



CITY OF NEWPORT BEACH

Fire Department

Fire Prevention Division

GUIDELINES AND STANDARDS

Guideline D.04 - Fire Safety Elements of Solar Photovoltaic Systems

D.04.1 PURPOSE

The installation of solar photovoltaic (PV) systems presents additional areas of concern for firefighter safety and fire fighting operations including: energized equipment, trip hazards, restricting venting locations, limiting walking surfaces on roof structures, etc. This guideline establishes the minimum standard for the layout design, marking, and installation of solar photovoltaic systems and is intended to mitigate the fire safety issues.

D.04.2 SCOPE

This guideline applies to all solar photovoltaic systems regardless of size for residential and commercial purposes.

D.04.3 GENERAL REQUIREMENTS

1. **Fire Classification.** Rooftop-mounted photovoltaic systems shall have a fire classification in accordance with Section 1509 of the 2019 CBC.
2. **Fire Classification.** Building integrated photovoltaic systems shall have a fire classification in accordance with Section 1505.8 of the 2019 CBC.
3. **Building Integrated Photovoltaic Systems.** Building-integrated photovoltaic systems that serve as the roof coverings shall be designed and installed in accordance with Section 1507.18 of the 2019 CBC. Building-integrated photovoltaic products installed as the roof covering shall be tested, listed and labeled for fire classification in accordance with 1501.1 of the 2019 CBC.
4. **Rooftop Mounted Photovoltaic Panel Systems.** Rooftop rack-mounted photovoltaic systems shall be tested, listed and identified with a fire classification in accordance with UL 1703 and UL 2703. The fire classification shall comply with Table 1505.1 based on the type of construction of the building.

5. **Ground-mounted Photovoltaic Systems.** Ground-mounted photovoltaic systems shall be designed and installed in accordance with Chapter 16 of the 2019 CBC and the 2019 California Fire Code.
6. **Equipment.** Photovoltaic panels and modules shall be listed and labeled in accordance with UL 1703. Inverters shall be listed and labeled in accordance with UL 1741. Systems connected to the utility grid shall use inverters listed for utility interaction.
7. **Marking.** PV Systems shall be marked. Marking needed to provide emergency responders with appropriate warning and guidance with respect to isolating the solar electric system. This can facilitate identifying energized electrical lines that connect the solar panels to the inverter, as these should not be cut when venting for smoke removal.

Materials used for marking shall be weather resistant. UL 969 shall be used as a standard for weather rating (UL listing of markings is not required).

8. **Main Service Disconnect.** For residential applications, the marking may be placed within the main service disconnect. If the main service disconnect is operable with the service panel closed, then the marking should be placed on the outside cover.

For commercial application, the marking shall be placed adjacent to the main service disconnect in a location clearly visible from the location where the lever is operated.

Marking Content and Format

- Marking Content: CAUTION: SOLAR ELECTRIC SYSTEM CONNECTED
- Red Background
- White Lettering
- Minimum 3/8" Letter Height
- All Capital Letters
- Arial or Similar Font, Non-bold
- Reflective weather resistant material suitable for the environment (durable adhesive materials must meet this requirement)

CAUTION: SOLAR ELECTRIC SYSTEM CONNECTED

9. **Marking DC Circuit.** Marking is required on all interior and exterior DC conduit, raceways, enclosures, cable assemblies, and junction boxes to alert the fire service to avoid cutting them. Marking shall be placed every 10 feet, at turns and above and/or below penetrations, and at all DC combiner and junction boxes.

Marking Content and Format

- Marking Content: CAUTION: SOLAR CIRCUIT
- Red Background
- White Lettering
- Minimum 3/8" Letter Height
- All Capital Letters
- Arial or Similar Font, Non-bold
- Reflective weather resistant material suitable for the environment (durable adhesive materials must meet this requirement)

CAUTION: SOLAR CIRCUIT

10. **Locations of DC conductors.** Conduit, wiring systems, and raceways for photovoltaic circuits shall be located as close as possible to the ridge or hip or valley and from the hip or valley as directly as possible to an outside wall to reduce trip hazards and maximize ventilation opportunities. Conduit runs between sub arrays and to DC combiner boxes shall be installed in a manner that minimizes the total amount of conduit on the roof by taking the shortest path from the array to the DC combiner box. The DC combiner boxes shall be located such that conduit runs are minimized in the pathways between arrays. DC wiring shall be installed in metallic conduit or raceways when located within enclosed spaces in a building. Conduit shall run along the bottom of load bearing members. CFC Sec. 605.11.1.2.6.
11. **R-3 Pathways to Ridge.** Not fewer than two 36- inch-wide (914 mm) pathways on separate roof planes, from lowest roof edge to ridge, shall be provided on all buildings. Not fewer than one pathway shall be provided on the street or driveway side of the roof. For each roof plane with a photovoltaic array, not fewer than one 36-inch-wide (914 mm) pathway from lowest roof edge to ridge shall be provided on the same roof plane as the photovoltaic array, on an adjacent roof plane or straddling the same and adjacent roof planes.
12. **R-3 Setbacks at Ridge.** For photovoltaic arrays occupying 33 percent or less of the plan view total roof area, a setback of not less than 18 inches (457 mm) wide

is required on both sides of a horizontal ridge. For photovoltaic arrays occupying more than 33 percent of the plan view total roof area, a setback of not less than 36 inches (457 mm) wide is required on both sides of a horizontal ridge.

13. **R-3 Alternative Setbacks at Ridge.** Where an automatic sprinkler system is installed within the dwelling in accordance with Section 903.3.1.3, setbacks at the ridge shall conform to one of the following:
 1. For photovoltaic arrays occupying 66 percent or less of the plan view total roof area, a setback of not less than 18 inches (457 mm) wide is required on both sides of a horizontal ridge.
 2. For photovoltaic arrays occupying more than 66 percent of the plan view total roof area, a setback of not less than 36 inches (914 mm) wide is required on both sides of a horizontal ridge.

14. **R-3 Emergency Escape and Rescue Openings.** Panels and modules installed on Group R buildings shall not be placed on the portion of a roof that is below an emergency escape and rescue opening. A pathway of not less than 36 inches (914 mm) wide shall be provided to the emergency escape and rescue opening.

15. **R-3 Solar Roof.** Solar roof tiles that are non-photovoltaic shall be placed along the required pathways to the ridge and pathways along the ridge. One detail shall be provided for non-photovoltaic panels and one detail shall be provided for photovoltaic panels. These details shall be identified on the plan. Plans shall clearly identify the pathway to the ridge with non-photovoltaic tiles and the setback at the ridge with non-photovoltaic tiles.

R-3 Solar Roof Placarding. Placarding identifying the home is equipped with a solar roof shall be on the plans and provided on site at the main electrical panel.

WARNING!
THIS HOME IS EQUIPPED WITH
A ROOF TILE
PHOTOVOLTAIC SYSTEM.

Access and spacing requirements shall be observed in order to:

1. Ensure access to the roof
2. Provide pathways to specific areas of the roof
3. Provide for smoke ventilation opportunity areas
4. Provide emergency egress from the roof

Exceptions to this requirement may be requested where access, pathway or ventilation requirements are reduced due to:

- Unique site specific limitations
- Alternative access opportunities (as from adjoining roofs)
- Ground level access to the roof area in question
- Other adequate ventilation opportunities when approved by the fire code official
- Adequate ventilation opportunities afforded by panel set back from other rooftop equipment (for example: shading or structural constraints may leave significant areas open for ventilation near HVAC equipment)
- Automatic ventilation device
- New technology, methods, or other innovations that ensure adequate fire department access, pathways, and ventilation opportunities

Designation of ridge, hip, and valley does not apply to roofs with 2-in-12 or less pitch. All roof dimensions are measured to centerlines.

A roof access point shall be defined as an area that does not require ladders to be placed over openings (i.e., windows, vents, or doors), that are located at strong points of building construction, and in locations where ladders will not be obstructed by tree limbs, wires, signs or other overhead obstructions.

RESIDENTIAL — Single and Two-Unit Residential Dwellings

Access

Residential Buildings with hip roof layouts:

Modules shall be located in a manner that provides one three-foot wide clear access pathway from the eave to the ridge on each roof slope where panels are located. The access pathway shall be located at a structurally strong location on the building, such as a bearing wall.

Residential Buildings with a single ridge:

Modules shall be located in a manner that provides two three-foot wide access pathways from the eave to the ridge on each roof slope where panels are located.

Hips and Valleys: Modules shall be located no closer than one and one half feet to a hip or a valley if panels are to be placed on both sides of a hip or valley. If the panels are to be located on only one side of a hip or valley that is of equal length, then the panels may be placed directly adjacent to the hip or valley.

4. Size of solar photovoltaic array

Each photovoltaic array shall be limited to 150 feet by 150 feet. Multiple arrays shall be separated by a 3-foot wide clear access pathway. CFC Sec. 605.11.1.2.1.

Ventilation

Panels and modules installed on Group R-3 buildings shall be located not less than 3 feet from the ridge in order to allow for fire department smoke ventilation operations. CFC Sec. 605.11.1.2.5

COMMERCIAL and Residential Housing with Three or More Units

Note: If the fire code official determines that the roof configuration is similar to residential pitched roofs, such as in the case of townhouses, condominiums, or single family attached buildings, the fire code official may make a determination to apply the residential access and ventilation requirements.

Examples of these requirements appear at the end of these guidelines (Examples 5-8).

Access

There shall be a minimum six-foot-wide clear perimeter around the edges of the roof.

Exception: If either axis of the building is 250 feet or less, there shall be a minimum four feet wide clear perimeter around the edges of the roof.

Pathways

Pathways shall be established in the design of the solar installation. Pathways shall meet the following requirements:

1. The pathway shall be over areas capable of supporting fire fighters accessing the roof.
2. The centerline axis pathways shall be provided in both axes of the roof. Centerline axis pathways shall run where the roof structure is capable of supporting fire fighters accessing the roof.
3. Pathways shall be a straight line not less than 4 feet clear to roof standpipes or ventilation hatches.
4. Pathways shall provide not less than 4 feet clear around roof access hatch with not less than one singular pathway not less than 4 feet clear to a parapet or roof edge.

Ventilation

Arrays shall be no greater than 150 by 150 feet in distance in either axis to create opportunities for fire department smoke ventilation operations.

Smoke ventilation options between array sections shall be either:

- A pathway eight feet or greater in width
- Four feet or greater in width pathway and bordering ~~on existing roof skylights or ventilation hatches~~ roof skylights or gravity-operated dropout smoke and heat vents on not less than one side.
- A 4-foot or greater in width pathway and bordering all sides of nongravity-operated dropout smoke and heat vents.
- Four feet or greater in width pathway and bordering 4' x 8' "venting cutouts" every 20 feet on alternating sides of the pathway

D.04.5 NON-HABITABLE BUILDINGS

These guidelines do not apply to non-habitable structures. Examples of non-habitable structures include, but are not limited to, parking shade structures, carports, solar trellises, etc.

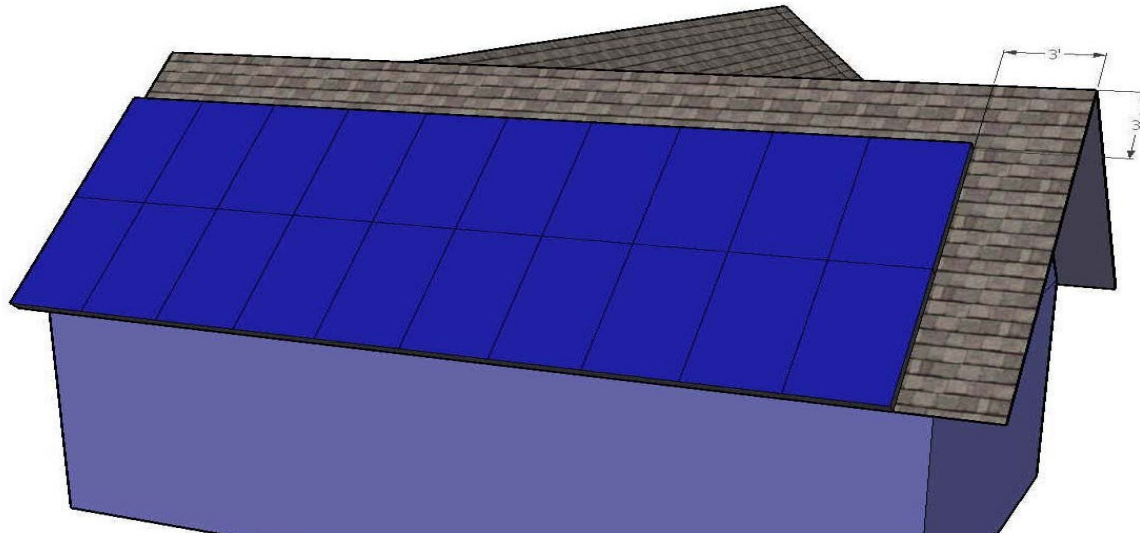
D.04.6 GROUND MOUNTED PHOTOVOLTAIC ARRAYS

Setback requirements do not apply to ground-mounted, free standing photovoltaic arrays. A clear brush area of 10' is required for ground mounted photovoltaic arrays.

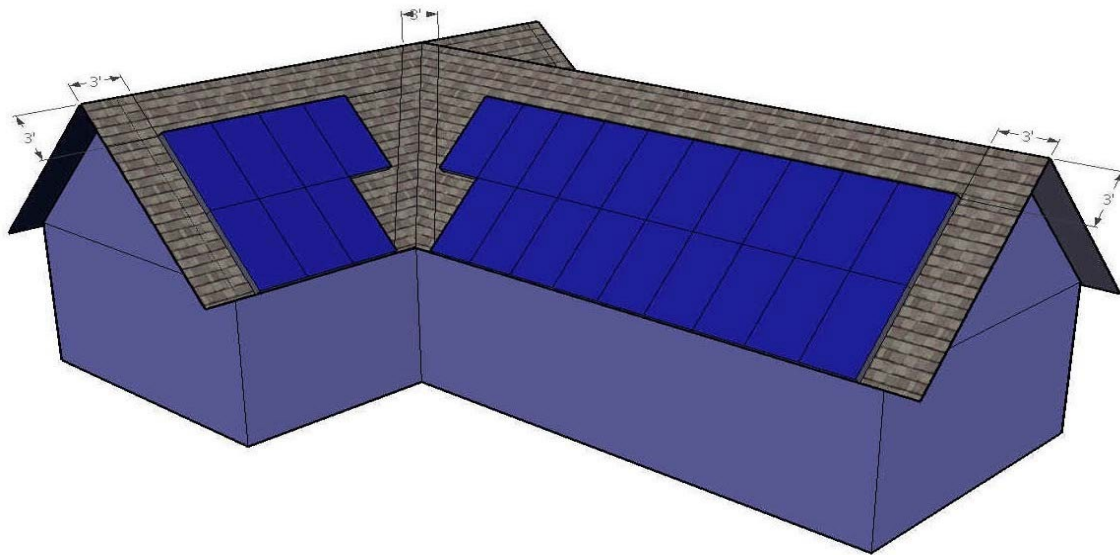
D.04.7 ABANDONED WIRING IN PLENUMS

Accessible portions of abandoned cables in air-handling plenums shall be removed. Cables that are unused and have not been tagged for future use shall be considered abandoned.

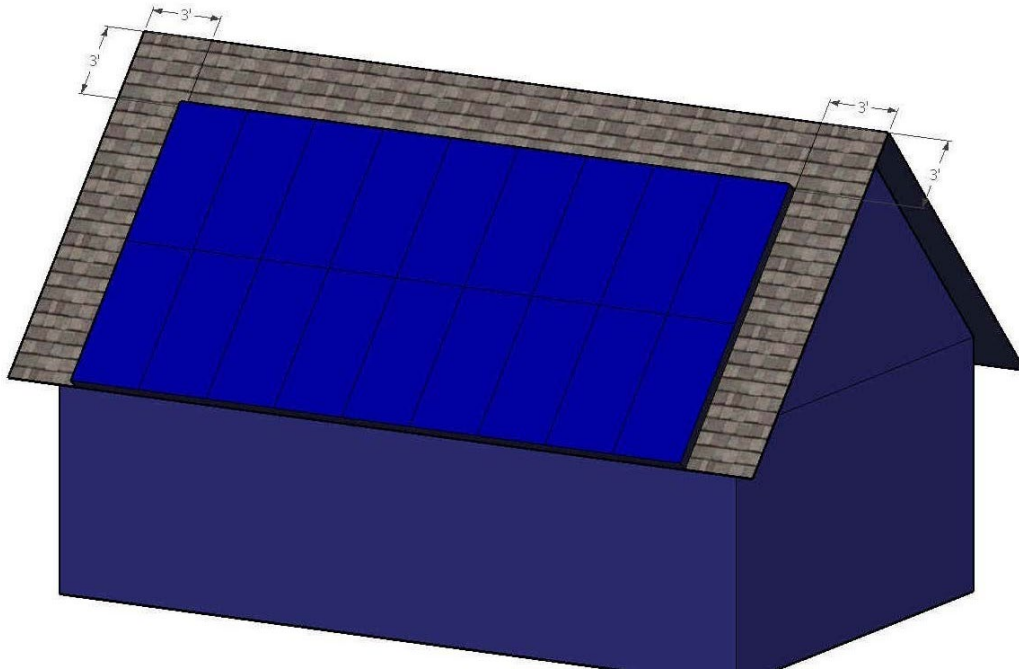
EXAMPLE 1 Cross Gable Roof



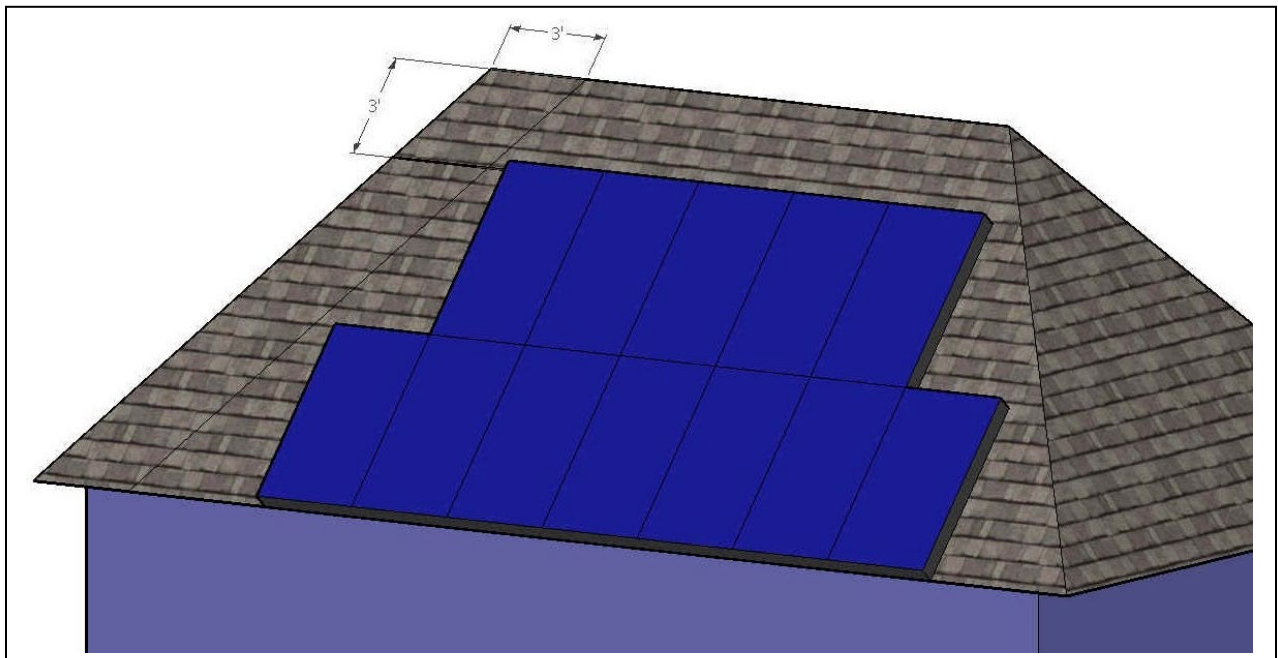
EXAMPLE 2 Cross Gable with Valley



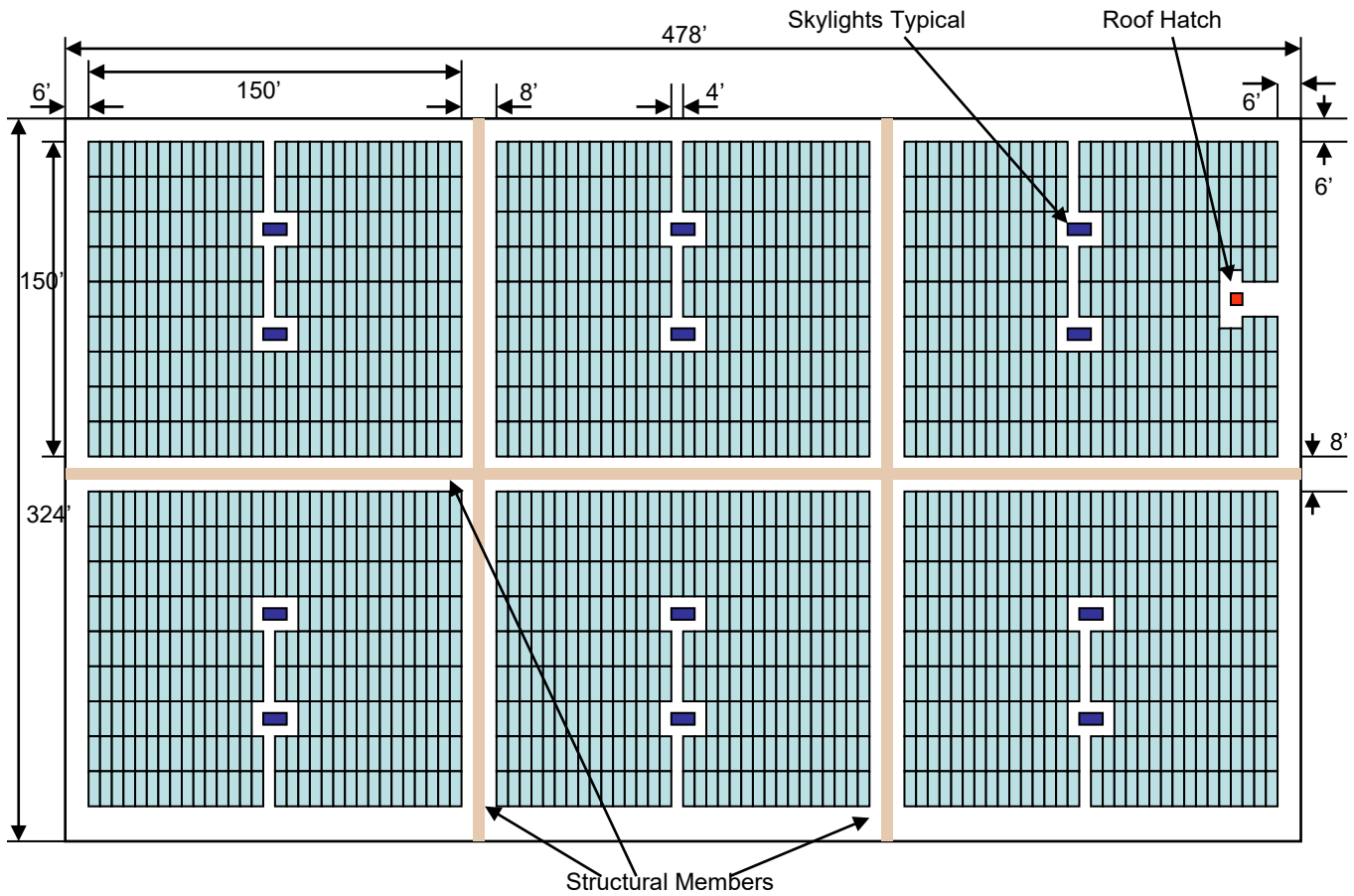
EXAMPLE 3: Full Gable



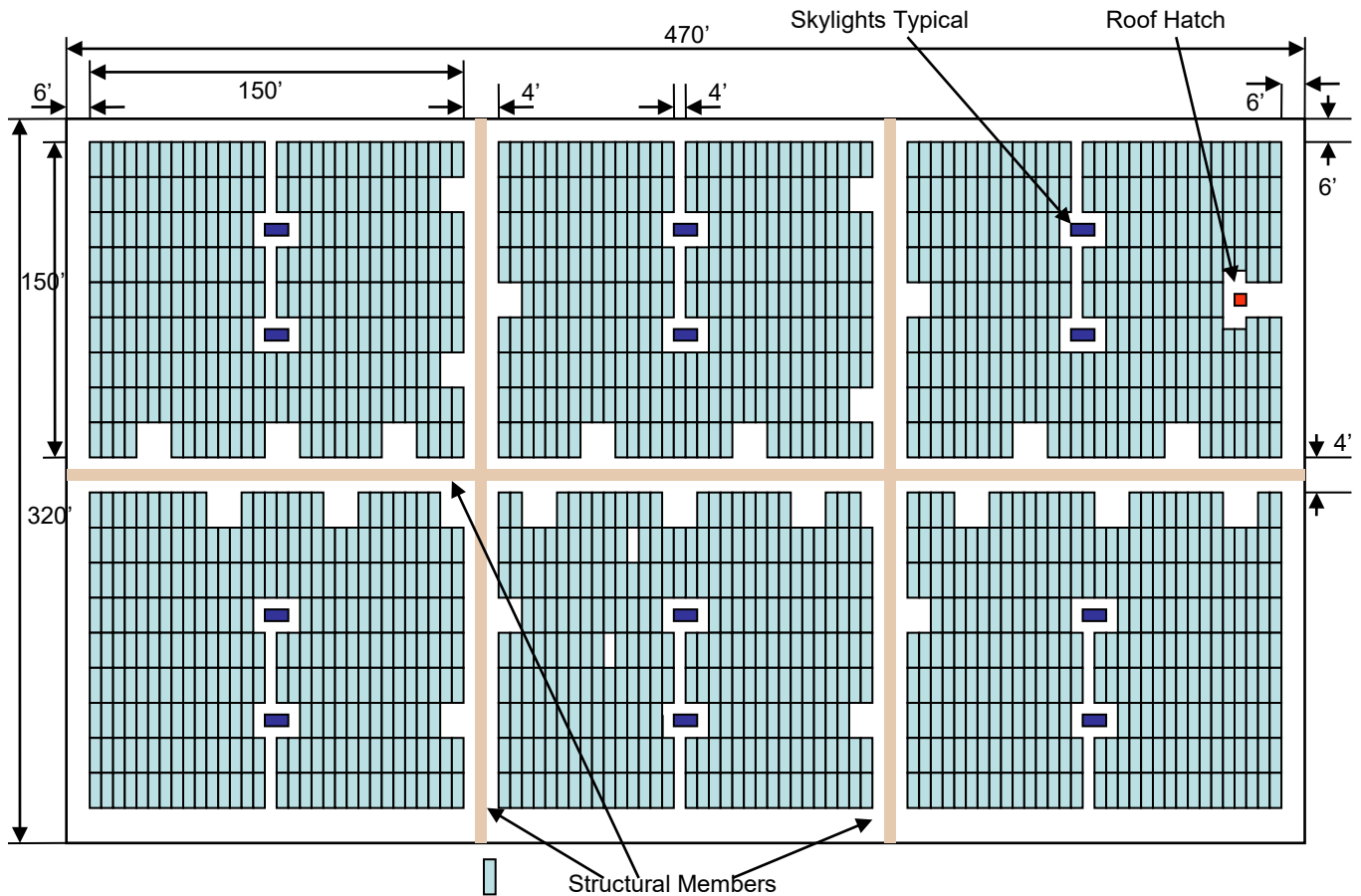
Example 4: Full Hip Roof



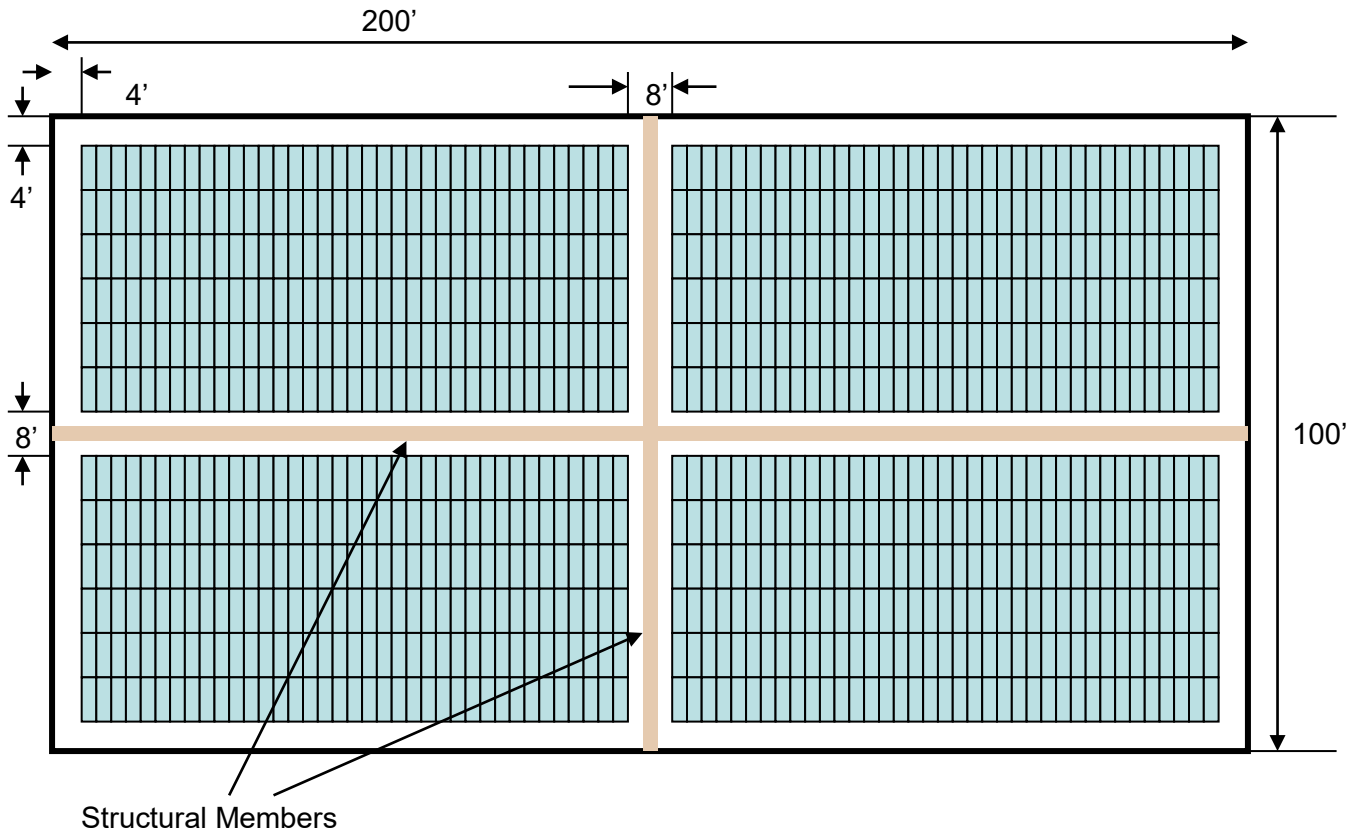
EXAMPLE 5 – Large Commercial (Axis > 250') 8' Walkways



EXAMPLE 6 –Large Commercial (Axis > 250') 4' Walkways With 8' x 4' Venting Opportunities Every 20'



Example 7 Small Commercial (Axis < 250') 8' Walkways



Example 8 Small Commercial (Axis < 250') – 4' Walkways Venting Opportunities Every 20' Along Walkway

