



Wind and Seismic Design for Ballasted Solar Photovoltaic Panel Systems

Direction for engineers regarding the seismic and wind design requirements for ballasted photovoltaic panel systems.

CODE REFERENCE

2022 California Building Code (CBC), ASCE 7-16, (GUIDANCE) SEAOC PV1-2012 & PV2-2017

BACKGROUND

PV panels in a ballasted system are typically not attached to the roof and rely on their weight and friction to counter the effect of wind and seismic forces. In some cases, ballasted systems are provided with attachment points to increase the friction forces.

The following white paper documents were developed by the Structural Engineering Association of California (SEAOC) in the effort to further clarify with procedure steps while applying the structural building code provisions to solar photovoltaic systems:

1. Seismic structural requirements and commentary for rooftop solar photovoltaic arrays (SEAOC PV1-2012).
2. Wind Design for low-profile solar photovoltaic arrays on flat roofs (Report SEAOC PV2-2017).

Engineers should use ASCE 7-16 for the definitive requirements that are not included in these white paper documents. These documents should not be considered a substitution for ASCE 7 standards.

FINDINGS

A ballasted solar array system can be used on flat roofs without a positive connection when the following requirements are met:

1. The seismic design of ballasted PV arrays shall comply with CBC 1613.3, ASCE 7-16 13.6.12, with guidance of PV1-2012. The displacement can be determined by one of the following procedures:
 - Prescriptive design seismic displacement; or
 - Nonlinear response history analysis; or
 - Shake table testing.
2. The wind design of ballasted PV arrays shall comply with CBC 1510.7.2 Exception, ASCE 7-16 29.4.3 or 31.6, with guidance of PV2-2017. The wind design load can be determined by one of the following procedures:
 - Prescriptive pressure coefficient G_{Crn} ; or
 - Wind tunnel tests.

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3. Post a placard: Permanently affix a durable weather and fade resistant placard on or near the photovoltaic system, visible from all sides of roof location. This may require placards in multiple locations. The placard shall state in letters with a minimum letter height of 5/8 inch the following:

WARNING
THIS IS A BALLASTED PHOTOVOLTAIC PANEL SYSTEM.
DO NOT REMOVE / RELOCATE ANY ARRAYS AND/OR
BALLASTS (specify ballast type). ANY CHANGES TO THE PV SYSTEM,
ROOFING MATERIAL, ROOF STRUCTURE AND OTHER ALTERATIONS
SHALL BE MADE WITH ALL REQUIRED BUILDING AND ELECTRICAL PERMITS.
DO NOT REMOVE THIS PLACARD

4. Signage or roof markings (e.g. yellow stripes) shall be provided delineating the area around the panel must be kept free of obstructions. Identify on roof plan.

For questions or comments about any of the above items please contact your Plan Review Engineer and see [Bulletin #274: Ballasted Photovoltaic System on Flat-Roof Low-Rise Building](#) for all other requirements.