IREC Interstate Renewable Energy Council

Understanding the Cal Fire Solar Photovoltaic Installation Guideline

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CALIFORNIA DEPARTMENT of FORESTRY and FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL

SOLAR PHOTOVOLTAIC INSTALLATION GUIDELINE

(In partnership with interested local fire officials, building officials, and industry representatives)

Presentation Overview

- Brief Overview of History of PV Firefighter Issues
- State Fire Marshal/CalSEIA Guideline Process
- Specifics of the Guidelines
  - What is not included and why
  - What is included and why
- National regulation coming in 2012
- Questions??

Brief Overview of History of PV Firefighter Issues

History Lesson

- Firefighter concerns are not new, but the level of awareness has greatly increased recently.
- In 1998, fire officials in Northern California suggested a variety of very stringent regulations for PV systems. Largely ignored and the issues went away (for a period of time)
- CalSEIA (California Solar Industries Association) and SMUD (Sacramento Municipal Utilities District) developed training materials for fire fighters in 2006.
- These training materials raised awareness among fire districts in California and elsewhere.
- LA Fire Department began strictly enforcing a document that was developed in 1999. They also added new requirements to the document.

The LA PV Installation Guidelines

- The LA Guidelines began to be more strictly enforced in the spring of 2007 after the fire department updated the document.
- Previous guidelines were only used for commercial PV systems—now being applied to residential.
- Main concerns related to language referring to:
  - 1) 4’ perimeter around arrays
  - 2) 50’x50’ maximum array sizes
  - 3) Reference to quick-release mounting hardware

How the State Guideline Process Started

- Many installation permits began being held up due to concerns over compliance with LA guidelines.
- Solar industry began voicing concerns to CalSEIA and the state fire marshal about delays.
- State Fire Marshal convened first meeting on August 17, 2007—approximately 20 participants—roughly half fire officials and half solar representatives.

Fire Service Contributors

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- Jim Hone, Santa Monica Fire Department
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- Wes Kitchel, Santa Rosa Fire Department
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Solar and "other" Contributors

CalSEIA

- Sue Kateley, CalSEIA
- Gary Gerber, Sun Light & Power
- Edgar Becerra, Sharp Solar
- Colin Murchie, SunEdison
- John Hostetter, REC Solar, Inc.
- Mark Mrohs, Kurt Johnson, Gary Neate, Dylan Anderson, and Carl Lenox, SunPower
- Peter Rive, SolarCity
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Additional Participants

- Bill Brooks, Brooks Engineering
- John Taeker, Underwriters Laboratories

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Introduction to Fire Marshal Guidelines (4/22/08 FINAL DRAFT)

- "This guideline was developed with safety as the principal objective. The solar photovoltaic industry has been presented with certain limitations in roof installations due to firefighting suppression techniques. The intent of this guideline is to provide the solar photovoltaic industry with information that will allow it to design, build, and install solar photovoltaic systems in a manner that meets the objectives of both the solar photovoltaic industry and the Fire Service."

1.0 MARKING (IFC 605.11.1)

- *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 modules to the inverter, as these should not be cut when venting for smoke removal.*
- *Materials used for marking should be weather resistant. Use UL 969 as standard to weather rating (UL listing of markings is not required).*

- *Vinyl signs would need to meet UL969 requirements while plastic and metal engraved signs do not need to meet the UL standard.*

Examples of Plastic Engraved and Vinyl Signs

1.1 Main Service Disconnect (IFC 605.11.1.3)

- *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 should be placed adjacent to the main service disconnect in a location clearly visible from the location where the lever is operated.*

- *Adhesive-fastened signs may be acceptable if properly adhered.*
- *Jurisdictions that require mechanical fastened signs may necessitate mounting signs adjacent to equipment.*

Summary of Fire Marshal Guidelines

- MARKING (IFC 605.11.1 and 605.11.1.4)
  - Main Service Disconnect

CAUTION: SOLAR ELECTRIC SYSTEM

  - dc conduit, raceways, enclosures, cable assemblies, and junction boxes. Every 10’, at every turn, above/below penetrations, and all dc combiner and junction boxes.

CAUTION SOLAR CIRCUIT

Sign Requirements

- MARKING CONTENT: CAUTION SOLAR CIRCUIT (NEC® and IFC uses “Warning: Photovoltaic Power Source)”
- RED BACKGROUND,
- WHITE LETTERING,
- MINIMUM 3/8” LETTER HEIGHT,
- ALL CAPITAL LETTERS,
- ARIAL OR SIMILAR FONT, NON-BOLD,
- REFLECTIVE, WEATHER RESISTANT MATERIAL (durable adhesive materials meet this requirement)

FRONIUS IG
FRONIUS IG

Karbex

2.0 ACCESS, PATHWAYS AND SMOKE VENTILATION (IFC 605.11.3)

- Section 2.0 relates to fire departments that engage in vertical ventilation operations.
- Some departments are beginning to limit vertical ventilation for lightweight construction.
- Other buildings already have automatic roof vents making roof access unnecessary.
- Metal and concrete decked buildings are rarely trenched, so access to vents and skylights is all that may be necessary.

Purpose of Section 2.0

Access and spacing requirements should be observed in order to:

- *Ensure access to the roof*
- *Provide pathways to specific areas of the roof*
- *Provide for smoke ventilation opportunities area*
- *Provide emergency egress from the roof*

Exceptions to Section 2.0

Local jurisdictions may create exceptions to this requirement where access, pathway or ventilation requirements are reduced due to:

- *Proximity and type of adjacent exposures*
- *Alternative access opportunities (as from adjoining roofs)*
- *Ground level access to the roof area in question*

Exceptions to Section 2.0 (cont.)

- *Adequate ventilation opportunities beneath solar array (as with significantly elevated or widely-spaced arrays)*
- *Adequate ventilation opportunities afforded by module set back from other rooftop equipment (shading or structural constraints may leave significant areas open for ventilation near HVAC equipment, for example.)*
- *Automatic ventilation device.*
- *New technology, methods, or other innovations that ensure adequate fire department access, pathways and ventilation opportunities.*

Roof Ventilation—Residential Roof Layouts Ventilation (IFC 605.11.3.2.4)

- 3’ space along ridge of roof
  - Ridge setback based on enough room to make 2’ wide ventilation cut.
  - ASCE 7, Minimum Design Loads for Buildings, requires this setback in high wind locations (e.g. eastern seaboard)
- No rooftop disconnect requirement. (see appendix)
- Each roof face treated independently.
- PV array and wiring is off limits to fire fighters.

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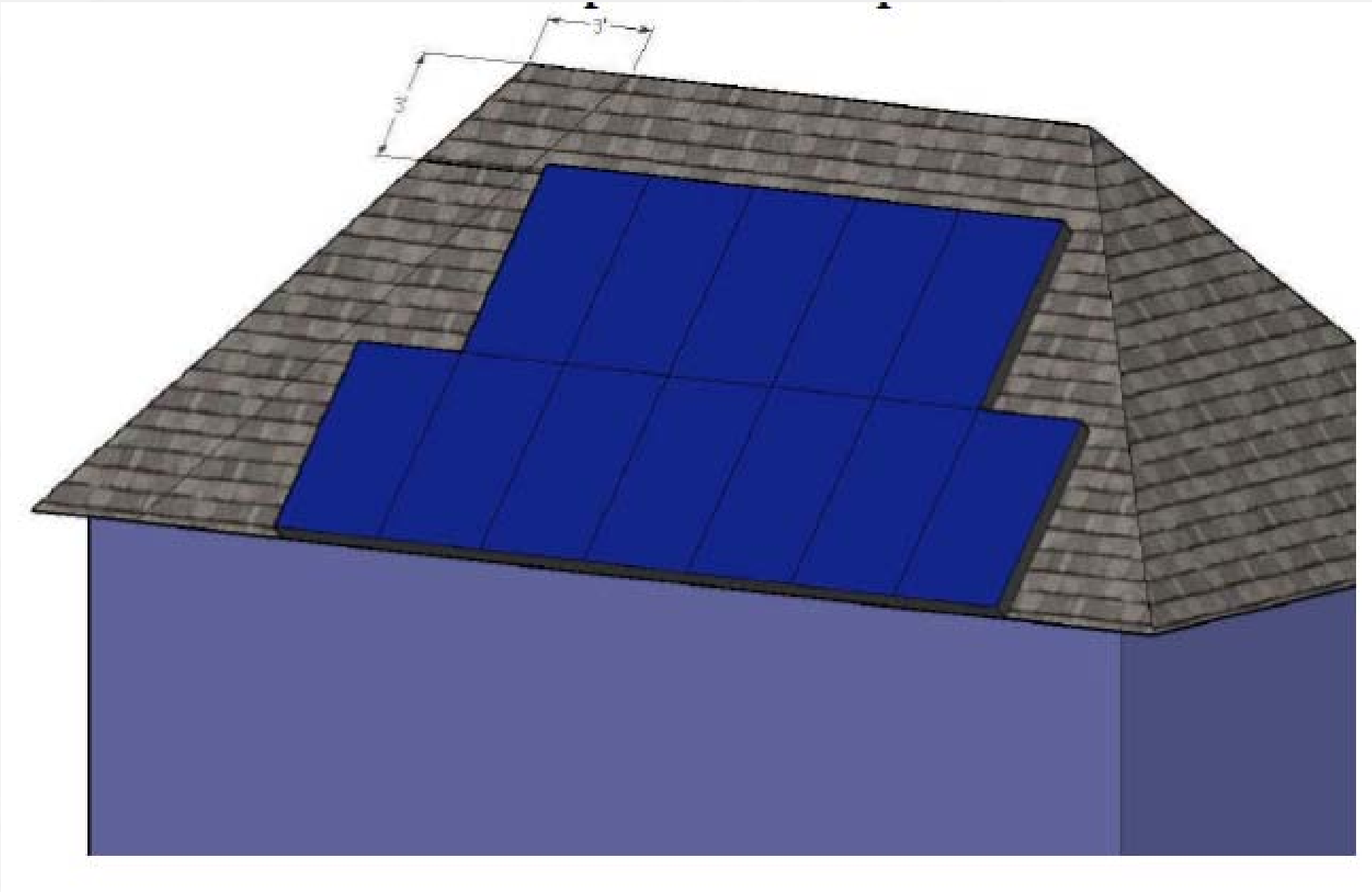
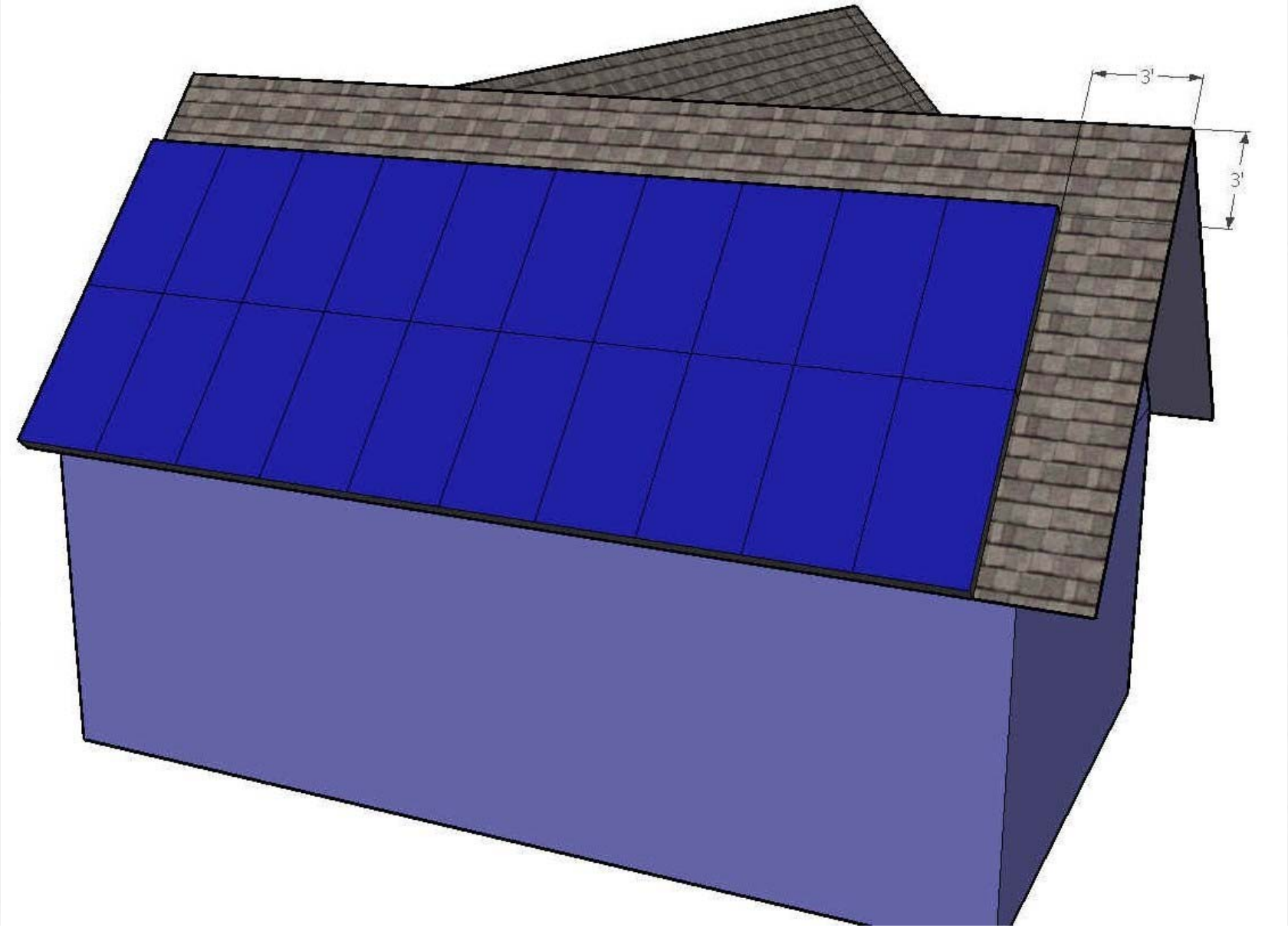
Roof Access—Residential Hip Roof Layouts (IFC 605.11.3.2.1)

- Single hip needs one 3’ pathway on array faces.
- Pathway should be along a structurally strong location such as a load bearing wall.
- IFC adds a statement that ladder locations cannot be in front of windows or doors and cannot conflict with tree limbs, wires, or signs.

Full Hip



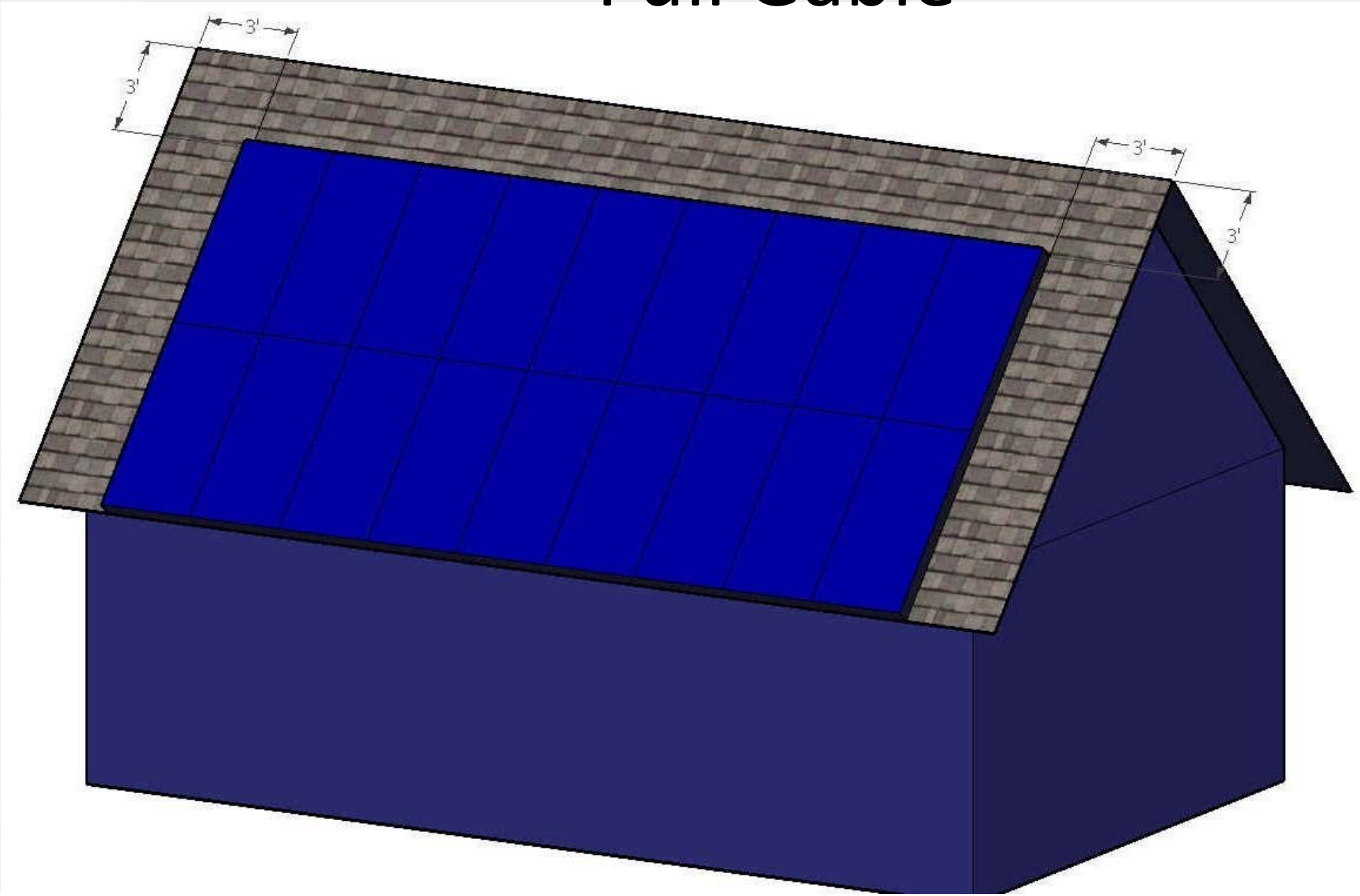
Cross Gable Roof



Roof Access—Residential with Single Ridge (IFC 605.11.3.2.2)

- Single ridge needs two 3’ pathways on array faces along edge of load bearing exterior wall.

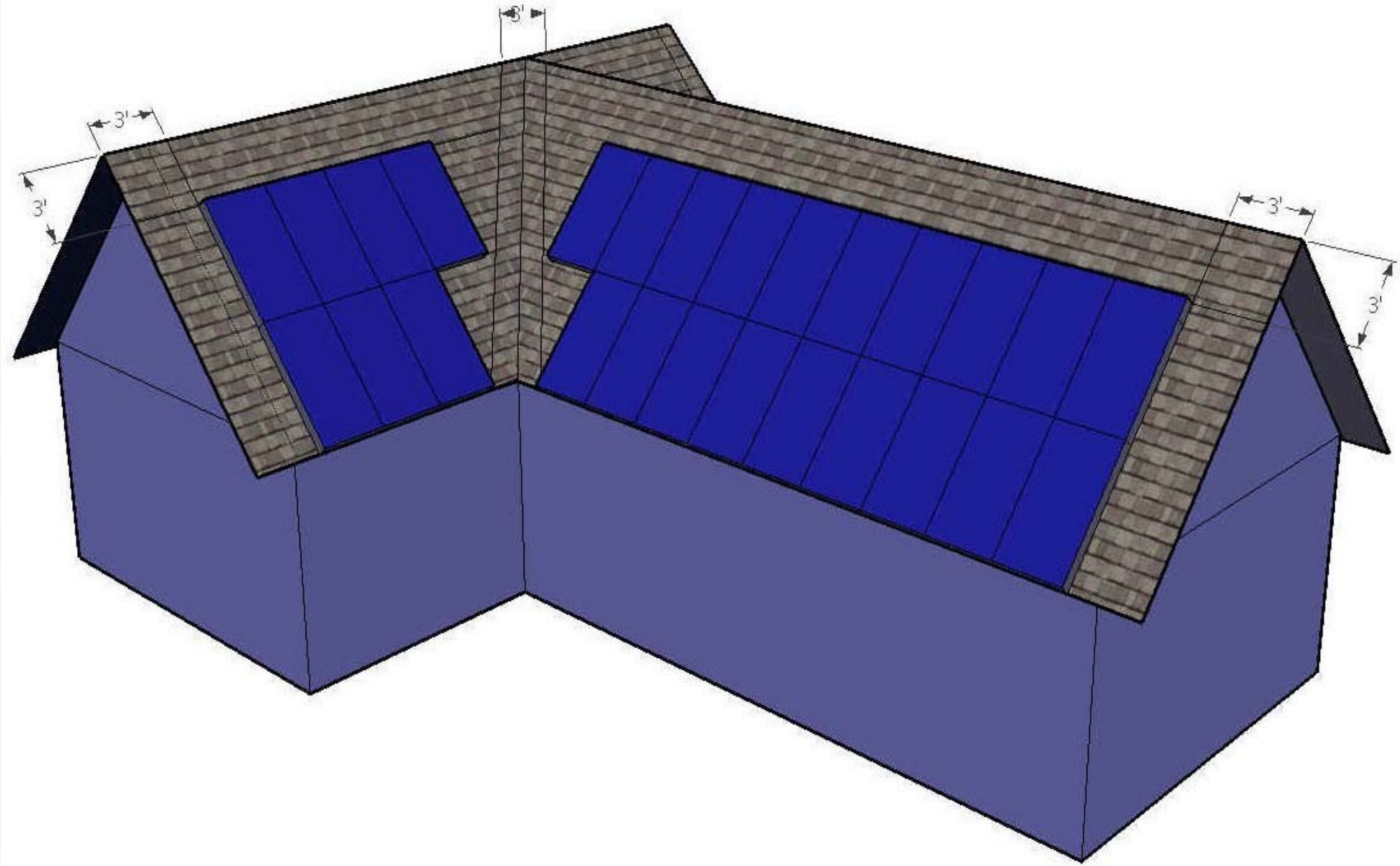
Full Gable



Roof Access—Residential Hips and Valleys (IFC 605.11.3.2.3)

- 1.5’ space on either side of a hip or valley.
- PV array can go to the center of the hip or valley if the hip or valley is of equal length on adjacent faces and no modules are on the adjacent face.

Cross Gable with Valley



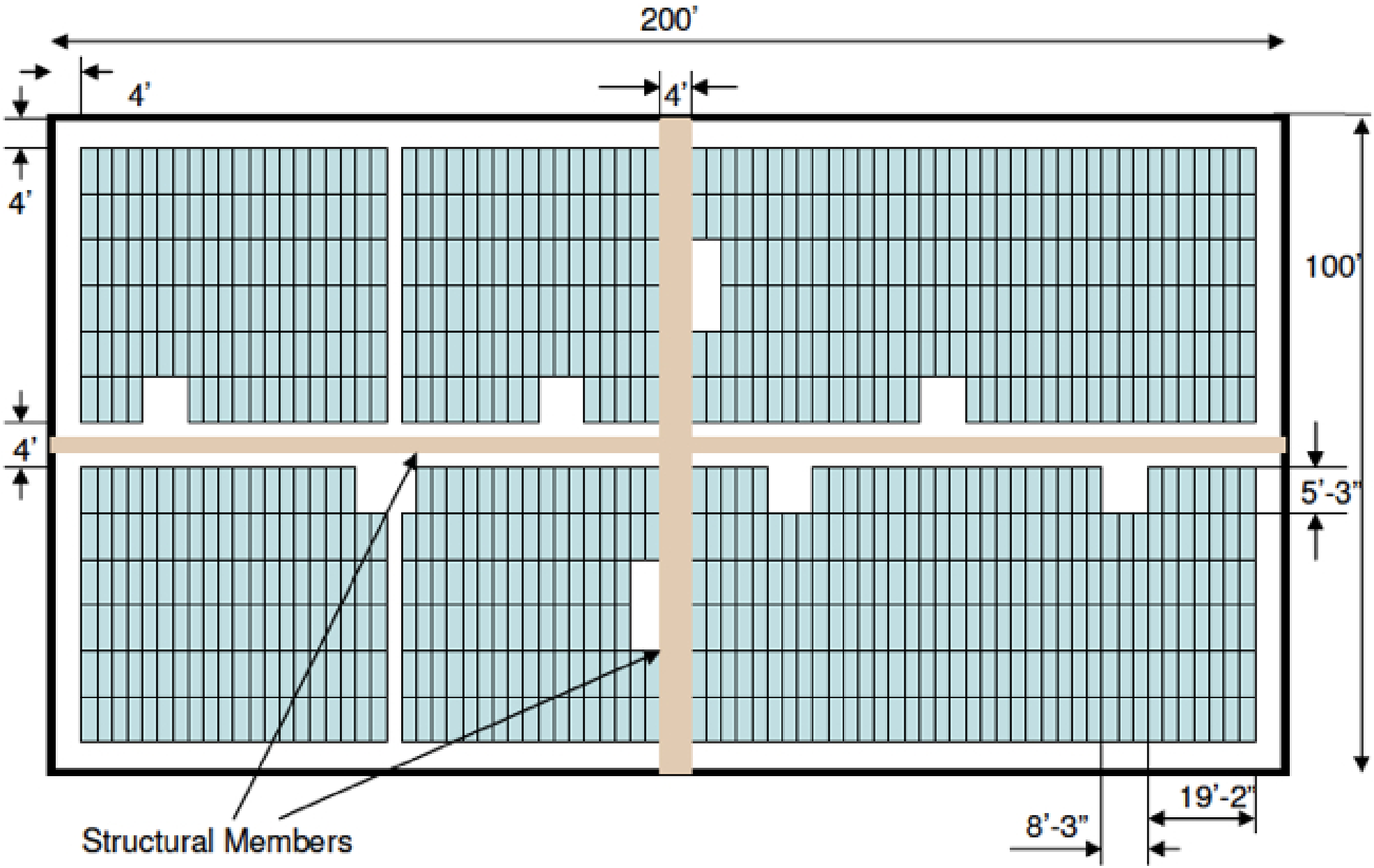
Access—Commercial (IFC 605.11.3.3.1)

- Commercial flat roof with no roof dimension more than 250 feet—4’ space around perimeter wall.
- Commercial flat roof with a roof dimension more than 250 feet—6’ space around perimeter wall.
- No rooftop disconnect requirement for fire fighters.

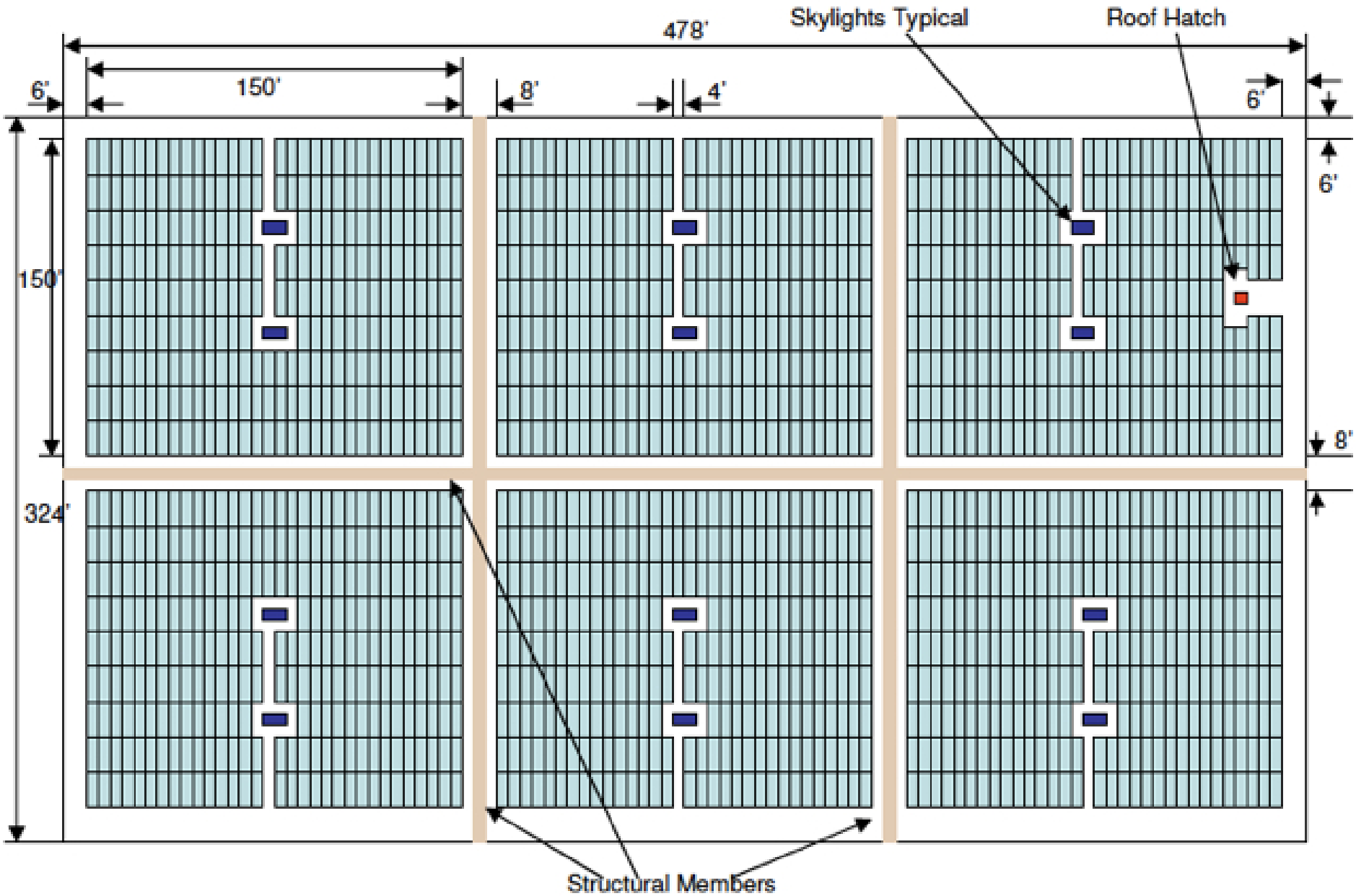
Pathways and Ventilation—Commercial (IFC 605.11.3.3.2 & 605.11.3.3.3)

- Minimum 4’ pathway on center access of building in both directions. A 4’ access to skylights, roof hatches, and fire standpipes shall be provided to the perimeter wall.
- Commercial rooftop arrays shall be no greater than 150 by 150 feet in distance in either axis.
- Array off limits to fire fighters.

Commercial < 250’

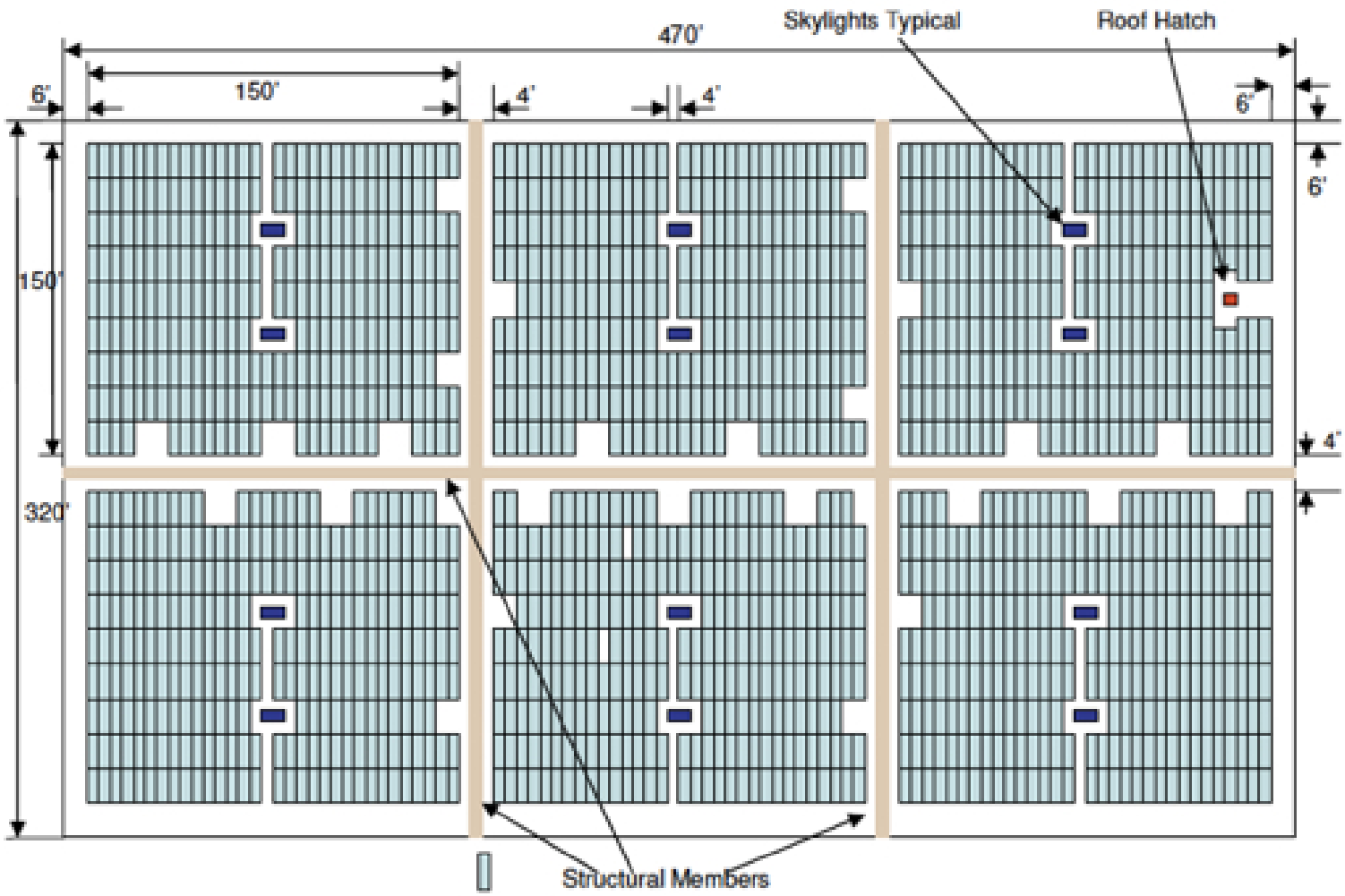


Commercial > 250’



Commercial > 250’

Vent openings every 20’



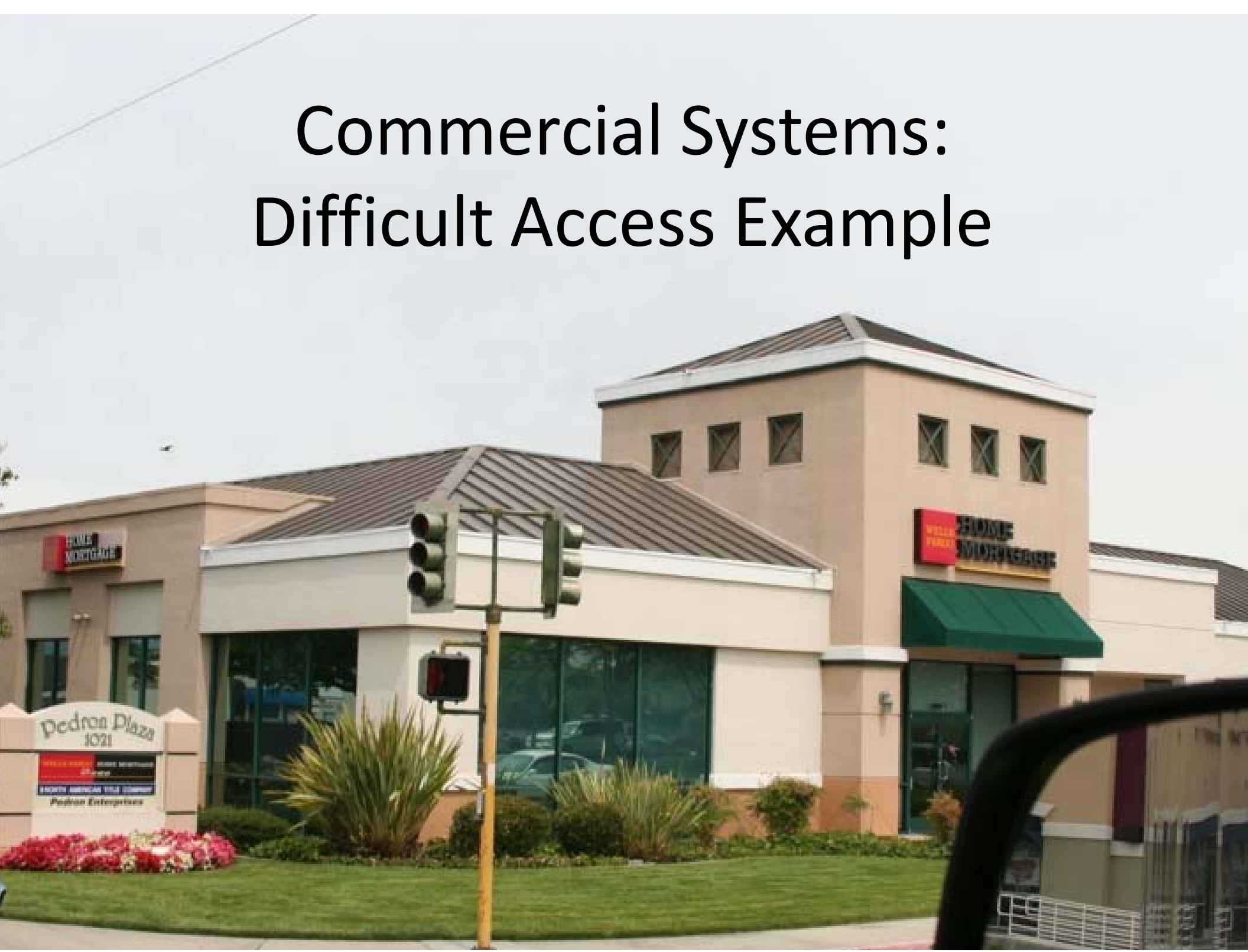
LOCATION OF DC CONDUCTORS (IFC 605.11.2)

- Conduit, wiring systems, and raceways for photovoltaic circuits should 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.
- The DC combiner boxes are to be located such that conduit runs are minimized in the pathways between arrays.

LOCATION OF DC CONDUCTORS (IFC 605.11.2)

- To limit the hazard of cutting live conduit in venting operations, DC wiring should be run in metallic conduit or raceways when located within enclosed spaces in a building and should be run, to the maximum extent possible, along the bottom of load-bearing members.
  - Intent is to stay away from common ventilation locations near ridge. Staying under load-bearing members minimizes likelihood of saws cutting wiring system.

Commercial Systems: Difficult Access Example



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CONCLUSION

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WORK WITH YOUR FIRE DEPARTMENTS

A GOOD RELATIONSHIP WILL HELP BOTH THE PV INDUSTRY AND FIREFIGHTERS