STATE OF HAWAII CODE AMENDMENT PROPOSAL

FORM FOR PUBLIC PROPOSALS TO AMEND THE HAWAII STATE BUILDING CODES

(Form Version 1.0 May 2010)

1)

Name: Gary Chock		**Date: December 13, 2010**	
Department/Company: State Building Code Council RepresentatIO			
Submitted on Behalf of: Structural Engineers Association of Hawaii			
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2) Indicate appropriate Model Code(s) and Sections to be amended in Hawaii by this Proposal – _____

CODE AMENDMENT PROPOSAL INSTRUCTIONS

Please provide all of the following items in your code change proposal.

REQUIRED INFORMATION:

The following items are required to be included in your proposal:

1. The proponent shall clearly state the purpose of the proposed code amendment (e.g., clarify the Code; revise outdated material; substitute new or revised material for current provision of the Code; add new Hawaii requirements to the adopted Code; delete current requirements, etc.). Any proposed revisions or additions to tables or figures must be included.

2. The proponent shall justify amending the current code provisions, stating why the proposal is superior to the current provisions of the Model Code. Proposals that add or delete requirements shall be supported by a logical explanation which clearly shows why the current Code provisions are inadequate or overly restrictive, specifies the shortcomings of the current Code provisions in Hawaii, and explains how such proposals will improve the Hawaii State Code.

3. The proponent shall substantiate the proposed code change based on technical information and substantiation. Substantiation provided which is determined as not germane to the technical issues addressed in the proposed code change shall be identified as such, and the proponent shall be notified that the proposal is considered an incomplete proposal and may be held until the deficiencies are corrected.

4. The proponent shall submit a bibliography of any substantiating material submitted with the code change proposal. The proponent shall make the substantiating materials available for review.

5. Per Hawaii Revised Statutes §107-26, the State Building Code Council shall not adopt provisions that relate to administrative, permitting, or enforcement and inspection procedures of each county. Any such code amendments shall be proposed instead to the individual county building officials during the code adoption process of each county.

PROPOSAL FORMATTING:

Show the proposal (see form on page 2) using ~~strikeout~~, underline format. At the beginning of each section, one of the following instruction lines are also needed:

- •Revise as follows
- •Add new text as follows
- •Delete and substitute as follows
- •Delete without substitution

The only formatting that is needed is **BOLDING,** ~~STRIKEOUT~~ AND UNDERLINING. Please do not provide additional formatting such as tabs, columns etc. DO NOT USE THE TRACKING CHANGES OPTION, AUTOMATIC NUMBERING, OR ANY OTHER ADVANCED FORMATTING TOOLS PROVIDED BY WORD.

This Section For Official Use Only

Date Considered by Building Official Sub-Committee: _____

Sub-Committee Action on Proposal: _____

Reason for Sub-Committee Action: _____

Action by State Building Code Council: _____

Date: _____

HAWAII CODE AMENDMENT PROPOSAL FORM

(See instructions on page 1)

Model Code: _____IBC 09_*(IBC-09, IEBC, IECC, UFC, IMC,UPC, IRC, etc)*

Code Sections/Tables/Figures/Standard Proposed for Revision; *If the proposal is for a new section, indicate proposed section #.*

_____ (new) Appendix W103 Section 1609.5.4_____

Proponent: ***Name/Company/Representing:*** *(DO NOT USE ACRONYMS FOR YOUR COMPANY OR ORGANIZATIONAL NAME)*

_____ Gary Chock / Structural Engineers Association of Hawaii _____

Revise as follows (include deletion in strikeout, with modified text/proposed addition underlined, affected Code Section(s) in Bold):

Appendix W103 Addition of Rooftop Mounted Panels for Buildings with h ≤ 60 ft (18.3 m).
Section 1609.5.4 is added to read as follows:

1609.5.4 ROOF-MOUNTED PANELS FOR BUILDINGS WITH h ≤ 60 ft (18.3 m)

The design wind force for roof-mounted panels located on buildings with a mean roof height h ≤ 60 ft (18.3 m)) shall be determined based on the location and height of the panel system and the configuration of the roof, in accordance with this section.

1609.5.4.1.1 The normal force on panels not located on a roof overhang nor in roof Zones 2 or 3 and mounted flush or within 6 inches of the roof surface shall be determined using the Components and Cladding external pressure given in ASCE 7-05 for the corresponding location on the roof, multiplied by the total area of an individual panel element, by the following equation:

$$F = q_h(GC_p)A \quad \text{(lb) (N)} \qquad \text{(1609.5.4.1-1)}$$

GC_p shall be taken as the component and cladding external pressure coefficient for roofs for the roof zone corresponding to the location of the solar panel, and the effective wind area shall be that of the solar panel. The minimum magnitude of negative pressure values of GC_p in Zone 1 shall be taken as -1.0.

A shall be the total area of the solar panel element

The force F shall be permitted to be applied to the centroid of the calculated pressure.
1609.5.4.1.2 The load on the panel need not be added to the resultant of the pressure determined per ASCE 7-05 acting on the portion of the roof underlying the panel. The roof shall be subject to Component and Cladding wind loads assuming that the roof-mounted panels are absent.

1609.5.4.2.1 The normal force on all other panel locations and configurations shall be determined by the following equation:

$$F=q_h(GC_p)C_N A \quad \text{(lb) (N)} \qquad \text{(1609.5.4.2-1)}$$

where

C_N = pressure coefficients for monoslope free roofs from ASCE 7 considering each elevated panel as a free roof surface in clear wind flow. The angle θ used for the determination of C_N shall be measured as the angle of the panel with respect to the plane of the roof. Values of C_N for forces on the panel may be taken as the Zone 1 coefficients, except Zone 2 coefficients for C_N shall be used where panels of angle θ > 7.5° are located within *2h (2 x roof height) of a roof corner with a parapet taller than 24 inches.*

GC_p shall be taken as the component and cladding external pressure coefficient for roofs for the roof zone corresponding to the location of the solar panel, and the effective wind

area shall be that of the solar panel. The minimum magnitude of negative pressure values of GC_p in Zone 1 shall be taken as -1.0.

A shall be the total area of the solar panel element

When located in roof zone 2 or 3 as defined in ASCE 7, the force F shall be applied with an eccentricity equal to a third of the solar panel width.
1609.5.4.2.2 The load on the panel shall be applied as point load anchorage reactions additive to the resultant of the pressure determined per ASCE 7 acting on the portion of the roof underlying the panel.

1609.5.4.3.1 No reduction of load on the panels shall be taken for permeability of the panel system unless demonstrated by approved wind-tunnel testing or recognized literature for the type of panel system being considered, replicating the panel separation spacing and height above the roof.

1609.5.4.4.1 No reduction of load on the panels shall be taken for shielding provided by the roof, or given by obstruction to, the panel system unless demonstrated by approved wind-tunnel testing or recognized literature for the type of panel system being considered, replicating the panel separation spacing and height above the roof.

1609.5.4.5.1 Ballasted panels that are tilted at an angle α of 10 degrees or more from a horizontal plane shall each be ballasted to resist a force determined by the following equation:

$$F_{ballast} \geq F\left(\frac{\mu\cos\beta + \sin\beta}{\mu\cos\alpha - \sin\alpha}\right) \qquad \textbf{(lb) (N)} \qquad \textbf{(1609.5.4.5.1)}$$

where

F = the normal force on each panel determined by equations 1609.5.4.1-1 or 1609.5.4.2-1
α = the angle of the roof plane with respect to horizontal
β = the angle of tilt of the panel with respect to the roof plane
μ = the static friction coefficient between the panel base and its bearing surface

Reason:
HRS Chapter 196 Section 6.5, part of the Hawaii Clean Energy Initiative, requires that on or after January 1, 2010, no building permit shall be issued for a new single-family dwelling that does not include a solar water heater system. Significant numbers of solar panels are being installed on other types of commercial and institutional buildings as well. While Hawaii is setting a new precedent for energy-efficient home construction, the wind loads on roof-mounted solar panels are not specifically addressed in the current International Building Code. To resolve this ambiguity in order to mitigate against property damage due to solar panel windborne debris, the Structural Engineers Association of Hawaii has developed conservative load provisions generically based on wind-tunnel studies in collaboration with the author of the cited reference who has conducted numerous studies of rooftop solar panel systems over the past decade. The proposed Section 1609.5.4 on determining wind loads on roof-mounted panels would editorially be located in IBC 2009 section 1609.5 Roof Systems.

List of Supporting Information References (attached):
Banks, D., et al, Flow visualization of conical vortices on flat roofs with simultaneous surface pressure measurement, Journal of Wind Engineering and Industrial Aerodynamics, Vol. 84 (2000).

Proposals must be submitted using this form and are to be submitted electronically to Kerry Yoneshige, kerry.k.yoneshige@hawaii.gov Department of Accounting & General Services, Administrative Services Office, 1151 Punchbowl Street, Room 414, Honolulu, Hawaii 96813