Construction

If you answer "NO" at any point, STOP! Take the engineered path.

☒ YES ☐ NO Is the roofing material metal, single layer wood shingle, or not more than two layers of composition shingle?

☒ YES ☐ NO Is this conventional light framed wood construction?

Continue if you answered "YES" to all the questions above.

Roof Framing Type

Select the type that applies to your project

☐ Pre-engineered trusses, continue.

☒ Roof rafters using conventional sawn lumber, continue.

☐ Other, STOP! Take the engineered path.

SOLAR WORKSHEET

Section 2: Prescriptive Path Eligibility continued

If You Selected Pre-Engineered Trusses

If you answer "NO", STOP! Take the engineered path.

[ ] Yes [X] No Are the pre-engineered roof trusses spaced at 24" on center (o.c.) maximum?

If "YES", continue to "**Structural Support and Attachments**" on page 6.

If You Selected Roof Rafters Using Conventional Sawn Lumber

If you answer "NO" at any point, STOP! Take the engineered path.

[ ] Yes [X] No Use the **OSSC Table 2308.7.2(1)** (page 12-13) to determine if the allowable span accordingly is greater than or equal to your actual roof rafter span.

Your roof rafter size: 2x4

Your roof rafter spacing: 24 inches o.c.

Your grade and species of wood*:

Unknown (Douglas Fir Larch #2 assumed)

*If you do not know the grade and species, default to "Douglas Fir-Larch #2".
Refer to **Figure 3** for illustration of the span length.

Your roof rafter span: 6 feet

[X] Yes [ ] No The roof framing consists of roof rafters and ceiling joists running parallel to the rafters in "A" frame configuration with a ridge board and/or collar tie at the ridge.

[X] Yes [ ] No The slope of the rafter is greater than 3 units vertical and 12 units horizontal.

Continue on next page.

SOLAR WORKSHEET

Section 2: Prescriptive Path Eligibility continued

Continued from previous page.

Roof Rafters Using Conventional Sawn Lumber, continued

[X] Yes [ ] No	The ceiling joists and roof rafters are at the same spacing and connected where they intersect.
[X] Yes [ ] No	The ceiling joist/rafter bears on top of the rafter support walls (top plate) and are attached to the roof rafters. If the ceiling joists do not bear on top of the top plate and are raised above the top plate, the framing could still be considered prescriptive; however, the roof rafter spans will need to be adjusted in accordance with adjustment factors from OSSC Table 2308.7.2(1) and Figure 3. In this case, please contact plan reviewers if you need assistance.
[X] Yes [ ] No	If the rafter is supported along its span by an intermediate brace or pony wall, and the intermediate brace or pony wall is used to reduce the span of the rafter, then the brace/pony wall shall bear directly on a bearing wall below.
[X] Yes [ ] No [ ] N/A	Do all hip and valley rafters that are impacted by the solar panel installation have: • minimum 2x members with the depth not less than the cut end of typical roof rafter; • support at the ridge, and; • support at an intermediate point if typical roof rafters require intermediate support to comply with roof rafter tables.

If **"YES" to ALL** the questions above, continue to "**Structural Support and Attachments**" on the next page.

SOLAR WORKSHEET

Section 2: Prescriptive Path Eligibility continued

Structural Support and Attachments

If you answer "NO" at any point, STOP! Take the engineered path.

☒ YES	☐ NO	Is the racking support positively attached to the roof structural components/blocking in accordance with the manufacturer's recommendations?
☒ YES	☐ NO	Is the spacing of the attachments to the roof structural components/blocking • less than or equal to 48" o.c in any direction, and; • no greater than 24" o.c when the attachments are located within 3 feet of the roof edge, eave or ridge?

Are you working with a standing seam metal roof?

☒ NO – STOP! You have **completed** the Prescriptive Path Eligibility. If you answered "**YES**" to the questions above, select the "**Prescriptive Pathway**" when applying on DevHub.

☐ YES – Continue:

For Standing Seam Metal Roofs Only

If you answer "NO" at any point, STOP! Take the engineered path.

☐ YES	☐ NO	Is the metal panel 26 gage or heavier?
☐ YES	☐ NO	Is the metal roofing panel width less than or equal to 18 inches?
☐ YES	☐ NO	Is the metal panel installed over minimum ½" nominal wood structural panels substrate and attached to the wood panels with at least #10 screws at 24" o.c.?
☐ YES	☐ NO	Are the ½" nominal wood structural panels attached to structural framing with a minimum of 8d nails at 6" o.c. at panel edges and 12" o.c. field nailing?

Continue on next page.

SOLAR WORKSHEET

Section 2: Prescriptive Path Eligibility continued

For Standing Seam Metal Roofs Only

If you answer "NO" at any point, STOP! Take the engineered path.

☐ YES ☐ NO Are the solar panels attached to the standing seam metal deck with clamps that are spaced not less than 24" o.c. nor greater than 60" o.c. along the seam?

☐ YES ☐ NO Are the solar panels attached to the standing seam metal deck with clamps that are spaced perpendicular to the seam such that the area calculated by multiplying the spacing along the seam by spacing perpendicular to the seam does not exceed 10 sq. ft.?

Did you answer "**YES**" to ALL the questions above? If yes, take the "**Prescriptive Pathway**" when you apply on DevHub.

You have completed the Prescriptive Path Eligibility.

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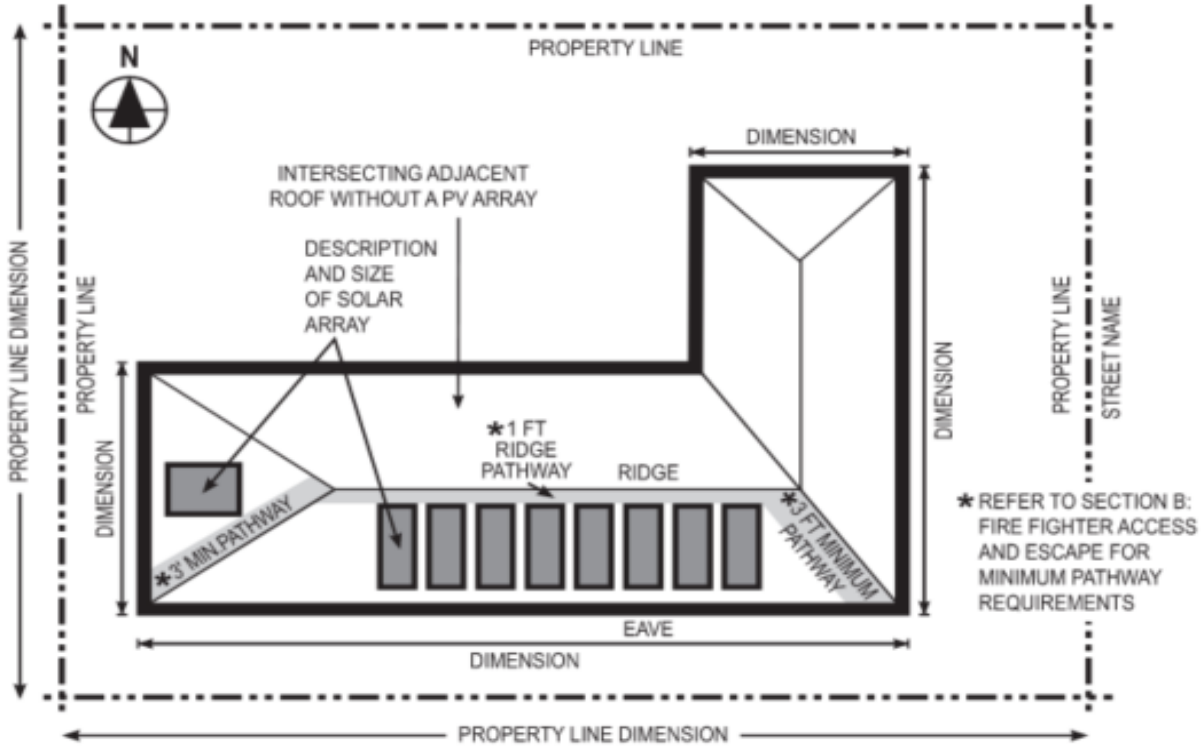
Figures and Tables

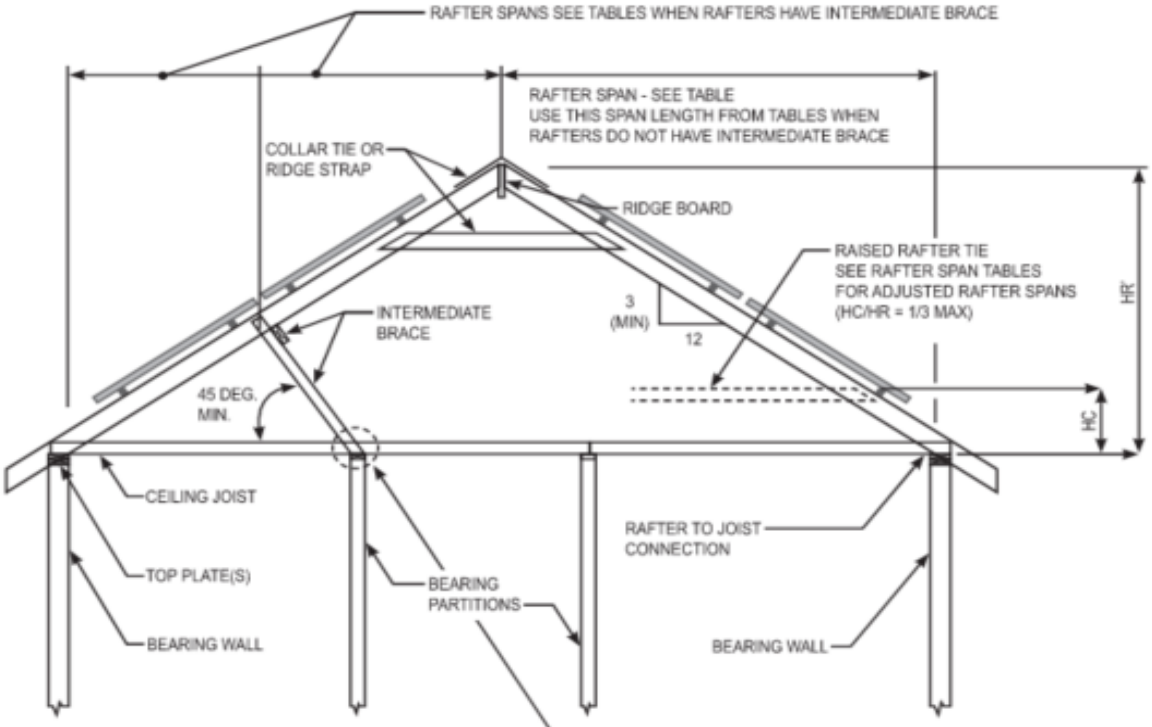
FIGURE 1
SAMPLE SITE PLAN



SOLAR WORKSHEET

Figures and Tables

FIGURE 3
SAMPLE ROOF CROSS SECTION



For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 degree = 0.018 rad.

Note: Where ceiling joists run perpendicular to the rafter, rafter ties shall be installed in accordance with Section R802.3.1

H_C = Height of ceiling joists or rafter ties measured vertically above the top of rafter support walls.

H_R = Height of roof ridge measured vertically above the top of rafter support walls.

Note: To qualify as an intermediate support or brace for rafters, the intermediate brace must bear on a bearing wall. Where the intermediate brace/support, bears on the ceiling joist, the intermediate brace shall not be considered as a support for rafters and rafter span shall be from exterior bearing wall to ridge.

SOLAR WORKSHEET

Figures and Tables

If the species and grade is not known use Douglas Fir-Larch #2

OSSC TABLE 2308.7.2(1)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof live load= 20 psf, celling not attached to rafters, L/1', = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum Rafter Spans				
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	11-6	18-0	23-5	Note b	Note b
	Douglas Fir-Larch	#1	10-6	15-4	19-5	23-9	Note b
	Douglas Fir-Larch	#2	9-10	14-4	18-2	22-3	25-9
	Douglas Fir-Larch	#3	7-5	10-10	13-9	16-9	19-6
	Hem-Fir	SS	10-10	17-0	22-5	Note b	Note b
	Hem-Fir	#1	10-3	14-11	18-11	23-2	Note b
	Hem-Fir	#2	9-8	14-2	17-11	21-11	25-5
	Hem-Fir	#3	7-5	10-10	13-9	16-9	19-6
	Southern Pine	SS	11-3	17-8	23-4	Note b	Note b
	Southern Pine	#1	10-6	15-8	19-10	23-2	Note b
	Southern Pine	#2	9-0	13-6	17-1	20-3	23-10
	Southern Pine	#3	6-11	10-2	12-10	15-7	18-6
	Spruce-Pine-Fir	SS	10-7	16-8	21-9	Note b	Note b
	Spruce-Pine-Fir	#1	9-10	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#2	9-10	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#3	7-5	10-10	13-9	16-9	19-6
16	Douglas Fir-Larch	SS	10-5	16-0	20-3	24-9	Note b
	Douglas Fir-Larch	#1	9-1	13-3	16-10	20-7	23-10
	Douglas Fir-Larch	#2	8-6	12-5	15-9	19-3	22-4
	Douglas Fir-Larch	#3	6-5	9-5	11-11	14-6	16-10
	Hem-Fir	SS	9-10	15-6	19-11	24-4	Note b
	Hem-Fir	#1	8-10	12-11	16-5	20-0	23-3
	Hem-Fir	#2	8-5	12-3	15-6	18-11	22-0
	Hem-Fir	#3	6-5	9-5	11-11	14-6	16-10
	Southern Pine	SS	10-3	16-1	21-2	25-7	Note b
	Southern Pine	#1	9-1	13-7	17-2	20-1	23-10
	Southern Pine	#2	7-9	11-8	14-9	17-6	20-8
	Southern Pine	#3	6-0	8-10	11-2	13-6	16-0
	Spruce-Pine-Fir	SS	9-8	14-10	18-10	23-0	Note b
	Spruce-Pine-Fir	#1	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#2	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#3	6-5	9-5	11-11	14-6	16-10
19.2	Douglas Fir-Larch	SS	9-10	14-7	18-6	22-7	Note b
	Douglas Fir-Larch	#1	8-4	12-2	15-4	18-9	21-9
	Douglas Fir-Larch	#2	7-9	11-4	14-4	17-7	20-4
	Douglas Fir-Larch	#3	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	SS	9-3	14-4	18-2	22-3	25-9
	Hem-Fir	#1	8-1	11-10	15-0	18-4	21-3
	Hem-Fir	#2	7-8	11-2	14-2	17-4	20-1
	Hem-Fir	#3	5-10	8-7	10-10	13-3	15-5
	Southern Pine	SS	9-8	15-2	19-7	23-4	Note b
	Southern Pine	#1	8-4	12-4	15-8	18-4	21-9
	Southern Pine	#2	7-1	10-8	13-6	16-0	18-10
	Southern Pine	#3	5-6	8-1	10-2	12-4	14-7
	Spruce-Pine-Fir	SS	9-1	13-7	17-2	21-0	24-4
	Spruce-Pine-Fir	#1	7-9	11-4	14-4	17-7	20-4
	Spruce-Pine-Fir	#2	7-9	11-4	14-4	17-7	20-4
	Spruce-Pine-Fir	#3	5-10	8-7	10-10	13-3	15-5

table continued on next page

SOLAR WORKSHEET

Figures and Tables

OSSC TABLE 2308.7.2(1)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof live load= 20 psf, celling not attached to rafters, L/1', = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum Rafter Spans				
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
24	Douglas Fir-Larch	SS	8-11	13-1	16-7	20-3	23-5
	Douglas Fir-Larch	#1	7-5	10-10	13-9	16-9	19-6
	Douglas Fir-Larch	#2	6-11	10-2	12-10	15-8	18-3
	Douglas Fir-Larch	#3	5-3	7-8	9-9	11-10	13-9
	Hem-Fir	SS	8-7	12-10	16-3	19-10	23-0
	Hem-Fir	#1	7-3	10-7	13-5	16-4	19-0
	Hem-Fir	#2	6-10	10-0	12-8	15-6	17-11
	Hem-Fir	#3	5-3	7-8	9-9	11-10	13-9
	Southern Pine	SS	8-11	13-10	17-6	20-10	24-8
	Southern Pine	#1	7-5	11-1	14-0	16-5	19-6
	Southern Pine	#2	6-4	9-6	12-1	14-4	16-10
	Southern Pine	#3	4-11	7-3	9-1	11-0	13-1
	Spruce-Pine-Fir	SS	8-4	12-2	15-4	18-9	21-9
	Spruce-Pine-Fir	#1	6-11	10-2	12-10	15-8	18-3
	Spruce-Pine-Fir	#2	6-11	10-2	12-10	15-8	18-3
	Spruce-Pine-Fir	#3	5-3	7-8	9-9	11-10	13-9

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch= 25.4 mm, 1 foot= 304.8 111111, 1 pound per square foot= 0.0479 kPa.

a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the following factors:

H_C / H_R	Rafter Span Adjustment Factor
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 or less	1.00

Where:
H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.
H_R = Height of roof ridge measured vertically above the top of the rafter support walls.
b. Span exceeds 26 feet in length.