

City of Glendale
Community Development Department
Building and Safety Division
PHOTOVOLTAIC CONVENTIONAL FRAMING
FOR SINGLE FAMILY & DUPLEX

Conventional Framing Notes for Photovoltaic systems installed on single Family/Duplex projects

1. "Contractor is responsible to verify existing roof structure complies with conventional framing requirements as per 2022 CBC 2308.7, 2022 CRC Chapter 8 and California Solar Permitting Guidebook PV Toolkit 5. Contractor understands that a structural design is required by a California-licensed civil or structural engineer when framing does not meet conventional requirements, and/or unusual conditions are observed such as sagging, deterioration, carpenter trusses, roof overlays, etc. Contractor's name and signature below confirms that a thorough framing audit has been completed, and existing roof structure is in full compliance with the above code criteria, and no unusual conditions exist which would require engineering."
2. **For arrays supported by 2x4 rafters**, horizontal rail anchor attachments shall be spaced horizontally maximum 48" o.c. and anchors shall be staggered from row to row. *City of Glendale has many old structures built prior to current code requirements.* Alternate to this requirement, design shall provide a complete layout of roof framing show proper code accepted supports (partitions, bracing from partitions, ridge, for spans not exceeding the following:
 3. 2x4 (1-3/4" x 3-3/4") rafter spaced at 24" o.c. Maximum span allowed is 9'- 9".
 4. 2x4 (1-1/2" x 3-1/2") rafter spaced at 24" o.c. Maximum span allowed is 8'- 0".
 5. Fastener shall a minimum 5/16" dia. lag screw with a 2 1/2" minimum embedment into sawn lumber.
 6. Rafter bracing supported to mid spans of ceiling joists is not acceptable unless providing a complete licensed engineering analysis, framing plans and detailing.
 7. Module weight do not exceed 4 psf (Lbs/Sq Ft)
 8. Fastener horizontal spacing does not exceed values in Table 1.
 9. Rafter spans shall not exceed values in Table 2 attached below for sized 2x6 and greater.
10. The roof structure appears structurally sound, without signs of alterations or structural deterioration or sagging. Identify roof sheathing and roof covering material.
11. The roof has only one layer of roofing material.
12. **Field conditions that do not met the criteria described here will require revisions to be resubmitted to City for review and approval.**

Contractor's Name: _____

Contractor's Signature: _____

Date: _____

Table 1. Maximum Horizontal Anchor Spacing				
Roof Slope		Rafter Spacing		
		16" o.c.	24" o.c.	32" o.c.
Photovoltaic Arrays (4 psf max)				
Flat to 6:12	0° to 26°	5'-4"	6'-0"	5'-4"
7:12 to 12:12	27° to 45°	1'-4"	2'-0"	2'-8"
13:12 to 24:12	46° to 63°	1'-4"	2'-0"	2'-8"
Solar Thermal Arrays (5 psf max)				
Flat to 6:12	0° to 26°	4'-0"	4'-0"	5'-4"
7:12 to 12:12	27° to 45°	1'-4"	2'-0"	2'-8"
13:12 to 24:12	46° to 63°	Calc. Req'd	Calc. Req'd	Calc. Req'd

Arrays supported by 2x4 rafters, shall have horizontal rail anchor attachments spaced horizontally maximum 48" o.c. Anchors shall be staggered from row to row.

Solar support component manufacturer's guidelines may be relied upon to ensure the array above the roof is properly designed, but manufacturer's guidelines typically do NOT check to ensure that the roof itself can support the concentrated loads from the solar array. Table 1 assumes that the roof complied with the building code in effect at the time of construction, and places limits on anchor horizontal spacing to ensure that a roof structure is not overloaded under either downward loads or wind uplift loads. Note 4 below lists the basic assumptions upon which this table is based.

Table 1 Notes:

1. Anchors are also known as "stand-offs," "feet," "mounts" or "points of attachment." Horizontal anchor spacing is also known as "cross-slope" or "east-west" anchor spacing (see Figure 2).
2. If anchors are staggered from row-to-row going up the roof, the anchor spacing may be twice that shown above, but no greater than 6'-0".
3. For manufactured plated wood trusses at slopes of flat to 6:12, the horizontal anchor spacing shall not exceed 4'-0" and anchors in adjacent rows shall be staggered.
4. This table is based on the following assumptions:
 - The roof structure conformed to building code requirements at the time it was built.
 - The attached list of criteria is met.
 - Mean roof height is not greater than 40 feet.
 - Roof sheathing is at least 7/16" thick oriented strand board or plywood. 1x skip sheathing is acceptable.
 - If the dwelling is in Wind Exposure B (typical urban, suburban or wooded areas farther than 500 yards from large open fields), no more than one of the following conditions apply:
 - The dwelling is located in a Special Wind Region with design wind speed between 115 and 130 mph per ASCE 7-10.
 - The dwelling is located on the top half of a tall hill, provided average slope is less than 15%.
 - If the dwelling is in Wind Exposure C (within 500 yards of large open fields or grasslands), all of the following conditions apply.
 - Design wind speed is 110 mph or less (not in a Special Wind Region).
 - The dwelling is not located on the top half of a tall hill.
 - The solar array displaces roof live loads (temporary construction loads) that the roof was originally designed to carry.
 - The Structural Technical Appendix provides additional information about analysis assumptions.

Table 2. Roof Rafter Maximum Horizontal Span (feet - inches)¹

Assumed Vintage	Nominal Size	Actual Size	Non-Tile Roof ²			Tile Roof ³		
			Rafter Spacing					
			16" o.c.	24" o.c.	32" o.c.	16" o.c.	24" o.c.	32" o.c.
Post-1960	2x4	1½"x3½"	9'-10"	8'-0"	6'-6"	8'-6"	6'-11"	5'-6"
	2x6	1½"x5½"	14'-4"	11'-9"	9'-6"	12'-5"	10'-2"	8'-0"
	2x8	1½"x7¼"	18'-2"	14'-10"	12'-0"	15'-9"	12'-10"	10'-3"
Pre-1960	2x4	1¾"x3¾"	11'-3"	9'-9"	7'-9"	10'-3"	8'-6"	6'-9"
	2x6	1¾"x5¾"	17'-0"	14'-0"	11'-3"	14'-9"	12'-0"	9'-9"
	2x8	1¾"x7¾"	22'-3"	18'-0"	14'-6"	19'-0"	15'-6"	12'-6"

Beyond a visual review by the contractor checking for unusual sagging or deterioration, some CBOs may want additional assurance that the roof structure complies with structural building code requirements. Table 2 is an optional table some CBOs may elect to use to provide additional assurance by requiring a check of existing roof rafter spans, and supports optional criteria 1.B.5 and 1.B.6. For post-1960 construction, these span tables match the rafter span tables found in the 2016 California Building and Residential codes. For pre-1960 construction, the rafter span tables are based on structural calculations with lumber sizes and wood species and grade appropriate for older construction. Note 5 below lists the basic assumptions upon which this table is based.

Table 2 Notes:

1. See Figure 4 for definition of roof rafter maximum horizontal span.
2. "Non-tile Roof" = asphalt shingle, wood shingle and wood shake, with an assumed roof assembly weight of 10 psf.
3. "Tile Roof" = clay tile or cement tile, with an assumed roof assembly weight of 20 psf
4. Unaltered manufactured plated-wood trusses may be assumed to be code compliant and meet intent of Table 2.
5. This table is based on the following assumptions:
 - Span/deflection ratio is equal to or greater than 180.
 - For post-1960 construction, wood species and grade is Douglas Fir-Larch No. 2.
 - For pre-1960 construction, wood species and grade is Douglas Fir-Larch No. 1.
 - Other wood species and/or grade are also acceptable if allowable bending stress is equal or greater to that listed.