



NGA GLASS CONFERENCE™

CHICAGO — JULY 18-20, 2022

TECHNICAL UPDATE



Karen Wegert

Associate Director of Advocacy & Technical
National Glass Association

GERMAN GLASS BREAKAGE BOOK

Ekkehard Wagner

Glasschäden

Oberflächenbeschädigungen
Glasbrüche in Theorie und Praxis

5., überarbeitete und erweiterte Auflage



Fraunhofer IRB Verlag

Author: Ekkehard Wagner

Title: Glass Damage

Subtitle: Surface damage, Glass breakage in Theory and Practice

Comprehensive reference used by glass specialists to

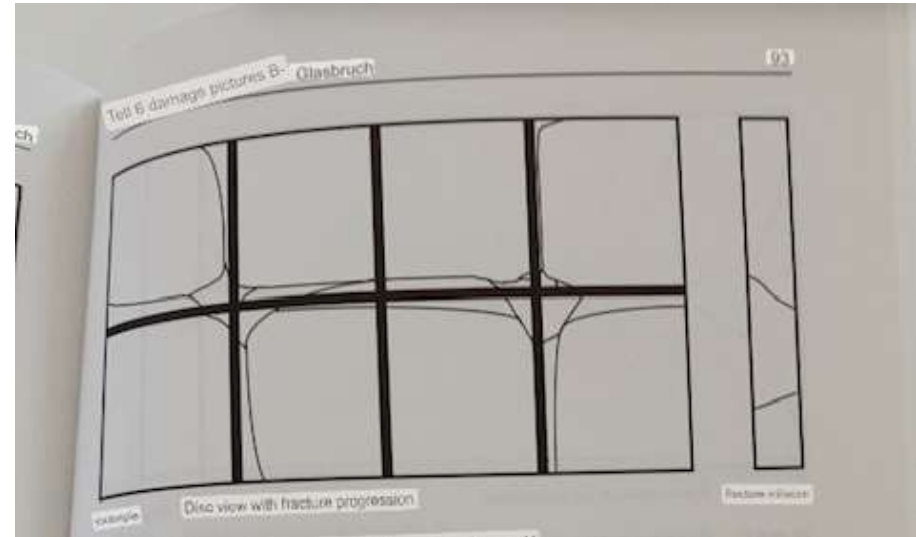
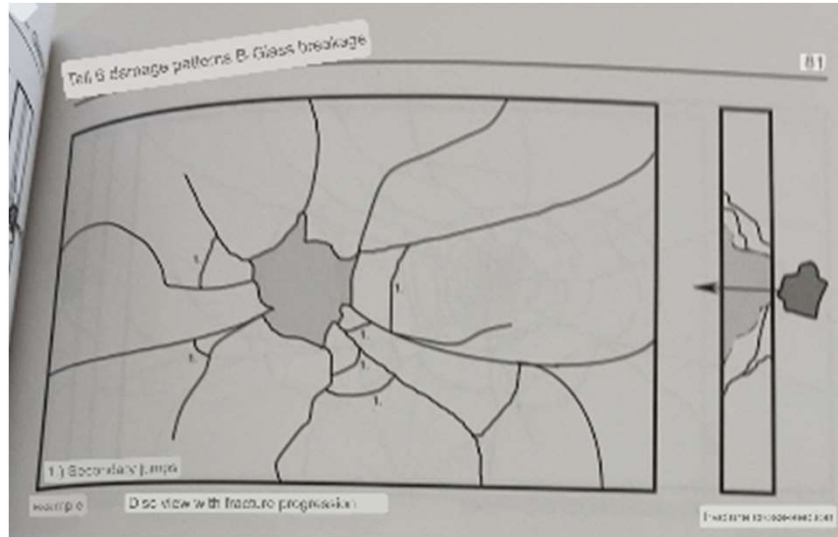
- precisely determine the causes of damage and glass breakage
- correctly assess and clearly allocate the causes of damage
- safely apply the theoretical principles in practice
- provide a better understanding of the properties, peculiarities and damage patterns of glass.

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EXAMPLES OF GLASS BREAKAGE DIAGRAMMS FROM THE 2ND EDITION, WITH GOOGLE-TRANSLATED TEXT



Would this be a helpful resource?



TECHNICAL UPDATE



Urmilla Sowell

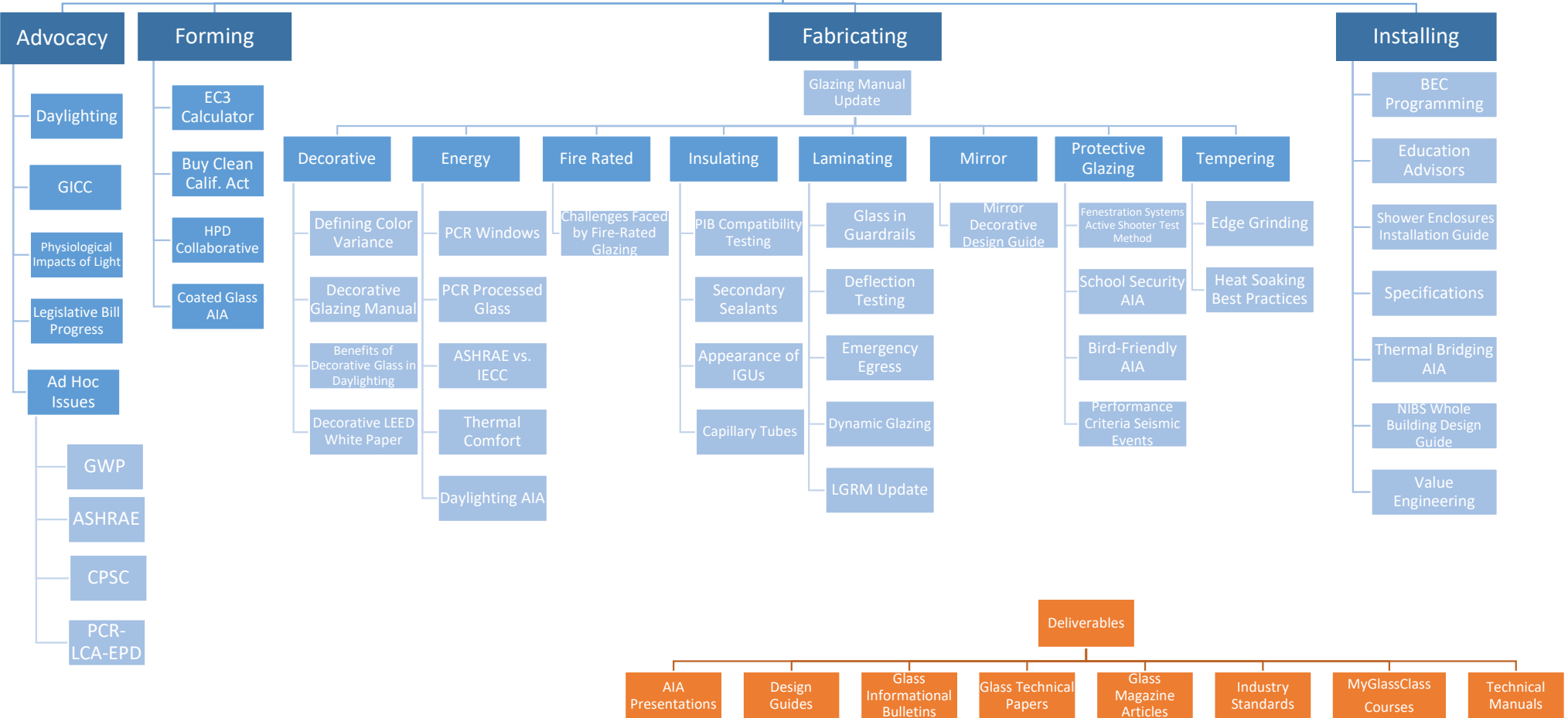
Advocacy & Technical Director
National Glass Association

National Glass Association Board of Directors

2022
International
Year of Glass

LEGEND

- Committee
- Committee Liaisons
- Task Groups





May 2022

Current Activities



New Resource: NGA Architectural Glass & Glazing Glossary

NGA is pleased to announce publication of the [Glossary of Architectural Glass & Glazing](#), covering 1,800 terms used in the architectural glass & glazing industry; an invaluable resource for industry veterans and new hires alike.

Your NGA Advocacy & Technical Services Team



Left to right: Urmilla Sowell, Karen Weqert, Tom Culp, Thom Zaremba, Nick Resetar, Amber Johnson, Nicole Harris

GLASS ADVOCATE

Leaders Look to Glass to Protect Children and the Environment at NGA Glass Conference: Long Beach

Industry technical leaders met Jan. 24-26, for the NGA Glass Conference: Long Beach. Key topics on the agenda included school security, daylighting and eye health, current and future IGU technologies, glass recycling and sustainability, and the 2022 International Year of Glass.

The three-day conference, hosted by the National Glass Association, included meetings of the NGA Advocacy, Forming and Fabricating Committees, which made progress on many of their current projects and resources under development. The Installing Committee will gather in March at the BEC Conference in Nashville.

Forming

The Forming Committee presented updates on several sustainability initiatives, including refining the reporting of glass products in Health Product Declarations, developing the Embodied Carbon in Construction Calculator as a tool for benchmarking sustainability data, ASHRAE 189.1 global warming potential discussions and new implementation dates and metrics for the Buy Clean California Act.

Advocacy

The Advocacy Committee meeting began with a discussion on the presentation Physiological Impacts of Light on Human

energy efficiency initiatives was reviewed, including the Build Back Better Blueprint, Energy & Covid Relief Act of 2020, American Rescue Plan Act, and the Infrastructure Investment & Jobs Act.

Fabricating

Within the Fabricating Committee, the GANA Glazing Manual 50th anniversary edition is undergoing review to be republished at the end of 2022. A new NGA Glossary of Architectural Glass & Glazing Terms has been developed and will be available for download from the NGA website.

The tempering segment reviewed updates to glass-related ASTM standards from the last year, including two new standards, C1908-21 Standard Test Method for Pummel Adhesion Testing of Two-ply Laminated Architectural Glass and C1914-21 Standard Test Method for Bake and Boil Testing of Laminated Glass. The desire to determine if surface polishing and/or edge grinding following tempering reduces the glass strength was reignited, and a proposal for testing and calculations will be developed for review. Finally, a new resource, Best Practices for Heat Soaking, will be developed.

The mirror segment is working on a new Mirror Design Guide, and the decorative

Design Guide is now referenced within GSA P100 Facilities Standards for the Public Buildings Service, updated October 2021. The fire-rated glazing segment is reviewing a new technical paper on the additional challenges faced by fire-rated glazing beyond fire resistance and fire protection.

The laminating segment is pursuing the enhancement of laminated glass deflection tables as published in the NGA Engineering Standards Manual for interior wall partitions. The content will eventually be added to the NGA Heavy Glass Door Design Manual and potentially the NGA Laminated Glazing Reference Manual.

The energy segment discussed possibilities for new educational resources based on the Thermal Bridging Considerations at Interface Conditions Design Guide, including recommending the Installing Committee's Specifications task group consider how thermal bridging should be addressed in specifications. New resources will be developed on the topics of thermal comfort and the status of code adoptions across the states, comparing historical and current versions of ASHRAE vs IECC model energy codes. The Windows PCR will be extended based on discussion that it is still important and relevant to the industry.



GLASS INFORMATIONAL BULLETIN

School Security Glazing

The objective of this bulletin is to provide information on security glazing options for windows and doors installed in schools. It is important to determine the assets, the potential threats and hazards, and the level of vulnerability to know what level of testing or certification is required before specifying the glazing.

Specification considerations

When deciding what level of protection to specify, consider these factors:

- Direct line of sight to students
- Location and movement of students during an active shooter event
- Distance and time for first responders.

FEMA publication "Primer to Design Safe School Projects in Case of Terrorist Attacks and School Shootings" includes the following considerations:

- Use extensive glazing at main entrance to enhance visual surveillance to parking lots and pedestrian routes.
- Install openings or windows in solid walls to make areas adjacent to the school without line of sight visible from the interior.
- Consider using burglary- and ballistic-resistant glazing in high-risk school areas.
- Consider using steel window frames securely fastened or cement grouted to the surrounding structure.

Security selection

The appropriate glazing penetration resistance should be determined based on the levels of resistance:

Basic safety glazing has enough strength to withstand accidental human

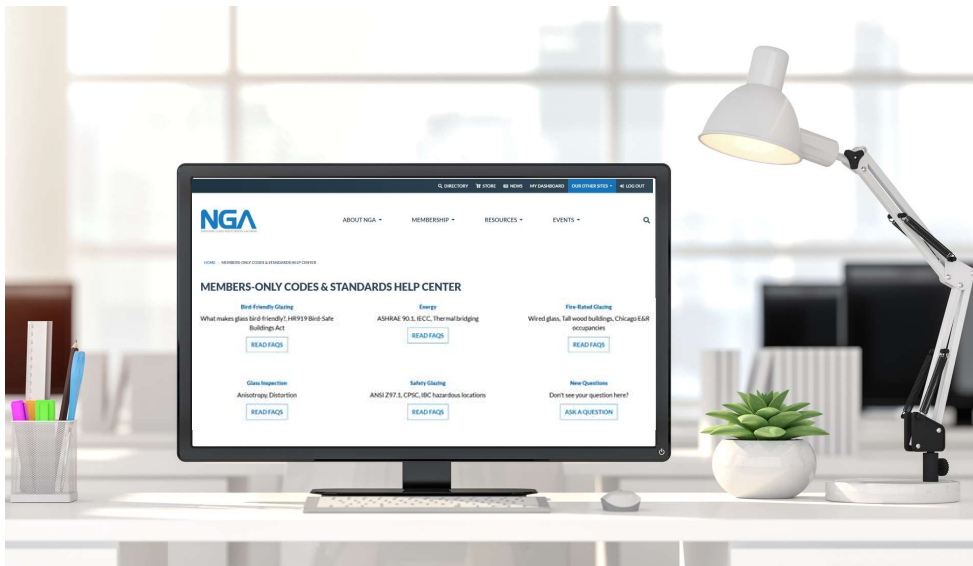
Security Selection Quick Reference Summary

Security selection	Security level of the selection*			
	Test standard	Low	Medium	High
Basic safety glazing	ANSI Z97.1	Class B		Class A
	CPSC	Cat I		Cat II
	CAN CGSB	Class B		Class A
	ASTM F3006/F3007	0.75 m Cat 2	3.66 m Cat 3	3.66 m Cat 2
Enhanced	UL 972	Std - 10 ft	Ind/Outdoor	High Energy (40 ft)
	ASTM E2395	L1	L3	L5
	ASTM F1233	1.0	1.1	1.2
Forced entry	ASTM F1233	1.4	2.3	5.0
	ASTM F3038 - mob with hand tools	5 min	15 min	30 min
Enhanced forced entry	ASTM F1233 Annex A2	3 shots with 9 mm handgun; Class 1.4	3 shots with .357 Magnum; Class 2.3	3 shots with .44 Magnum; Class 5.0
Ballistic protection (handguns)	UL 752	1 (9 mm handgun)	2 (.357 Magnum)	3 (.44 Magnum)
	ASTM F133	HG3 (9 mm handgun)	HG2 (.357 Magnum)	HG4 (.44 Magnum)
Multiple forced entry assault (ballistics and forced entry)	ASTM F1233	HG1/R1-1.4	HG2/R2-2.3	HG4/R3-5.0
Blast resistance	ASTM F1642/F2912	H3	H2	H1

* This is not meant to be all-inclusive; there are levels existing outside of this table.

Members-Only Codes & Standards Help Center

Have Questions? Get Answers.



Glass is complicated—NGA is here to help.

Exclusively for NGA members, we have compiled answers to nearly 40 tough technical codes and standards questions in an easy-to-use, online help center.

Available now (member login required).

Get started: glass.org/members-only-resources



OUR COMMITTEES DEVELOP NEW RESOURCES AND ADDRESS CRITICAL ISSUES FACING THE INDUSTRY

[VOLUNTEER NOW](#)

[SEE CURRENT MEMBERS AND TASK GROUPS](#)

glass.org/
[about-nga/advocacy/committees](https://glass.org/about-nga/advocacy/committees)



SAVE the DATE

Glazing Executives Forum

Oct 18, 2022 | Las Vegas Convention Center

GlassBuild America

Oct 18-20, 2022 | Las Vegas Convention Center

NGA Glass Conference: Miramar Beach

Jan 24-26, 2023 | Hotel Effie Sandestin

BEC Conference 25th Anniversary

Mar 5-7, 2023 | Caesars Palace, Las Vegas

GlassBuild America

Oct 31-Nov 2, 2023 | Georgia World Congress Center



Visit glass.org for details!

TECHNICAL AND CODES UPDATE



Thom Zaremba

NGA Fire, Safety & Structural Code Consultant
[Roetzel & Andress](#)



Nick Resetar

NGA Fire, Safety & Structural Code Consultant
[Roetzel & Andress](#)



Individual Consideration Agenda

Public Comment ZAREMBA-1:

IRC: R303.1.2

Proponents: Thom Zaremba, representing National Glass Association (tzaremba@ralaw.com); Nicholas Resetar, representing Glazing Industry Code Committee (GICC) (nresetar@ralaw.com) requests As Modified by Public Comment

Further modify as follows:

2021 International Residential Code

R303.1.2 Natural ventilation. Habitable rooms shall have an aggregate area openable to the outdoors not less than 4 percent of the floor area of such rooms. Openings shall be through windows, skylights, doors, louvers or other approved openings to the outdoor air. Such openings shall be provided with ready access or shall otherwise be readily controllable by the building occupants.

Exceptions:

- ~~1. Natural ventilation shall not be required in habitable rooms other than kitchens where a whole house mechanical ventilation system or a mechanical ventilation system capable of producing 0.35 air changes per hour in the habitable rooms is installed in accordance with Section M1505.~~
- ~~2. Natural ventilation shall not be required in kitchens where a local exhaust system is installed in accordance with Section M1505.~~
3. Required ventilation openings shall be permitted to open into a thermally isolated sunroom or roofed porch, deck, or patio where not less than 40 percent of the roofed area perimeter is open to the outdoor air.
4. Required ventilation openings shall be permitted to open into a thermally isolated sunroom provided there is an openable area between the adjoining room and the sunroom of not less than one-tenth of the floor area of the interior room and not less than 20 square feet (2 m²). The minimum openable area of the sunroom to outdoor air shall be based on the total floor area of the adjoining room and the sunroom.

APPENDIX E—NGA: SECURITY SUMMARY

National Glass Association: Security Selection Quick Reference Summary



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NUMBER	PROPONENT	CODE & SECTION	COMMITTEE ASSIGNED	ANALYSIS	CONSULTANT RECOMMENDATION	GICC/PRIMARIES POSITION	COMMITTEE ACTION
S9	ASCE7 Wind Load Subcommittee etc	IBC 202 + multiple Tables	S	Harmonizes IBC with language used in ASCE 7 and other loading standards	M=monitor	M	AM
S18	Sustainable Energy Action Committee	IBC1505.8	S	Updates Building -integrated photovoltaic (BIPV) language	M=monitor	M	AS=11/3
S21	Sustainable Energy Action Committee	IBC 202, 1507 and Tables	S	Deletes "PV Shingles" and adds "BIPV Roof Covering"	M=monitor	M	AS=13/1
S42	BMcHugh Chi.Roofing Contractors	IBC 1511	S	Copies IECC air barrier provisions and adds them to IBC	O=oppose. Unnecessary. Any modifications to IECC provisions would need an update in IBC	O	D=14/0
S62	ASCE	IBC Ch 2, 15, 16 and Tables	S	Updates IBC to the provisions of the 2022 edition of ASCE/SEI 7 including technical (new hurricane coastline from Carolina to Texas plus Calif and Colo), editorial and re-organizations	M=monitor	M	AS=11/3



NUMBER	PROPONENT	CODE & SECTION	COMMITTEE ASSIGNED	ANALYSIS	CONSULTANT RECOMMENDATION	GICC/PRIMARIES POSITION	COMMITTEE ACTION
S101	NCSEA	IBC 1607	S	Handrails & Guards: Clarifies that uniform and concentrated loads need NOT be applied concurrently per ASCE 7 + editorial to match the order of presenting concentrated load first and uniform second as per ASCE 7.	M=monitor	M	AS
S102	NCSEA	IBC 1607	S	Guard infills: Clarifies concentrated load of 50# is horizontally applied and distributed per 4.5.2 of ASCE 7. Specifically addresses Barrier Cable infill Systems	M=monitor	M	D
S147	WDMA	IBC 1709.5	S	Adds WDMA I.S.11 as an alternative to AAMA 2502 for engineering analysis of design pressures of exterior window and door assemblies	M=monitor	M	AS
S157	NCSEA	IBC 1807.2.5	S	Adds new provisions addressing Guards on retaining walls	M=monitor	M	Ams
S178	NBI	IBC 202, 1903.5, 2205, 2308, 2406 + Tables	S	Adds embodied CO2e requirements for steel, wood, concrete, and glass. See new 2403.6 re: Embodied CO2e disclosure Type III EPD Certified from "cradle to grave" would be required for all glass installed in commercial buildings. Adds new definition for flat glass and sheet glass.	O=oppose. This should be addressed by the Energy Conservation Code Committee, not a Building Code Committee	O	D=14/0

NUMBER	PROPONENT	CODE & SECTION	COMMITTEE ASSIGNED	ANALYSIS	CONSULTANT RECOMMENDATION	GICC/PRIMARIES POSITION	COMMITTEE ACTION
S228	FGIA	IBC 2405.2.,3	S	Corrects reference to 2606 from 2607 re: light transmitting plastics + editorial re-write and clean-up of screening requirements applicable to sloped glazing	M=monitor/S=support	S	AS
S229	GICC	IBC 2406.1	S	Clarifies that (in the absence of an exception) all panes of glass in multi-pane assemblies must be safety glazing in hazardous locations	S=support	AM="All glass panes in individual glazed areas, including glass mirrors, single panes of glass, laminated glass, and all panes in multi-pane glass assemblies	AM=14/0
S230	GSearer	IBC 2406.4.3	S	Reduces 25' exception to outboard panes in hazardous locations to only 8' (S231 contradicts S230)	O=oppose. Proponent misunderstands the reason for the 25' height exception in hazardous locations	O	D=14/0 at proponent's request
S231	Gsearer	IBC 2406.4.3	S	Three changes: 1- changes hazardous locations where (a) the bottom edge is <18" above the floor to "floor, roof or adjacent walking surface" and (b) the same change where the top edge is > 36" above the floor, and 2- changes 25' exception by deleting all height above grade and exempting all panes of IGUs or multiple later glazing except those "on the accessible side(s) of the windows."	O=Oppose. Ambiguous and potentially dangerous.	O=Resolved	AM=14/0. Outboard panes in insulating glass units or multiple glazing where the bottom exposed edge of the glass is 8 feet (2438 mm) or more above any grade or walking surface adjacent to the glass exterior.

NUMBER	PROPONENT	CODE & SECTION	COMMITTEE ASSIGNED	ANALYSIS	CONSULTANT RECOMMENDATION	GICC/PRIMARIES POSITION	COMMITTEE ACTION
S232	GICC	IBC 2406.5	IBC 2409.1	Fire Dept. Access Panel - editorial	Move behind S233 and withdraw if S233 passes; Support if S233 fails.	Move behind S233; w/draw if S233 passes; S if S233 fails	AS=14/0
S233	Jensen Hughes	IBC 2406.5	S	Delete section. Fire dept. access panels is not defined in the code. Is it access to a fire alarm - or - is it a panel used for smoke control?	M=monitor. Let the Committee decide what a fire dept. access panel is.	M	D=14/0
S234	Procza	IBC 2409.1	S	For glass floor/ceiling assemblies not complying with ASTM E2751, this would require loads to meet those specified in Ch. 16 but would add engineering design reports or evaluations under Ch. 104 as an alternate material with load requirements that are not specified in the Code.	O?/M?	S	AS=14/0



NUMBER	PROPONENT	CODE & SECTION	COMMITTEE ASSIGNED	ANALYSIS	CONSULTANT RECOMMENDATION	GICC/PRIMARIES POSITION	COMMITTEE ACTION
S235	GICC	IBC 2407.1.1	S	Clarifies factor of safety of four applicable to glass in glass guards	S=support	"Glass <u>used</u> in handrails and guards...."	AM=14/0 2407.1.1 Loads. Glass handrails and guards and their support systems shall be designed to withstand the loads specified in Section 1607.9 . Calculated stresses in glass elements of handrails and guards due to these loads shall be limited to a maximum of 3,000 psi (20.7 MPa) for heat strengthened glass and 6,000 psi (41.4 MPa) for fully tempered glass.
S236	Kerr	IBC 2407.1.1	S	Adds: glass "elements" to factor of safety of four	O= oppose. Unnecessary, and ambiguous terminology. Would be clearer to say: "Only the glass components in handrails and guards"	O	D=14/0



TECHNICAL AND CODES UPDATE



Tom Culp

NGA Energy Code Consultant
Birch Point Consulting





ENERGY CODE UPDATE - ASHRAE

ASHRAE 90.1

- Final votes on ASHRAE 90.1-2022 occurred last month. Will publish Oct-Nov.
- We updated fenestration criteria in 2013, 2016, 2019. Won't change in 2022.
- Several big new items (assuming no successful appeals):
 - New **thermal bridging** requirements – we've talked about these for years; finally done.
 - New **envelope backstop**, based on envelope performance factor similar to NYC.
 - New **on-site renewable energy** requirement for new buildings, strongly pushing PV, BIPV. Also approved late increase from 0.25 to 0.5 W/ft² last month.
 - New **“additional energy credits”** section that requires designer to choose additional items on top of the main code; options include higher performance fenestration, shading, daylighting, on-site renewable energy.
 - Tighter **air leakage** criteria and increased testing.

ENERGY CODE UPDATE - ASHRAE

ASHRAE 189.1 / International Green Construction Code

- Working on 189.1-2023 which becomes the 2024 IgCC
- Expanded **views** requirements – *now mandatory for classrooms*; increased view area percentage; more space types added along with offices as jurisdictional option.
- Expanded **EPD requirements** going out for public review.
 - Increase number of EPDs required on a building project, but
 - (a) still allow industry-wide EPDs in addition to company-specific EPDs,
 - (b) not require facility-specific EPDs, and
 - (c) allow EPDs for components to be submitted for assemblies
 - Also discussing a new proposal setting limits on CO₂eq / embodied carbon of materials and products, but still a ways to go.
- Tightened **air leakage**.
- Clarified **on-site and off-site renewable energy** requirements.



ENERGY CODE UPDATE - IECC

2024 International Energy Conservation Code

- Wrapping up first round review of over 250 commercial and 180 residential proposals with final committee ballot this month.
- Revised draft of the 2024 IECC will go out for second public review and new proposals around Sep – early Oct.



ENERGY CODE UPDATE - IECC

2024 International Energy Conservation Code

- Some of the key changes:
 - New default U-factors for **spandrel assemblies**.
 - Reorganized **air leakage** section with tighter air leakage and increased testing.
 - New **thermal bridging** requirements, similar to ASHRAE 90.1 but a little simpler.
 - New **additional energy credits** requirements similar to ASHRAE 90.1. Options include higher performance fenestration, daylighting, automated shading, PV / BIPV.
 - Increased **daylighting controls**.
 - Very aggressive moves towards **electrification** and **net-zero**:
 - new **on-site renewable energy** requirement (PV, BIPV) even stronger than 90.1,
 - new EV parking and energy storage requirements,
 - new “glide path” addendum showing jurisdictions how to get to net-zero by 2030.

BUILDING DECARBONIZATION / ELECTRIFICATION & GLASS

- Reduce your loads → Energy efficiency
- Electrify your loads → Heating, cooling, water, appliances, cars
- Serve the loads with low carbon electricity → PV, hydro, wind, geothermal, nuclear
- Integrate / coordinate everything → Interactive grid, energy storage, EV charging, building energy management

Continued increase of low-e, gas-fill, warm edge spacers, 4th surface low-e, advanced framing, triple glazing, sunshades.

Offsite PV,
rooftop PV
BIPV (vision area, spandrel, canopies, etc)
Dynamic systems



ENERGY CODE UPDATE - IECC

2024 International Energy Conservation Code

- What was ***not*** approved in first round (but may come back):
 - **Orientation** requirements related to window area and/or SHGC (including shading) on west and east vs. north and south.
 - Proposal to allow **actual-size and configuration NFRC ratings** in performance path.
 - **Envelope backstops**
 - No changes to **fenestration U-factors** yet ... but this will come back once the cost effectiveness analysis complete.

ENERGY STAR

- Just yesterday, EPA announced final criteria for Energy Star v7.
- Final comment period through Aug 10, but no further changes expected. Implementation 1 year after completion – likely Sep 2023.
- Will significantly push triple glazing and 4th surface low-e in north and north-central, latest generation triple silver low-e in south and south-central.

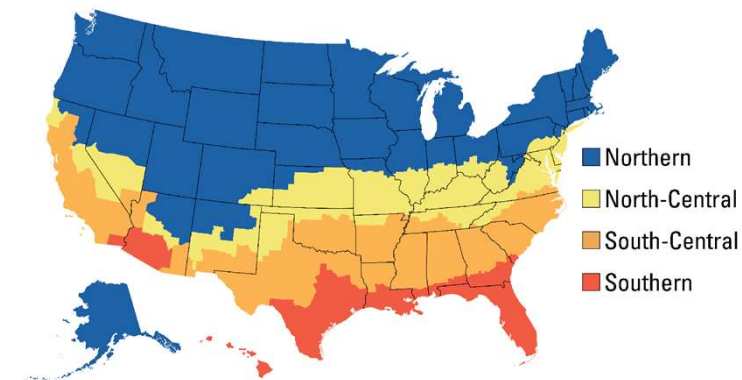
Version 6

Climate Zone	U-Factor	SHGC	
Northern	≤ 0.27	Any	Prescriptive
	= 0.28	≥ 0.32	Equivalent Energy Performance
	= 0.29	≥ 0.37	
	= 0.30	≥ 0.42	
North-Central	≤ 0.30	≤ 0.40	
South-Central	≤ 0.30	≤ 0.25	
Southern	≤ 0.40	≤ 0.25	



Version 7

Climate Zone	U-Factor ¹	SHGC ²	
Northern	≤ 0.22	≥ 0.17	Prescriptive
	= 0.23	≥ 0.35	Equivalent Energy Performance
	= 0.24	≥ 0.35	
	= 0.25	≥ 0.40	
	= 0.26	≥ 0.40	
North-Central	≤ 0.25	≤ 0.40	
South-Central	≤ 0.28	≤ 0.23	
Southern	≤ 0.32	≤ 0.23	





OTHER ENERGY / GREEN ACTIVITY AREAS

ICC 700 – National Green Building Standard

- I've been reappointed to the 2024 NGBS committee reviewing proposals.
- Currently no proposals directly affecting fenestration.
Mostly clean-up proposals to make it more usable, and to apply better to mixed-occupancy buildings (e.g. residential over commercial multifamily)

NFRC

- Approved technical and certification program documents for new commercial rating program (4th time is a charm?), which is supposed to be more streamlined with both new custom project and product paths. Staff working on implementation and web-tool.

Charles Pankow Foundation spandrel research project

- Project underway with SGH, MH, and RDH. Working on literature review, industry survey to understand current practice, testing / modeling research plan.

Partnership for Advanced Window Solutions

- Public / private partnership with DOE, national labs, efficiency groups, utilities, industry.

