



**City of  
Portland, Oregon**  
**Bureau of Development Services**  
FROM CONCEPT TO CONSTRUCTION

Chloe Eudaly, Commissioner  
Rebecca Esau, Director  
Phone: (503) 823-7300  
Fax: (503) 823-6983  
TTY: (503) 823-6868  
[www.portlandoregon.gov/bds](http://www.portlandoregon.gov/bds)

## Residential Non-Prescriptive Solar Permit Guidelines

Scope: This document is intended to provide guidelines for residential non-prescriptive solar permits. The guidelines presented below are general in nature and represent requirements for non-prescriptive solar installations on typical residential roof types consistent with the typical housing stock within the City of Portland. Requirements for existing structures with complex roof framing systems may fall outside these guidelines and require additional documentation and/or analysis.

- Plan preparation:
  - Drawings may not contain color; Line quality and contrast must be easy to read and dark enough to scan.
  - Dimensions and Notes must be printed to match 12-point font minimum.
  - All plans, building sections, and elevations must be drawn to scale; the scale used must be clearly shown.
  - Drawings that depict structural information shall be stamped/signed by an engineer registered in Oregon.
- Residential Non-Prescriptive Solar specific drawing guidelines:
  - Roof Framing plan should include the following:
    - Show existing structural framing members including rafters, ridge board or ridge beam, hip or valley framing, and support posts/bearing walls. Posts, bearing or pony walls below the roof which support the roof framing shall be shown dashed.
    - Indicate size and spacing of roof members impacted by installation of the new PV array.
    - Clearly show the spacing and locations of racking attachment points to the existing roof structure.
  - Provide a full building section at each location where a new PV array is located:
    - Section should specify all existing structural framing members (bearing walls, ceiling joists, roof rafters, collar ties, pony walls, ridge beam or rim board, diagonal braces, and/or any other pertinent structural framing member).
    - Clearly identify any new strengthening members (sistered members, added braces or collar ties, etc.) in the section and indicate the connections to the existing framing.
    - Clearly identify which elements are new and which are existing.
    - Identify the size and spacing of new or existing members if not already indicated on plan drawing.
    - Provide solar rack attachment detail showing the attachment to the existing framing. Clearly identify PV panel, racking system, attachment hardware, and required fasteners.

- Residential Non-Prescriptive Solar structural analysis guidelines:
  - Addition of roof mounted PV arrays is an alteration to the load path and load application to the existing roof members. The dead load of the solar panels and the snow and wind loads on the panels are now imparted to the existing roof rafters at discrete points at the racking standoffs as compared to the existing uniform distribution of loads; This must be considered in the analysis.
  - Analysis of the existing structure shall include the following:
    - Where a ridge is framed by a ridge board that is not directly supported a vertical reaction, the rafters and ceiling joists create a “frame” and must be analyzed as such. The connection of the rafters to the ceiling joists (heel connection) is critical for load transfer and must be determined to be sufficient or strengthened.
    - All roof framing members that are affected by the PV installation must be checked. If the existing framing consists of dormers, hips, or valleys, these elements must be evaluated for the modified load path; For this condition, it is not sufficient to check only the roof rafters.
    - Where long-span ceiling joists transmit axial load, and are likely spliced over an existing bearing wall, the splice connection shall be verified or strengthened to meet demand.
    - Analysis shall determine the adequacy of the existing framing and connections, and provide strengthening as required to address any deficiencies (sistered members, added braces, added collar ties, strengthened connections, etc.).
    - Where new braces are added to reduce the span of roof rafters or provide vertical support to the rim board, the entire load path shall be evaluated considering the added load on the existing bearing wall and the structural support at the ground floor. Where the existing bearing wall is supported by existing ground floor beams or girders, the adequacy of the existing floor framing shall be evaluated for the new loads.
  - Analysis of racking attachment to existing structure:
    - Design of racking attachment to the existing structure shall be provided considering all governing load cases. Attachments shall be designed to determine fastener size, spacing, and embedment into existing framing.
- Residential Non-Prescriptive Solar response to structural plan review comments:
  - To clarify how plan review comments have been specifically addressed, please provide written responses to each checksheet comment and identify where in the calculations or revised drawings the comment has been addressed.