

**Moreno Valley Fire Department
Fire Prevention Bureau**

**Photovoltaic (Solar)
Guideline**



Approved and Authorized By:

Randall Metz, Fire Marshal

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Photovoltaic Systems

PURPOSE

The installation of solar photovoltaic (PV) systems presents additional areas of concern for firefighter safety (energized equipment, trip hazards, etc.) and firefighting operations (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.

SCOPE

This guideline applies to all solar photovoltaic systems regardless of size for residential and commercial purposes and shall be in accordance with the 2013 California Fire Code (CFC), Section 605.11 and all applicable subsections and California Residential Code (CRC), Section R331, and all applicable subsections.

REQUIREMENTS

MARKINGS

General Requirements

PV Systems shall be marked. Marking is 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. Marking for the Main Service Disconnect and Solar Circuit Disconnect shall be in accordance of the California Electrical Code.

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).

Marking Direct Current (DC) Circuit

CFC 605.11.1 and CRC R331.2 requires "WARNING: PHOTOVOLTAIC POWER SOURCE." marking is placed on all interior and exterior direct-current (DC) conduit, enclosures, race- ways, cable assemblies, junction boxes, combiner boxes and disconnects to alert the fire service to avoid cutting them. Marking shall be placed on all DC conduit every 10 feet (3048 mm), within 1 foot (305 mm) of turns or bends and within 1 foot (305 mm) above and below penetrations of roof/ceiling assemblies, walls or barriers.

Marking Content and Format

Marking Content: WARNING: PHOTOVOLTAIC POWER SOURCE

- Red Background
- White Lettering

WARNING: PHOTOVOLTAIC POWER SOURCE

- 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)

NOTE: Effective January 1, 2014, "Caution: Solar Circuit" warning label has been superseded by the above warning label with additional locations for its application.

Inverters

The inverter is a device used to convert DC electricity from the solar system to AC electricity for use in the building's electrical system or the grid.

No markings are required for the inverter.

ACCESS, PATHWAYS, and SMOKE VENTILATION

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

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 points 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.

Examples of these requirements appear at the end of these guidelines (Examples 1-4).

Ventilation

Modules shall be located no higher than three feet below the ridge.

COMMERCIAL BUILDINGS & RESIDENTIAL WITH THREE OR MORE UNITS.

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.

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

Pathways

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

1. Shall be over structural members.
2. Centerline axis pathways shall be provided in both axes of the roof. Centerline axis pathways shall run on structural members or over the next closest structural member nearest to the center lines of the roof.
3. It shall be in a straight line not less than four feet clear width to skylights and/or ventilation hatches.
4. It shall be in a straight line not less than four feet clear width to roof fire protection standpipe outlets.
5. It shall provide not less than four feet clear width around roof access hatch with at least one pathway not less than 4 feet in clear width to parapet or roof edge.

Ventilation

Arrays shall be no greater than 150 by 150 feet in distance in either axis

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
- Four feet or greater in width pathway and bordering 4' x 8' "venting cutouts" every 20 feet on alternating sides of the pathway

LOCATION 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 use the design 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 are to be located such that conduit runs are minimized in the pathways between arrays.

To limit the hazard of cutting live conduit in venting operations, DC wiring shall be run in metallic conduit or raceways when located within enclosed spaces in a building and shall be run, to the maximum extent possible, along the bottom of load-bearing members. When it is not practical to run along the bottom of load bearing members the conduit it shall be run a minimum of 18 inches below the roof.

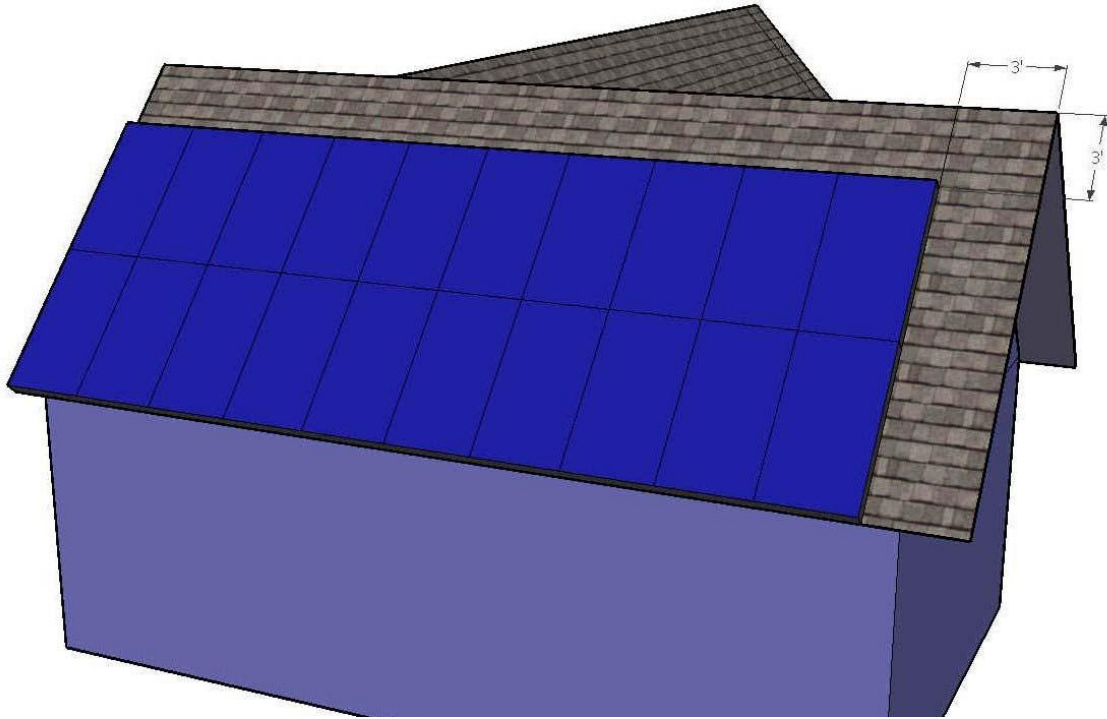
NON-HABITABLE BUILDINGS

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.

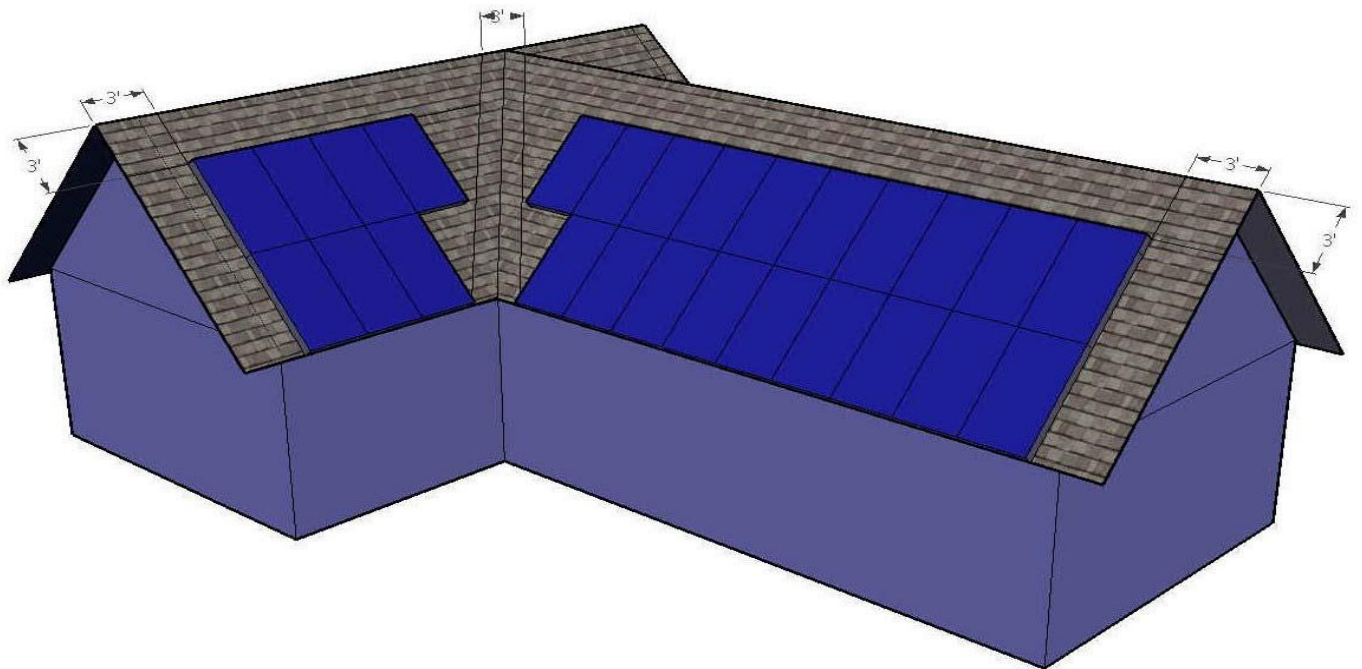
GROUND MOUNTED PHOTOVOLTAIC ARRAYS

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.

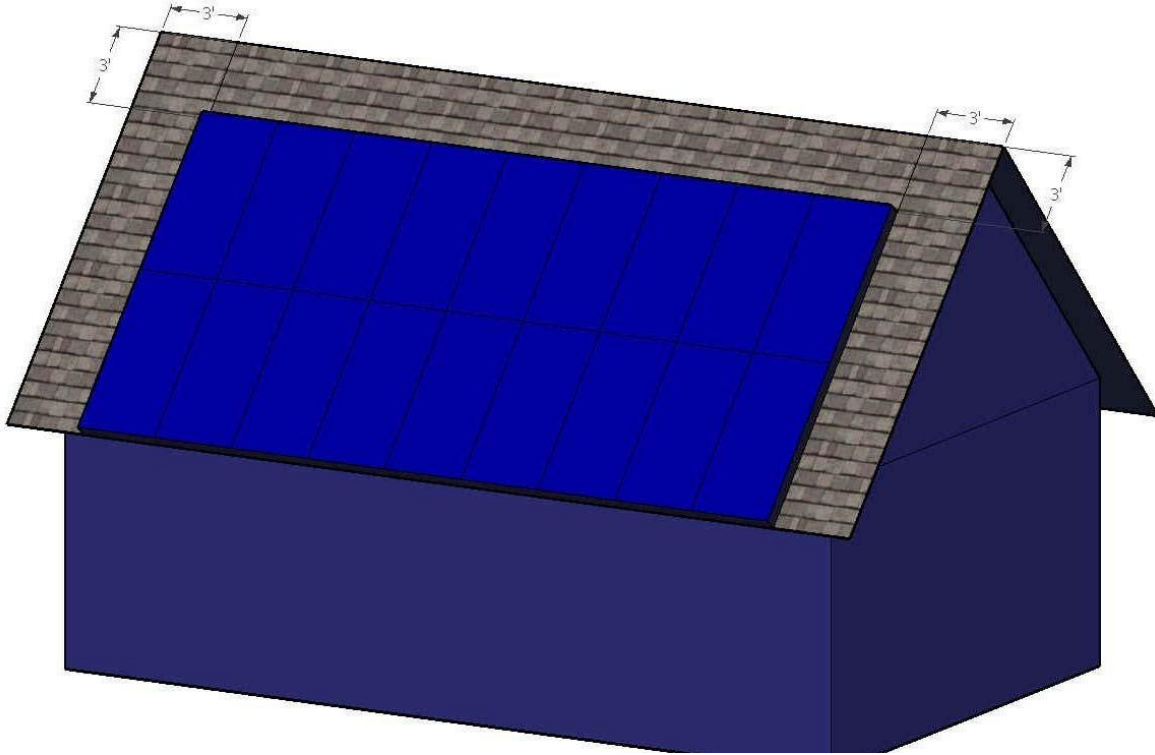
EXAMPLE 1 Cross Gable Roof



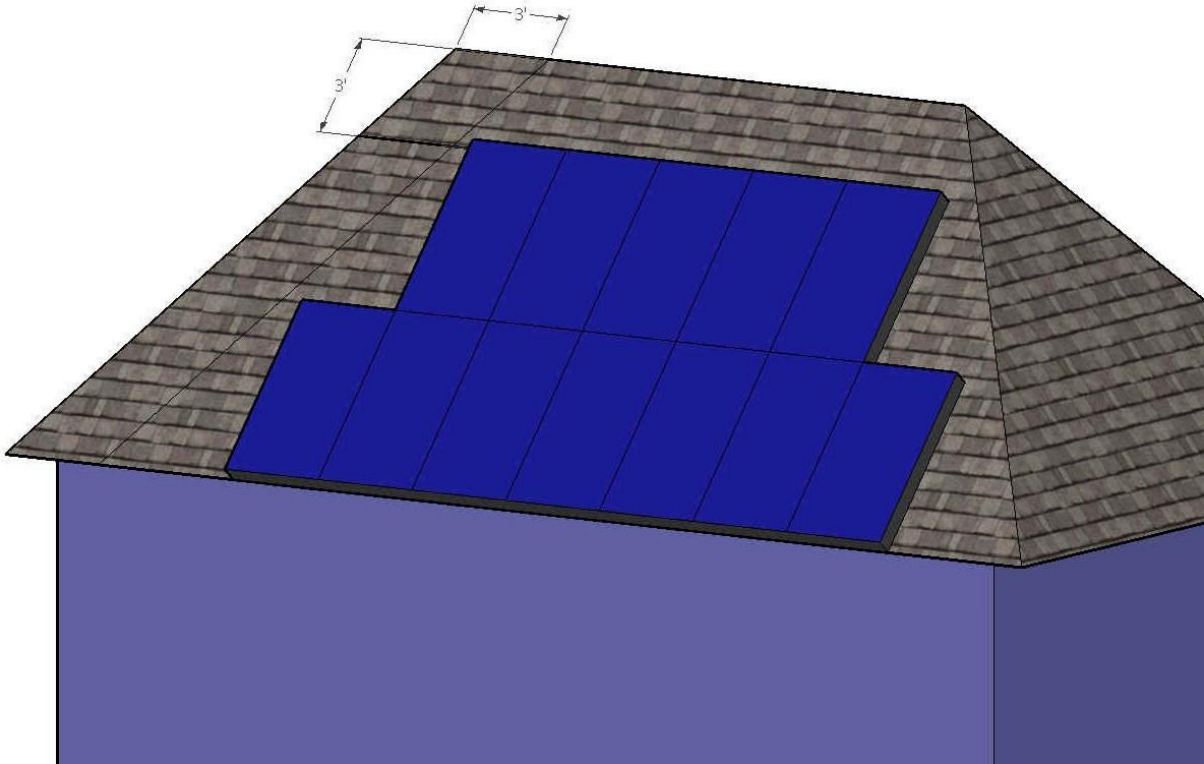
EXAMPLE 2 Cross Gable with Valley



EXAMPLE 3: Full Gable

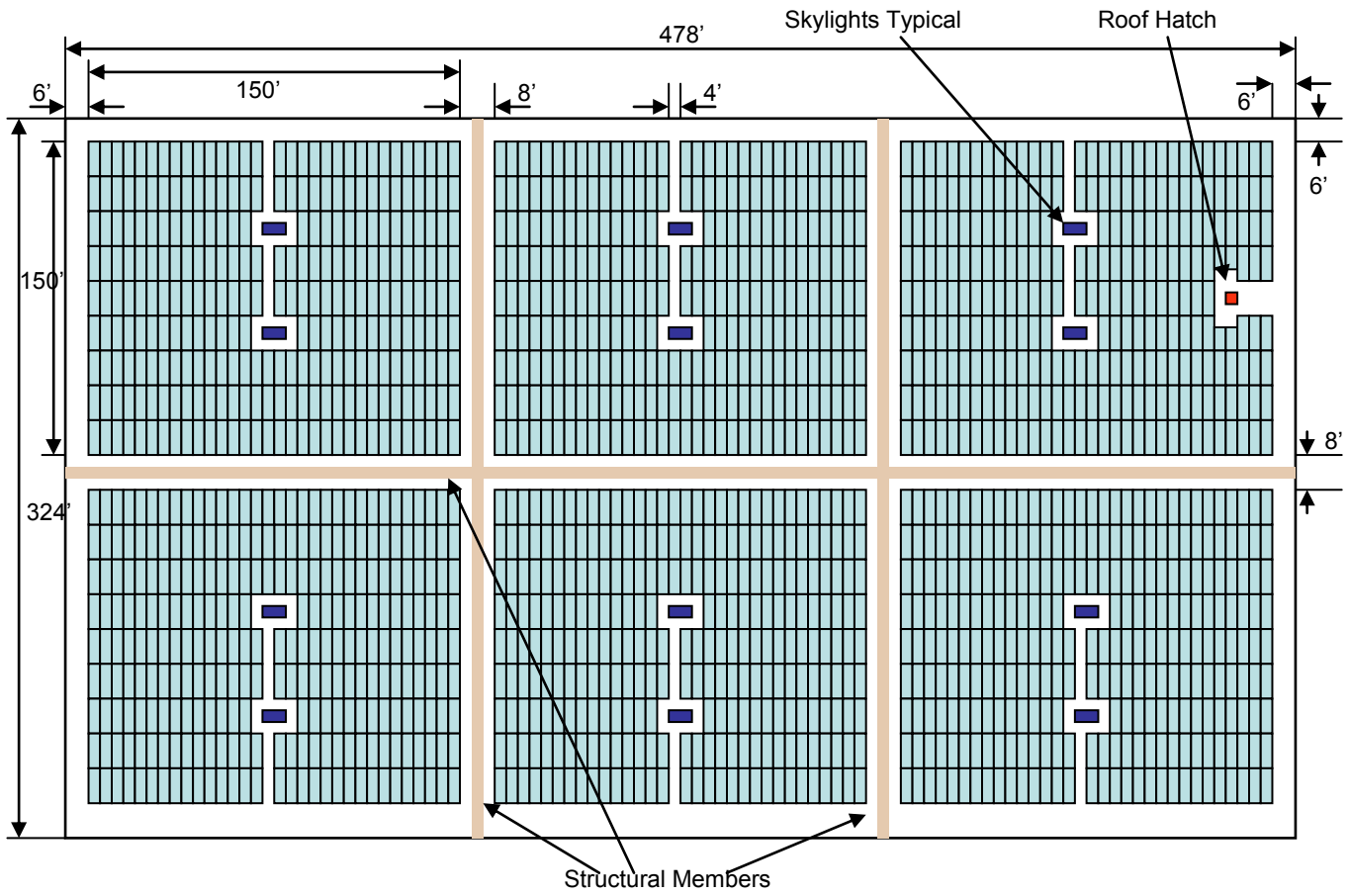


Example 4: Full Hip Roof



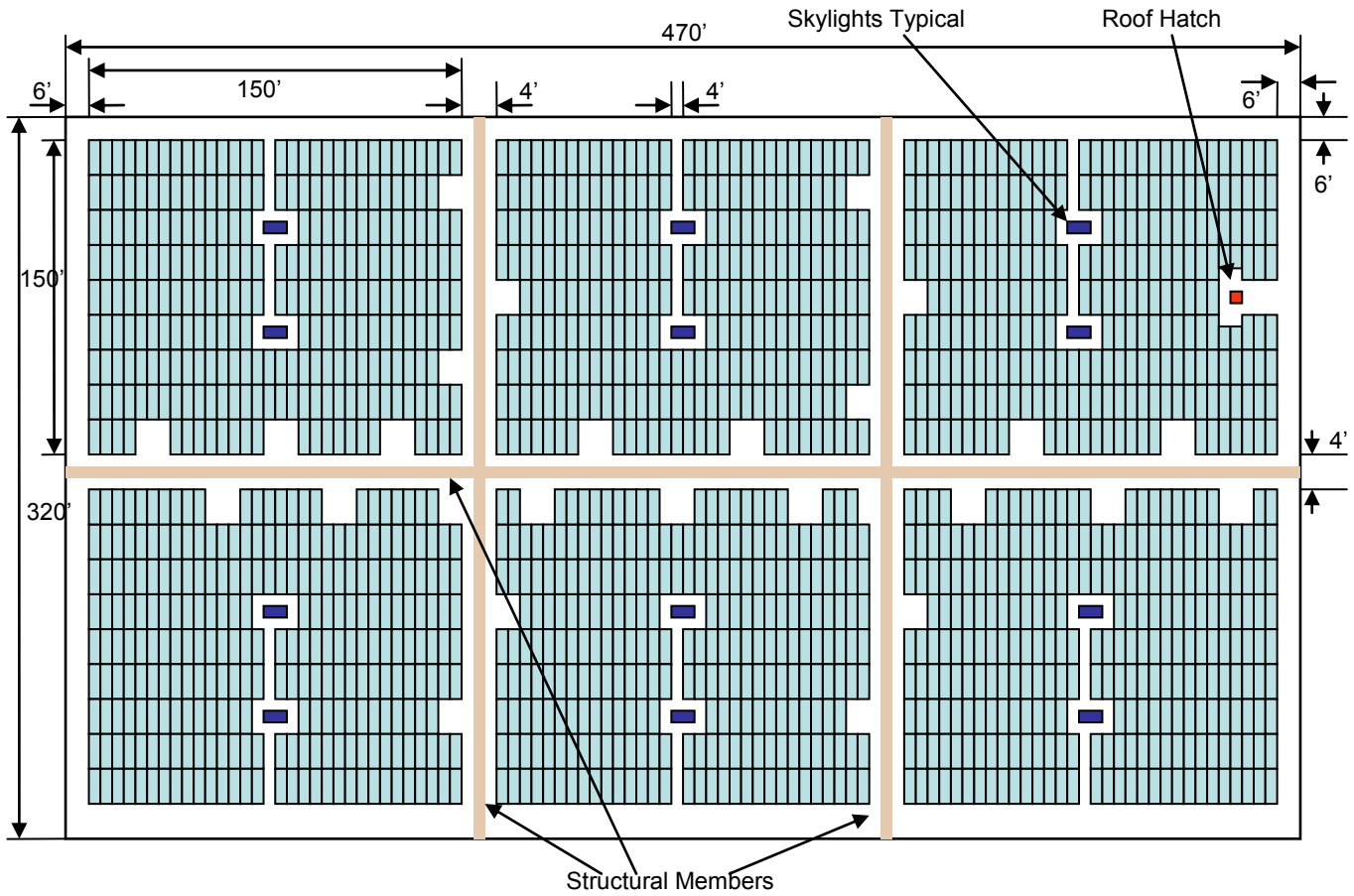
EXAMPLE 5 – Large Commercial (Axis > 250')

8' Walkways

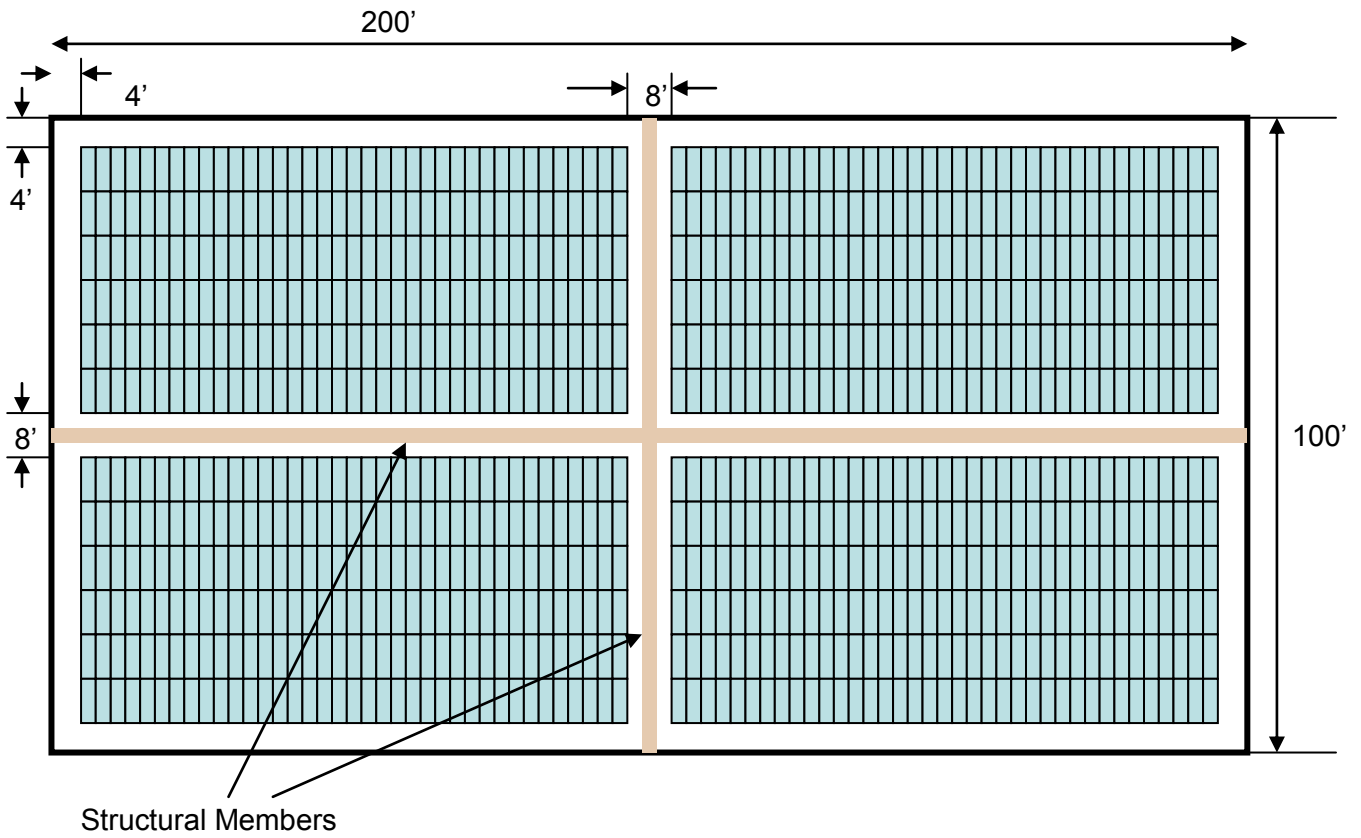


EXAMPLE 6 –Large Commercial (Axis > 250') 4' Walkways

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

