

SCREEN ENCLOSURES WORKGROUP
REPORT TO THE FLORIDA BUILDING
COMMISSION



APRIL 3, 2012—MEETING I

GAINESVILLE, FLORIDA

FACILITATION, MEETING AND PROCESS DESIGN BY



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FLORIDA BUILDING COMMISSION
SCREEN ENCLOSURES WORKGROUP

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FLORIDA BUILDING COMMISSION

SCREEN ENCLOSURES WORKGROUP

OVERVIEW

Dick Browdy, Commission Chair, made appointments to the Screen Enclosures Workgroup, and they are listed below by representation. Members are charged with representing their stakeholder group’s interests, and working with other interest groups to develop a consensus package of recommendations for submittal to the Florida Building Commission. The Screen Enclosures Workgroup is tasked by the 2012 Florida Legislature with developing recommendations regarding the Commission’s development of a rule for implementing an alternative design method for screen enclosures which allows for the removal of a section of the screen to accommodate high-wind events consistent with the provisions of the Florida Building Code. The project will be a facilitated consensus-building process consistent with Commission procedures and policies and will conclude with recommendations for screen enclosure Code requirements submitted to the Florida Building Commission for implementation by rule. The Commission shall incorporate the alternative screen enclosure design method requirements into the next version of the Florida Building Code. However, legislation requires the Rule to be effective by January 2, 2012.

WORKGROUP MEMBERSHIP	
MEMBER	REPRESENTATION
Thomas Johnston	Screen Enclosure Manufacturing Industry
Santos Gonzalez	Screen Enclosure Manufacturing Industry
David Johns	Aluminum Contractors Industry
Dale Desjardins	Aluminum Contractors Industry
Jack Glenn	Florida Homebuilders Association
Peter Coccaro	Florida Swimming Pool Association
Jamie Gascon	Building Officials Association of Florida
Larry Carnley	Building Officials Association of Florida
Dan Arlington	Building Officials Association of Florida
Jeffrey Stone	Building Products Industry
Do Kim	Structural Engineer

SCREEN ENCLOSURES WORKGROUP PROJECT CHRONOLOGY	
DATE	ACTIVITY
April 3, 2012	Workgroup Meeting I—Organizational Meeting and Review of Proposed Alternative (On-Site Meeting)
May 16, 2012	Workgroup Meeting II—Review Revised Proposed Alternative (Conference Call)
June 11, 2012	Workgroup Meeting III— Finalize The Criteria for the Proposed Alternative (On-Site Meeting)
August 7, 2012	Rule Development Workshop (On-Site)
October 9, 2012	Rule Development Hearing, If Requested (On-Site)
January 2, 2013	Rule effective date

REPORT OF THE APRIL 3, 2012 MEETING

OPENING AND MEETING ATTENDANCE

Jeff Blair, Commission Facilitator, welcomed participants and opened the meeting at 12:30 PM.

The following ten *Workgroup* members were present:

Dan Arlington, Peter Coccaro, Dale Desjardins, Jamie Gascon, Jack Glenn, Santos Gonzalez, David Johns, Thomas Johnston, Do Kim, and Jeffrey Stone.

Members Absent

Larry Carnley.

Commissioners Present

Dick Browdy and Jim Schock.

DCA Staff Present

Leslie Anderson-Adams, Joe Bigelow, Jim Hammers, Ila Jones, Mo Madani, and Jim Richmond.

Meeting Facilitation

The meeting was facilitated by Jeff Blair from the FCRC Consensus Center at Florida State University. Information at: <http://consensus.fsu.edu/>



PROJECT WEBPAGE

Information on the project, including agenda packets, meeting reports, and related documents may be found in downloadable formats at the project webpage below:

<http://consensus.fsu.edu/FBC/Screen-Enclosures-Workgroup.html>

AGENDA REVIEW AND APPROVAL

The Workgroup voted unanimously, 10 - 0 in favor, to approve the agenda as presented including the following objectives:

- To Approve Regular Procedural Topics (Agenda and Procedural Guidelines)
- To Hear an Overview of Workgroup Charge and Scope
- To Hear an Overview of Proposed Alternative Screen Enclosure Design
- To Discuss Alternative Screen Enclosure Design Requirements Development and Implementation Issues for Evaluation
- To Discuss Subtasks and Identify Information Development Needs
- To Consider Public Comment
- To Identify Needed Next Steps: Information, Assignments, and Agenda Items for Next Meeting

(Attachment III—April 3, 2012 Workgroup Agenda)

REVIEW OF COMMISSION’S SUBCOMMITTEE MEETING GUIDELINES, CONSENSUS-BUILDING AND DECISION-MAKING PROCESS, AND SUNSHINE REQUIREMENTS

Jeff Blair, Commission Facilitator, reviewed the Workgroup’s process, decision-making procedures, and applicability of the Sunshine Law and answered member’s questions. The relevant documents were provided on pages 4 – 7 of the meeting agenda packet.

Sunshine Law Requirements Applicability to Workgroup Members

Jeff Blair explained that Workgroup members are subject to the requirements of Florida's Government in the Sunshine Law, commonly referred to as the Sunshine Law (Section 286.011 F.S.), and may not discuss with each other, outside of properly noticed meetings, issues that may foreseeably come before the Workgroup for discussion.

Following is a summary of key applicable points:

1. Meetings of public councils, advisory groups or commissions must be open to the public;
2. Reasonable notice of such meetings must be given; and
3. Minutes of the meeting must be taken.

Equally applicable to elected and appointed groups (workgroup), the Sunshine Law applies to any gathering of two or more members of the same group to discuss some matter which will foreseeably come before that workgroup for action.

Applies to:

- Written reports circulated among workgroup members for comments.
- Telephone conversations and computer communication.
- Delegation of authority to a single individual.
- Use of nonmembers as liaisons between workgroup members.

REVIEW OF LEGISLATION, PROJECT SCOPE AND TIMELINES

Mo Madani, DBPR Staff, provided members with a PowerPoint presentation titled: “*Screen Enclosures Workgroup*” that reviewed the project scope, and answered questions. Mo explained that the Workgroup was formed in response to 2012 Legislation and the Workgroup’s role is to implement the legislation into rule for inclusion in the Florida Building Code.

Summary of Presentation: “Screen Enclosures Workgroup”:

Legislative Mandate:

- CS for CS for SB 704 Section 19
- The Florida Building Commission shall establish a workgroup to assist the commission in developing a rule for implementing an alternative design method for screen enclosures which allows for the removal of a section of the screen to accommodate high-wind events consistent with the provisions of the Florida Building Code.

The Workgroup:

- (1) The workgroup shall be comprised of the following representatives:
 - (a) Two members who represent the screen enclosure manufacturing industry;
 - (b) Two members who represent the aluminum contractors industry;

- (c) One member who represents the Florida Home Builders Association;
- (d) One member who represents the Florida Swimming Pool Association;
- (e) Three members who represent the Building Officials Association of Florida;
- (f) One member who represents the building products industry; and
- (g) One member who is employed as a structural engineer.

Considerations:

- (2) The workgroup shall address the following factors to be included in the rule:
 - (a) An alternative design method for a screen enclosure that is site-specific engineered;
 - (b) A screen enclosure design using the alternative method that serves as a barrier that is required for a swimming pool and remains in place at the minimum height required for the barrier;
 - (c) a screen enclosure design using clear, highly visible labels for panels that can be cut, retracted, or removed when winds are forecasted to exceed 75 mph;
 - (d) a design for a screen that can be removed, cut, or retracted without the use of a ladder or scaffolding;
 - (e) a requirement that the contractor provide replacement screen at the initial point of sale to repair the screen enclosure for designs that require cutting; and
 - (f) an alternative design for a screen enclosure that requires the contractor to provide notice to the homeowner and the local building department that the homeowner must cut, retract, or remove a panel or panels of the screen enclosure in accordance with engineering or manufacturer's instructions when wind speeds are expected to exceed 75 mph.

Timeline:

- (3) The Florida Building Commission shall appoint no later than 15 days after the effective date of this act to draft a proposed rule. Rulemaking must be initiated pursuant to chapter 120, Florida Statutes, as soon as practicable after appointment of the workgroup. The commission shall file a notice of proposed rule by October 1, 2012.

The Florida Building Code Commission shall file the rule for adoption by January 2, 2013, unless the commission files a letter on or before that date with the Joint Administrative Procedures Committee explaining the reasons for not completing rulemaking. Upon final adoption of the rule, the Florida Building Commission shall incorporate these requirements into the next version of the Florida Building Code.

This section expires upon adoption of the rule and its inclusion in the Florida Building Code.

Section 20. Except as otherwise expressly provided in this act and except for this section, which shall take effect upon the act becoming a law, this act shall take effect July 1, 2012.

(Attachment IV—Enacting Legislation)

ALTERNATIVE SCREEN ENCLOSURE DESIGN PROPOSAL OVERVIEW

Joe Belcher, JDB Code Services, reviewed proposed rule language with members and answered questions. The document was posted (project webpage), linked (Commission agenda) and distributed (e-mail) in advance of the meeting.

(Attachment V—Draft Rule)

(Attachment VI—Demo Cage Layout)

IDENTIFICATION AND DISCUSSION OF ISSUES REGARDING THE PROPOSED ALTERNATIVE SCREEN ENCLOSURE DESIGN

Workgroup members engaged in a general discussion regarding the various sections of the proposed rule draft, and agreed that the best strategy for reviewing the document was for members to provide written proposed revisions to Jeff Blair for inclusion in a worksheet for evaluation at the next meeting (May 16, 2012 by teleconference). Members will be sent a template for providing any proposed revisions on April 4, 2012 and should send the completed templates to Jeff Blair by close of business on Tuesday, April 10, 2012. Send to: jblair@fsu.edu.

Summary of Discussion:

- The proposed design/alternative provision still has to be engineered and signed and sealed.
- The proposed design provides for frame design at 110 mph (section (1) b. of the draft rule).
- The proposed alternative clarifies that rational engineering analysis including 3D and Finite Element Method engineering are acceptable design methods for screen enclosures (section (1) d. of the draft rule).
- There is a misconception regarding the applicable engineering design method for screen enclosures.
- Local enforcement already covers acceptable design engineering.
- Recommend combining sections (1) c. and d. to further clarify the list of design methods to use for screen enclosures.
- The majority of the proposed alternate design specifications are as mandated by Law.
- The removal of screens is not allowed under the Code due to the fact that screens are part of the structure.
- Wind loads as per the 2010 FBC are lower than wind loads from the 2007 FBC. This means that the load design for screen enclosures will see a reduction in the wind load of up to 20%.
- A considerable amount of screen would need to be cut to satisfy the alternate design provisions.
- Even with a 10' height, upper parts of the screen could not be removed without the use of a ladder and that is prohibited by the Law (section 5 of the draft rule).
- There needs to be a maintenance agreement to ensure the removed screed is replaced/repared.
- Who would be responsible if the screen is not removed.
- Just like shutters it is the homeowner's responsibility to remove the screens.
- There needs to be education so homeowners with screen enclosures designed using the alternative screen enclosures design know that removing the screens is part of their responsibility in preparing for a potential high wind event.

DISCUSSION OF PROJECT SUBTASKS AND IDENTIFICATION OF INFORMATION DEVELOPMENT NEEDS

Jeff Blair asked members if there are any documents and/or information they would like to share with the Workgroup to send them to him for distribution and posting to the project webpage. Members were asked if there was any information they needed, and no member indicated this was the case.

GENERAL PUBLIC COMMENT

Members of the public were invited to provide the Workgroup with comments. Members of the public were also provided opportunities to speak on each of the substantive discussion issues before the Workgroup.

- Paul Martin: discussed the failure of aluminum structures. He provided a written comment to members, the text of which is included in this Report as “*Attachment VP*”.

(Attachment VII—Submitted Public Comment)

NEXT STEPS

Workgroup members should send Jeff Blair their specific comments regarding the draft rule (presented by Joe Belcher and included as “*Attachment V*” of this Report) by Tuesday, April 10, 2012 COB (close of business). In addition, if there are any documents members would like shared with the Workgroup they should also send them to Jeff Blair for distribution (jblair@fsu.edu). The next meeting is scheduled by teleconference for May 16, 2012 and an agenda will be posted and distributed well in advance of the meeting.

ADJOURN

The Workgroup voted unanimously, 10 - 0 in favor, to adjourn at 2:00 PM.

ATTACHMENT I
MEETING EVALUATION RESULTS

APRIL 3, 2012—GAINESVILLE, FLORIDA

Average rank using a 0 to 10 scale, where 0 means totally disagree and 10 means totally agree.

9 of the 10 members present completed *Evaluation Forms*.

1. OVERALL MEETING ASSESSMENT.

- 10.0 The background information was very useful.
- 9.9 The agenda packet was very useful.
- 9.9 The objectives for the meeting were stated at the outset.
- 9.3 Overall, the objectives of the meeting were fully achieved.
- 9.9 Overview of Workgroup Charge and Scope.
- 9.7 Overview of Proposed Alternative Screen Enclosure Design.
- 9.1 Discussion of Alternative Screen Enclosure Design Requirements Development.
- 9.0 Discussion/Identification of Subtasks and Information Development Needs
- 9.9 Identification of Next Steps.

2. HOW WELL THE FACILITATOR HELPED THE MEMBERS ENGAGE IN THE MEETING.

- 9.9 The members followed the direction of the Facilitator.
- 9.9 The Facilitator made sure the concerns of all members were heard.
- 9.9 The Facilitator helped us arrange our time well.
- 9.9 Participant input was documented accurately in Meeting Notes and Facilitator's Report.

3. MEMBERS LEVEL OF SATISFACTION WITH THE MEETING.

- 9.4 Overall, I am very satisfied with the meeting.
- 10.0 I was very satisfied with the services provided by the Facilitator.
- 9.4 I am satisfied with the outcome of the meeting.

4. HOW WELL THE NEXT STEPS WERE COMMUNICATED.

- 9.6 I know what the next steps following this meeting will be.
- 9.8 I know who is responsible for the next steps.

5. WHAT MEMBERS LIKED BEST ABOUT THE MEETING.

- Facilitator (Jeff Blair).
- Very good process.
- Well structured and orderly.
- On task and concise.
- Well thought out.
- All information and questions were addressed.
- Varied discussion on the topic.

6. COMMENTS REGARDING HOW THE MEETING COULD HAVE BEEN IMPROVED.

- Would have liked a definitive start time, but I understand.

7. OTHER GENERAL COMMENTS.

None were offered.

COMMENTS ON SPECIFIC AGENDA ITEMS:

None were offered.

ATTACHMENT II
MEETING ATTENDANCE—PUBLIC

PUBLIC MEETING ATTENDANCE	
NAME	REPRESENTATION
Joe Belcher	JDB Code Services, Inc.
Chris Herron	All Custom Aluminum
Bill Kaufmann	Metals USA
C.W. Macomber	AAMA SE
Dwight Wilkes	Q.tec, LLC
COMMISSION MEMBERS	
Dick Browdy	Commission Chair
Bob Boyer	Commissioner/Local Government

ATTACHMENT III
WORKGROUP AGENDA—APRIL 3, 2012

WORKGROUP MEETING OBJECTIVES

- To Approve Regular Procedural Topics (Agenda and Procedural Guidelines)
- To Hear an Overview of Workgroup Charge and Scope
- To Hear an Overview of Proposed Alternative Screen Enclosure Design
- To Discuss Alternative Screen Enclosure Design Requirements Development and Implementation Issues for Evaluation
- To Discuss Subtasks and Identify Information Development Needs
- To Consider Public Comment
- To Identify Needed Next Steps

MEETING AGENDA—TUESDAY, APRIL 3, 2012

All Agenda Times—including Adjournment—are Approximate and Subject to Change

<i>Start*</i>	A.)	Welcome and Opening
	B.)	Agenda Review and Approval
	C.)	Review of Commission’s Workgroup Meeting Guidelines, Consensus-Building and Decision-Making Procedures, and Sunshine Requirements
	D.)	Review of Legislation, Project Scope and Timelines
	E.)	Overview of Proposed Alternative Screen Enclosure Design
	F.)	Identification and Discussion of Issues Regarding the Proposed Alternative Screen Enclosure Design
	G.)	Discussion of Project Subtasks and Identification of Information Development Needs
	H.)	General Public Comment
	I.)	Review of Project Delivery and Meeting Schedule, and Next Steps
	J.)	<i>Adjourn</i>

ATTACHMENT IV

WORKGROUP ENACTING LEGISLATION AND PROJECT SCOPE

SCREEN ENCLOSURES WORKGROUP

SB 704 ER

Section 19. The Florida Building Commission shall establish a workgroup to assist the commission in developing a rule for implementing an alternative design method for screen enclosures which allows for the removal of a section of the screen to accommodate high-wind events consistent with the provisions of the Florida Building Code.

- (1) The workgroup shall be comprised of the following representatives:
 - (a) Two members who represent the screen enclosure manufacturing industry;
 - (b) Two members who represent the aluminum contractors industry;
 - (c) One member who represents the Florida Home Builders Association;
 - (d) One member who represents the Florida Swimming Pool Association;
 - (e) Three members who represent the Building Officials Association of Florida;
 - (f) One member who represents the building products industry; and
 - (g) One member who is employed as a structural engineer.

- (2) The workgroup shall address the following factors to be included in the rule:
 - (a) An alternative design method for a screen enclosure that is site-specific engineered;
 - (b) A screen enclosure design using the alternative method that serves as a barrier that is required for a swimming pool and remains in place at the minimum height required for the barrier;
 - (c) A screen enclosure design using clear, highly visible labels for panels that can be cut, retracted, or removed when winds are forecasted to exceed 75 mph;
 - (d) A design for a screen that can be removed, cut, or retracted without the use of a ladder or scaffolding;
 - (e) A requirement that the contractor provide replacement screen at the initial point of sale to repair the screen enclosure for designs that require cutting; and
 - (f) An alternative design for a screen enclosure that requires the contractor to provide notice to the homeowner and the local building department that the homeowner must cut, retract, or remove a panel or panels of the screen enclosure in accordance with engineering or manufacturer's instructions when wind speeds are expected to exceed 75 mph.

- (3) The Florida Building Commission shall appoint the workgroup no later than 15 days after the effective date of this act to draft a proposed rule. Rulemaking must be initiated pursuant to chapter 120, Florida Statutes, as soon as practicable after appointment of the workgroup. The commission shall file a notice of proposed rule by October 1, 2012. The Florida Building Code Commission shall file the rule for adoption by January 2, 2013, unless the commission files a letter on or before that date with the Joint Administrative Procedures Workgroup explaining the reasons for not completing rulemaking. Upon final adoption of the rule, the Florida Building Commission shall incorporate these requirements into the next version of the Florida Building Code. This section expires upon adoption of the rule and its inclusion in the Florida Building Code.

ATTACHMENT V
PROPOSED RULE DRAFT

Proposed Rule to Implement Alternate Design Method for Screen Enclosures

Chapter XX-X
Screen Enclosures

XX-X.001 Scope.

- (1) This purpose of this rule is to provide an alternate method for designing screen enclosures as defined by the Florida Building Code permitting the loads of the structural frame to be based on portions of the screen in the screen walls removed.

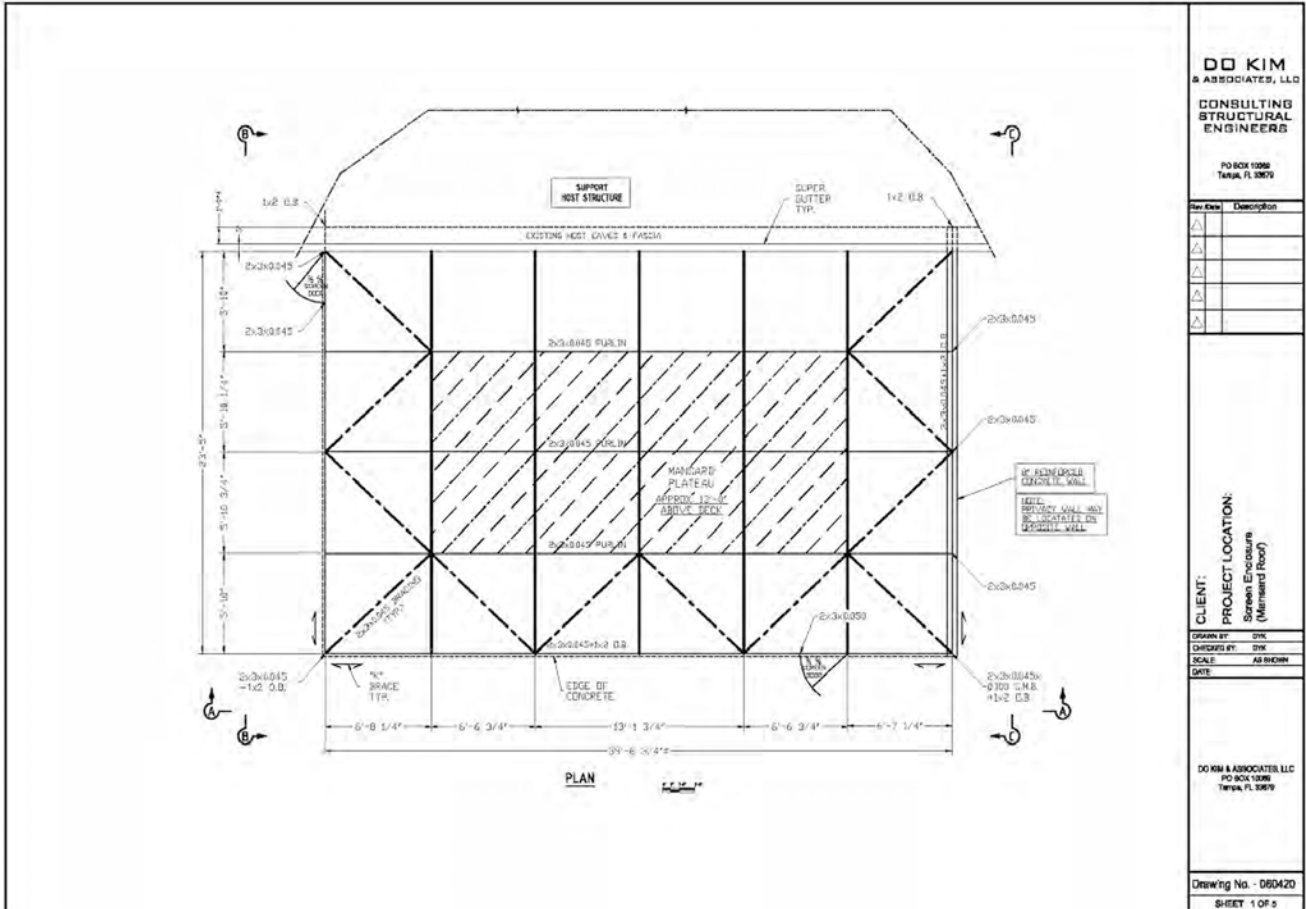
XX-X.002 Design Requirements.

- (1) Engineering criteria shall conform to the following.
 - a. Screen enclosure frames designed in accordance with the screen removal alternates of this rule, shall be designed using signed and sealed site-specific engineering and shall be designed in accordance with the wind load provisions of the Florida Building Code, Section 1609.1.1.
 - b. Designs shall comply with Florida Building Code, Building, Section 2002.4 and Table 2002.4 using the 110 mph column and as modified by Table 2002.4A.
 - c. Designs using strength design or load and resistance factor design in accordance with the Florida Building Code, Building Section 1605.2, or allowable stress design methods of the Florida Building Code, Building, Section 1605.5.3.1 shall be permitted.
 - d. The design shall be by rational analysis. In addition, 3D Finite Element Analysis may be used as an analytical method but is not required for the determination of forces and moments.
- (2) Where screen enclosures are designed in accordance with the screen removal alternates of this rule, removable screen may consist of removable panels, retractable panels, or by designating specific screen panels in the design in which the screen is to be removed by cutting the screen. Removable panels shall be removed, retractable panels shall be placed in the retracted position, and screen designated in the design to be cut shall be cut shall be completely cut when wind speeds are forecast to exceed 75 mph.
- (3) Where screen enclosures designed in accordance with the screen removal alternates of this rule serve as the barrier required by the Florida Building Code at Sections 424.2.17 and R4101.17.1, the required minimum height of the barrier shall be maintained when screen panels are retracted, removed, moved to the open position, or cut.

- (4) Where screen enclosures are designed in accordance with the screen removal alternates of this rule, retractable screen panels, removable screen panels, and screen panels identified to be cut shall be clearly identified with highly visible permanent labels or by other means approved by the local building department.
- (5) Where screen enclosures are designed in accordance with the screen removal alternates of this rule, the retraction of screen panels, removal of screen panels, or cutting of screen panels shall not require the use of ladders or scaffolding.
- (6) Engineering documents submitted with building permit applications shall identify the panels to be removed, retracted, opened, or cut.
- (7) Actual wall thickness of extruded structural aluminum members shall be not less than 0.040 inch (1mm).
- (8) Where screen enclosures are designed in accordance with the screen removal alternates of this rule based on removing screen panels by cutting the screen, the contractor shall provide replacement screen for a one-time replacement of all screen and spline designated by the design to be cut.
- (9) Where screen enclosures are designed in accordance with the screen removal alternates of this rule, the contractor shall provide notice to the homeowner and the local building code enforcement department that the homeowner must retract, remove, or cut a panel or panels of the screen enclosure in accordance with the project engineering design or the manufacturer's instructions when wind speeds are expected to exceed 75 mph.

ATTACHMENT VI

DEMO CAGE LAYOUT



DO KIM & ASSOCIATES, L.L.C.
CONSULTING STRUCTURAL ENGINEERS

PO BOX 1000
 TAMPA, FL 33679

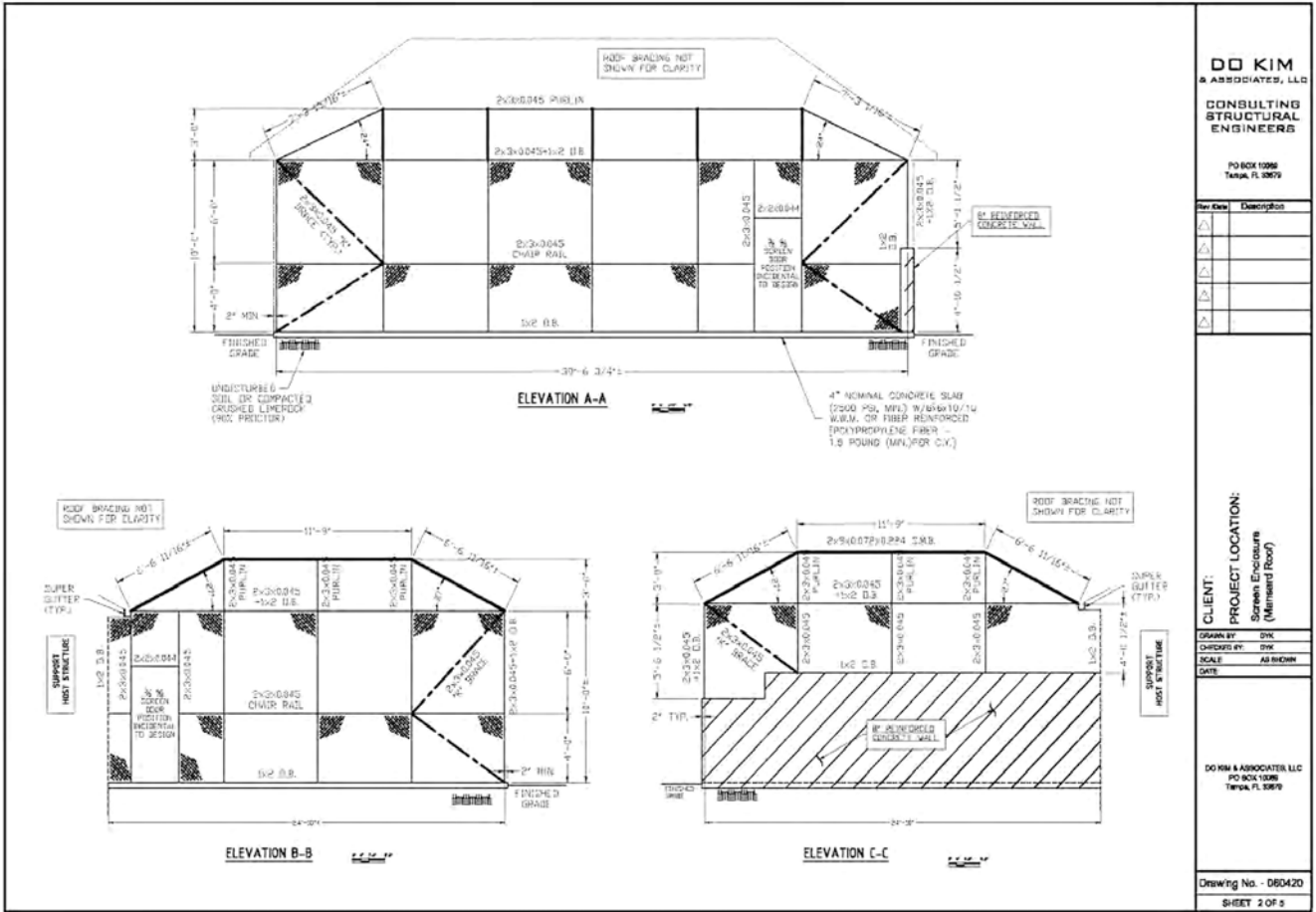
Rev	Desc

CLIENT:
PROJECT LOCATION:
 Screen Enclosures
 (Mirrored Roof)

DRAWN BY: DTK
CHECKED BY: DTK
SCALE: AS SHOWN
DATE:

DO KIM & ASSOCIATES, L.L.C.
 PO BOX 1000
 TAMPA, FL 33679

Drawing No. - 060420
 SHEET 1 OF 5



DO KIM & ASSOCIATES, LLC
CONSULTING STRUCTURAL ENGINEERS

PO BOX 1098
 Tampa, FL 33679

Rev	Description

CLIENT:
PROJECT LOCATION:
 Screen Enclosure
 (Mirrored Room)

DESIGNED BY: DTK
 CHECKED BY: DTK
 SCALE: AS SHOWN
 DATE:

DO KIM & ASSOCIATES, LLC
 PO BOX 1098
 Tampa, FL 33679

Drawing No. - DED420
 SHEET 2 OF 3

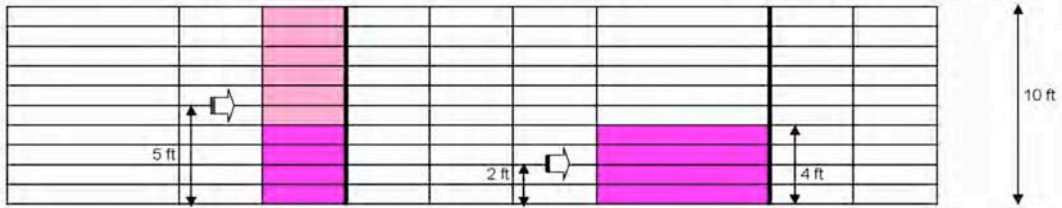
FBC SCREEN ENCLOSURE WORKGROUP

Ultimate Design Wind Speed Vult (mph)				
SURFACE	110		170	
	Design Pressure (psf)			
	B	C	B	C
Horizontal Pressure on Windward Surfaces	17	24	40	56
Horizontal Pressure on Leeward Surfaces	13	18	29	44
Vertical Pressure on Screen Surfaces	4	7	11	15

Ultimate Design Wind Speed Vult (mph)				
SURFACE	110		170	
	Design Pressure (psf)			
	B	C	B	C
Horizontal Pressure on Windward Surfaces	0.43	0.43	1.00	1.00
Horizontal Pressure on Leeward Surfaces	0.45	0.41	1.00	1.00
Vertical Pressure on Screen Surfaces	0.36	0.47	1.00	1.00

WALL LOADING DIAGRAM FOR 110 MPH

WALL LOADING DIAGRAM FOR 170 MPH



3/26/2012

Do Kim and Associates, LLC

FBC SCREEN ENCLOSURE WORKGROUP

	Horizontal Load Ratio w/ screen removed @ 170 mph	Overturing @ 110 (unit lbs*ft), Exp B	Overturing @ 110 (unit lbs*ft), Exp C	Overturing @ 170 w/ removed screen (unit lbs*ft), Exp B & C
SURFACE				
Horizontal Pressure on Windward Surfaces	0.40	2.13	2.14	2
Horizontal Pressure on Leeward Surfaces	0.40	2.24	2.05	2
Vertical Pressure on Screen Surfaces	1.00			

3/26/2012

Do Kim and Associates, LLC

ATTACHMENT VII

SUBMITTED PUBLIC COMMENT

Designed to Fail?

The subject is design of aluminum structures that may ultimately fail under wind loading. The focus is on screen enclosures designed per the alternate method proposed by Florida Senate Bill 704. It is proposed that certain portions of the screen may be cut or removed when wind velocities are forecast to exceed 75 mph, supposedly limiting the forces to some undetermined magnitude less than normally used for design. A few questions arise.

First, how is the design pressure determined? Is it to be simply determined by the ratio of dynamic pressure at 75 mph to the dynamic pressure normally used? Dynamic pressure, q , varies directly with the square of wind velocity therefore the dynamic pressure at 75 mph would be 56% of that at 100 mph. If the normal design speed is 150 mph, the pressure at 75 mph would be only 25% of that at 150 mph. And what about footnote i of Table 2002.4? If the designer is using the method of Allowable Stress Design, then an additional factor of 0.6 is permitted. Respectively, this would further reduce the pressures to 34% and 15% for the two examples cited above.

Second, the design pressure is determined by the product of dynamic pressure and force coefficient. To determine design pressure as suggested above without consideration of force coefficient is not rational. What force coefficient is to be used? Is there any test data to show the effects of cutting a screen?

Force coefficients are a function of not only geometric parameters such as blockage¹ but also Reynolds Number. How were the design pressures in Table 2002.4 for the 2010 code obtained? The design pressures specified in Table 2002.4 for the 2004 code are based on wind tunnel tests conducted at Clemson and Virginia Tech². The tests were conducted in two parts. The objective of the Virginia Tech tests "was to provide wind load information for full-scale materials. This eliminates possible Reynolds Number effects and provides pressure coefficients which are similar to those used in building codes including ASCE 7-98". "Tests were conducted at wind speeds of about 40, 60, 70, and 80 mph." It is clear from the report that the tests on the bare aluminum frames were conducted over this speed range. However it is not clear that this speed range was used in determining the total force when the various screen products were mounted in the frames. If only one speed was used then the "Average Force Coefficient for Screen Mesh" listed in Table 1 of the report is suspect.

I call your attention to the discussion under **Component and Cladding Loads** on page 5 of the report. "This use of a mean pressure coefficient with a gust speed to estimate peak loads on cladding is not appropriate for solid surfaces because *flow separation can generate much higher peak negative pressures* (emphasis added). However, it should be appropriate for a porous surface such as a screen enclosure where loads are developed by *flow through the screen* (emphasis added)". The emphasis on "*flow separation*" and "*flow through*" invites rational discussion.

Figure 1 is a plot of the exposure C windward wall pressures in Table 2002.4 for code years 2004, 2007, and 2010. Indicated by circles are the pressures from Table 11 of the report. Footnote i of the 2010 pressure table allows multiplying the pressures by 0.6 if the method of Allowable Stress Design is used. That in effect returns the pressures to exactly those of the 2004 code. As you can see, all sets of pressures vary directly with the square of the velocity ratio. The dashed lines show the reduction in

pressures to 75 mph based on ratio of velocity to lowest speed listed in the respective tables. The pressure of 13.8 psf shown in the triangle is based on a drag (force) coefficient of 0.0128 obtained from Figure 2.

Figure 2 is a plot of Reynolds Number versus drag coefficient based on the 2007 code windward pressures for exposure C. This is a semi-logarithmic plot of the drag coefficients with two different extrapolations to the 75 mph Reynolds Number. The first extrapolation is linear through the data for 100 mph through 110 mph and indicates a pressure of 8.4 psf. This corresponds to varying the pressure in direct proportion to the square of the velocity. The second extrapolation is through the data for 110 mph through 100 mph. Note the abrupt change in slope. This indicates that somewhere between 100 and 110 mph the flow transitions from laminar to turbulent and corresponds closely with the *bucket* in the superposed graph for the round wire. The drag coefficients in the *bucket* are fairly constant which means the drag force will vary almost directly with velocity ratio in this Reynolds Number range. For the screen mesh, a rapid increase in drag coefficient occurs at velocities below 110 mph which means pressures based strictly on velocity ratio will be un-conservative. As indicated by the two pressures on Figure 2, the pressure could be 64% higher.

The above discussion is based on the tests conducted at Clemson. The report pressures are based on a test scale of 1:24 for the frame but full scale screen. The report does not specify the test velocity used to determine these pressures therefore any Reynolds Number effects cannot be determined. To accurately represent the screen, its mesh size would have to be adjusted to represent the blockage and the diameter of each yarn would have to be reduced from full scale 0.013 to 0.0005 for proper Reynolds Number. It is my opinion that the pressures of Table 11 at best indicate a trend with varying configurations but do not accurately represent pressures because of wrong Reynolds Number effect produced by use of full size screen mesh. Reference 1, which was published the same year as the wind tunnel tests, offers theoretical treatment of the blockage effect of screens on flow passing through.

Figure 3 shows the effect of blockage on the windward wall. Although not shown, a similar effect can be expected for the screen roof. With removal of the wall screen, higher velocity air is allowed to enter below the roof screen. When this flow encounters blockage by the host wall it comes to an abrupt halt, creating an increase in the *static* pressure. This increases the pressure differential across the screen and will therefore result in higher uplift forces, in particular near the eave of the host structure.

Summary: There is sufficient evidence in the literature to caution against using velocity ratio alone to determine pressures. Without quantitative wind tunnel tests to determine pressures on the roof screens consistent with partial removal of wall screens the State would be venturing further away from sound engineering practice.

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1. *Low Speed Wind Tunnel Testing*, J.B. Barlow, W. H. Rae, A. Pope, John Wiley & Sons, New York, 1999.
2. *Wind Loads on Screen Enclosures-Final Report*, Timothy A. Reinhold, Ph.D., P.E, (Colorado), October, 1999.