BCM GLASS

BCM FIELD GUIDE · FOR ARCHITECTS

The Architect's Glass Selection Manual

Heat treatment, safety glazing, insulating and laminated units, low-E coatings, color, bird-friendly design, and special function glazing, explained for specifiers.

INSIDE

1. How to use this manual
2. Annealed, heat-strengthened, and tempered glass
3. Safety glazing
4. Laminated glass and insulating glass units
5. Low-E coatings, explained
6. Color, reflectivity, and reviewing glass samples
7. Bird-friendly glazing
8. Security, ballistic, impact, and blast glazing
9. Fire-rated glazing
10. Writing the glass type schedule
11. Sources and basis

Version 1.0 · October 2026

bcmglassco.com · estimating@bcmglassco.com

CONTENTS

01	How to use this manual	
02	Annealed, heat-strengthened, and tempered glass	NO. 14
03	Safety glazing	NO. 14
04	Laminated glass and insulating glass units	NO. 14
05	Low-E coatings, explained	NO. 02
06	Color, reflectivity, and reviewing glass samples	NO. 24
07	Bird-friendly glazing	NO. 18
08	Security, ballistic, impact, and blast glazing	NO. 15
09	Fire-rated glazing	NO. 15
10	Writing the glass type schedule	
11	Sources and basis	

CHAPTER 1

How to use this manual

This manual is for architects and specifiers choosing and documenting architectural glass. It starts with the glass itself, builds up to insulating and laminated units and coatings, then covers appearance, bird-friendly design, and special function glazing. It ends with a checklist for writing a glass type schedule that a glazing contractor can price and build without guessing.

Each chapter expands one or more posts in our BCM Field Guide series on LinkedIn.

> **The short version.** Terms that sound alike mean different things. Heat-strengthened glass is not safety glass; tempered glass can be. Published low-E numbers are center-of-glass, not whole-window. Small samples hide color. Security, ballistic, impact, and fire ratings belong to tested systems, not to the glass alone. Write each glass type out in full, from the outside in, and confirm current manufacturer data before you specify.

BASIS AND LIMITS

This manual is general guidance from a commercial glazing contractor. It is not a specification. The project specification, the building code adopted by the jurisdiction, and the authority having jurisdiction decide what is required. Manufacturer data changes; confirm current published values before you specify.

CHAPTER 2

Annealed, heat-strengthened, and tempered glass

FIELD GUIDE NO. 14

Almost all architectural glass starts as float glass: molten glass floated on a bath of molten tin to produce a flat, uniform sheet. What happens next decides its strength and how it breaks.

Annealed glass

Annealed glass is the baseline: float glass cooled slowly so it has little built-in stress. It can be cut, drilled, and edge-worked after manufacture. When it breaks, it breaks into large, sharp pieces. Flat annealed glass is covered by ASTM C1036. Most other glass types start here.

Heat-strengthened glass

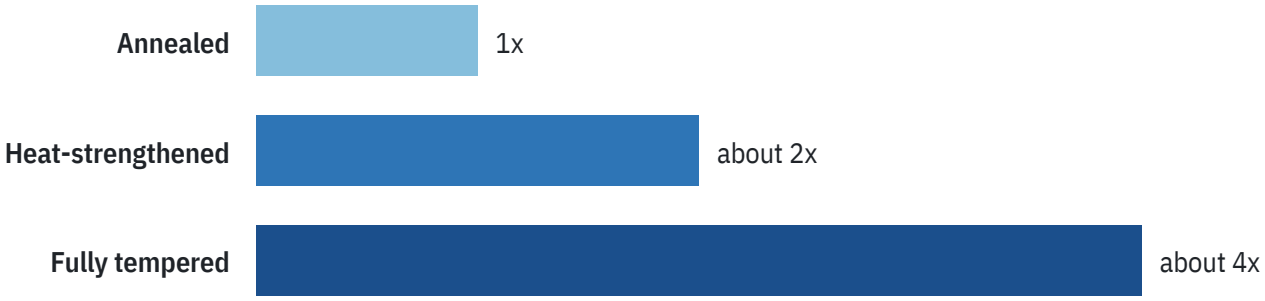
Heat-strengthened glass (HS) is annealed glass reheated to near its softening point and cooled in a controlled way. That builds compression into its surfaces and makes it about twice as strong as annealed glass of the same thickness. When it breaks, it tends to break into larger pieces that often stay in the frame.

Heat-strengthened glass is not safety glass. It is commonly used for vision and spandrel glass where the added strength or thermal-stress resistance is needed, and in laminated lites, where its larger break pattern helps the laminate stay in the opening.

Fully tempered glass

Fully tempered glass (FT) is reheated and cooled rapidly, building in much higher surface compression. It is about four times as strong as annealed glass. When it breaks, it breaks into small, relatively blunt pieces, which is why it can qualify as safety glazing. It cannot be cut, drilled, or edge-worked after tempering; all fabrication happens first.

Heat-strengthened and fully tempered glass are both covered by ASTM C1048, which defines the surface compression ranges for each.



Approximate strength relative to annealed glass of the same thickness.

	Heat-strengthened	Fully tempered
Strength	About 2x annealed	About 4x annealed
Break pattern	Larger pieces that often stay in the frame	Small, relatively blunt pieces
Safety glazing	No	Yes, when tested and marked to the safety glazing standard
Common uses	Vision and spandrel glass, laminated lites	Doors, sidelites, hazardous locations, high thermal or wind loads
Standard	ASTM C1048	ASTM C1048

Spontaneous breakage and heat soak testing

Tempered glass can, rarely, break without an outside cause. The usual culprit is a tiny nickel sulfide inclusion that slowly changes volume after tempering. A heat soak test holds tempered lites at an elevated temperature for a set time so that the most at-risk lites break in the oven instead of on the building. It is commonly performed to EN 14179.

Heat soaking reduces the risk; it does not eliminate it. Consider specifying it where tempered glass is required and a breakage would be costly or hazardous to replace, such as high on a facade or over occupied space. Heat-strengthened glass is far less susceptible, which is one reason it is often chosen where tempering is not required.

Distortion from heat treatment

Heat treatment passes glass over rollers while it is hot, which can leave slight waviness, called roller wave, that shows most in reflection. It is a normal characteristic of heat-treated glass, not a defect, within published limits. On a prominent reflective facade, specify acceptable distortion limits and review a full-size mockup.

Thermal stress

Glass that absorbs heat unevenly, such as tinted or coated glass partly shaded by a mullion, overhang, or interior blind, can crack from thermal stress. Heat-treated glass resists it far better than annealed glass. Ask the glass fabricator for a thermal stress analysis when you specify annealed tinted or coated glass, or annealed glass in spandrel.

CHAPTER 3

Safety glazing

FIELD GUIDE NO. 14

Safety glazing is glass tested to break in a way that limits injury. Fully tempered and laminated glass can both qualify. Heat-strengthened glass alone does not.

Where the code requires it

The International Building Code lists the hazardous locations that require safety glazing in Section 2406. In general terms, they include:

- Glazing in doors, including swinging, sliding, and bifold doors.
- Glazing adjacent to doors, within set distances of the door edge and above the floor.
- Large lites near the floor, meeting set size and height conditions, with walking surfaces nearby.
- Glazing in guards and railings.
- Glazing in walls and enclosures facing hot tubs, spas, whirlpools, saunas, steam rooms, bathtubs, showers, and indoor and outdoor swimming pools.
- Glazing adjacent to stairs, ramps, and landings, within set distances.

The exact distances, sizes, and exceptions are in the edition of the code your jurisdiction has adopted. Read Section 2406 for each project rather than working from memory. The code also requires safety glazing in hazardous locations to carry an identifying mark, with limited exceptions.

The two test standards

Standard	Categories	How they compare
CPSC 16 CFR 1201 (federal)	Category I and Category II	Category II is tested at a higher impact level and is the code default. Category I is allowed only in limited cases, generally smaller lites.
ANSI Z97.1	Class A and Class B	Class A is roughly comparable to Category II; Class B is roughly comparable to Category I.

When in doubt, specify safety glazing meeting CPSC 16 CFR 1201 Category II, and confirm the marking on each lite at installation.

CHAPTER 4

Laminated glass and insulating glass units

FIELD GUIDE NO. 14

Laminated glass

Laminated glass is two or more lites bonded together with an interlayer. When the glass breaks, the interlayer holds the pieces in place. That one property makes laminated glass the answer to many different requirements:

- **Safety glazing,** when tested and marked to the standard.
- **Overhead and sloped glazing,** where the building code limits which glass can be used (IBC Section 2405). Laminated glass is the common choice.
- **Security, ballistic, impact, and blast resistance,** with thicker or multiple interlayers (Chapter 8).
- **Sound control,** with acoustic interlayers.
- **Guards and railings,** and other locations where the glass must stay in place after breakage.
- **Ultraviolet control,** since standard interlayers block most UV.

The most common interlayer is PVB (polyvinyl butyral). Ionoplast interlayers are much stiffer and stronger, which allows thinner glass, longer spans, and better post-breakage performance; they are common in railings, canopies, and structural glass. Laminated glass is covered by ASTM C1172.

Laminated glass can use annealed, heat-strengthened, or tempered lites. Heat-strengthened lites are a frequent choice: stronger than annealed, with a larger break pattern than tempered, so a broken laminate keeps more stiffness in the opening.

Insulating glass units

An insulating glass unit (IGU) is two or more lites separated by a spacer around the edge and sealed, with a dry air space between them. Most commercial units are 1 inch overall: two 1/4 inch lites and a 1/2 inch space. Triple-glazed units add a third lite and a second space.

The parts of a unit:

- **Spacer.** Aluminum is traditional. Warm-edge spacers (stainless steel, or non-metal composites) reduce heat flow at the edge and help resist condensation there.
- **Primary seal.** Usually polyisobutylene (PIB), which limits moisture vapor and gas from passing through.
- **Secondary seal.** Usually silicone, polysulfide, or polyurethane, which holds the unit together. Units in structural silicone glazed curtain wall require a silicone secondary seal.
- **Desiccant.** Inside the spacer, it absorbs moisture in the air space.

- **Gas fill.** Argon is the most common. It slows heat transfer compared to air.

A failed edge seal lets moisture in, which shows as fogging or film between the lites. Insulating glass durability is tested to ASTM E2190, and many fabricators certify their units through a third-party program.

Surface numbering

Glass surfaces are numbered from the outside in. In a double-glazed unit, surface 1 faces outdoors, surfaces 2 and 3 face the air space, and surface 4 faces the room. A triple-glazed unit runs from 1 to 6. Coatings, frit, and patterns are always located by surface number, so use the numbers in your glass schedule.

CHAPTER 5

Low-E coatings, explained

FIELD GUIDE NO. 02

Low-E isn't one product. Coatings differ in how much light they pass, how much solar heat they block, and how they look, and the same coating performs differently depending on the glass, the unit, and the frame.

What low-E does

Low-E stands for low emissivity. A microscopically thin metallic coating reflects long-wave heat while letting visible light pass. In winter it helps keep heat in. In summer, solar control coatings also help keep solar heat out.

Hard coat and soft coat

- **Pyrolytic (hard coat)** low-E is applied while the float glass is being made. It is durable and can be handled and exposed more freely, but it offers less performance.
- **Sputtered (soft coat)** low-E is applied in layers in a vacuum chamber after the glass is made. It performs better, and most soft coats must be sealed inside an insulating glass unit, facing the air space. Room-side (surface 4) low-E coatings are special durable products.

One, two, or three silver layers

Silver does the reflecting. More silver layers give more control over the solar spectrum. Single-silver coatings focus on insulation. Double-silver coatings add solar control. Triple-silver coatings deliver the lowest solar heat gain while keeping visible light high.

The numbers that matter

Value	What it means	Better is
VT, visible transmittance	The share of daylight that passes through the glass	Higher is brighter
SHGC, solar heat gain coefficient	The share of solar heat that gets in, directly and by absorption	Lower blocks more heat
U-factor	The rate of heat flow through the glass from indoor-outdoor temperature difference	Lower insulates better
LSG, light to solar gain	VT divided by SHGC	Higher means more light for each unit of heat

Value	What it means	Better is
Reflectance, outdoor and indoor	The share of visible light reflected from each side	Depends on the design intent

Center-of-glass versus whole assembly

Published glass data is center-of-glass: the performance in the middle of a large lite. The spacer, the edge of the unit, and the frame all change the performance of the whole assembly. Energy codes look at the full assembly, rated under NFRC 100 (U-factor) and NFRC 200 (SHGC and VT), or calculated by an approved method. In curtain wall and storefront, the framing can have a large effect on the overall U-factor, so a high-performance glass alone does not guarantee a compliant assembly.

Coating position

Solar control coatings are most often on surface 2, the inside face of the outer lite. Some coatings are designed for surface 3, and some designs add a second low-E coating on surface 4 to improve U-factor. Moving a coating changes heat gain, reflectance, and color, so follow the manufacturer's recommended position.

Gas fill and spacers

Argon in the air space slows heat flow. In one published example, argon lowers the U-factor of a Solarban 60 unit from 0.29 to 0.24. Fills of about 90 percent argon are typical at manufacture. Warm-edge spacers improve performance at the edge of the unit.

Substrate and tint

The glass under the coating matters. Tinted substrates lower both light and heat: SunGuard SNX 62/27 drops from 62 percent visible transmittance on clear glass to 44 percent on CrystalGray. Low-iron glass raises light and gives a more neutral color: Solarban 60 goes from 70 percent to 74 percent on Starphire.

Heat treatment

Many coatings are available in versions that can be heat-strengthened or tempered after coating. Heat treatment can shift color and reflectance slightly. When a facade mixes heat-treated and annealed lites of the same coating, review samples and a mockup, and confirm the coating is approved for each process.

Climate and code

Cold climates reward a low U-factor. Hot climates reward a low SHGC. Mixed climates, like much of the Mid-Atlantic, need both. Energy codes set maximum fenestration U-factor and SHGC by climate zone. Confirm which

edition of the energy code your jurisdiction has adopted, and whether the project follows the prescriptive path or a performance path.

Three leading coatings, compared

These tables compare double-silver and triple-silver coatings from three manufacturers. Values are manufacturer-published, center-of-glass, in a 1 inch insulating unit (two 1/4 inch lites, 1/2 inch space) with argon, coating on surface 2 of clear glass. Guardian publishes SN 68's U-factor as 0.245, shown rounded.

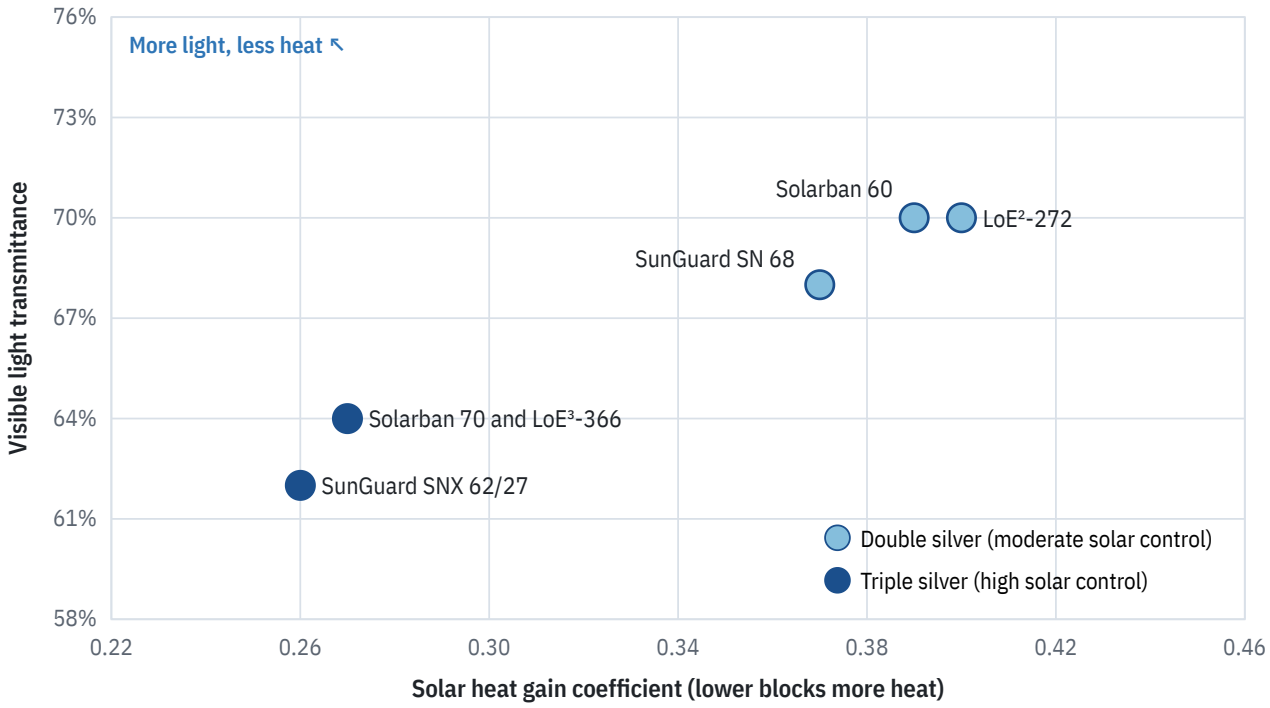
Moderate solar control: double-silver coatings

	Vitro Solarban 60	Guardian SunGuard SN 68	Cardinal LoE²-272
Visible transmittance	70%	68%	70%
SHGC	0.39	0.37	0.40
U-factor (winter)	0.24	0.25	0.25
Light to solar gain	1.79	1.82	1.75

High solar control: triple-silver coatings

	Vitro Solarban 70	Guardian SunGuard SNX 62/27	Cardinal LoE³-366
Visible transmittance	64%	62%	64%
SHGC	0.27	0.26	0.27
U-factor (winter)	0.24	0.24	0.24
Light to solar gain	2.37	2.36	2.37

Cardinal LSG calculated as VT divided by SHGC.



Light versus heat for the six coatings. Up and to the left is better: more light, less heat.

Reading the comparison. Within a tier, these coatings land within a few points of each other. The practical differences are color and reflectance, availability, lead time, heat-treatment options, and which fabricators in your region are certified to process each coating. Confirm current values with the manufacturer before you specify; published data is revised from time to time.

CHAPTER 6

Color, reflectivity, and reviewing glass samples

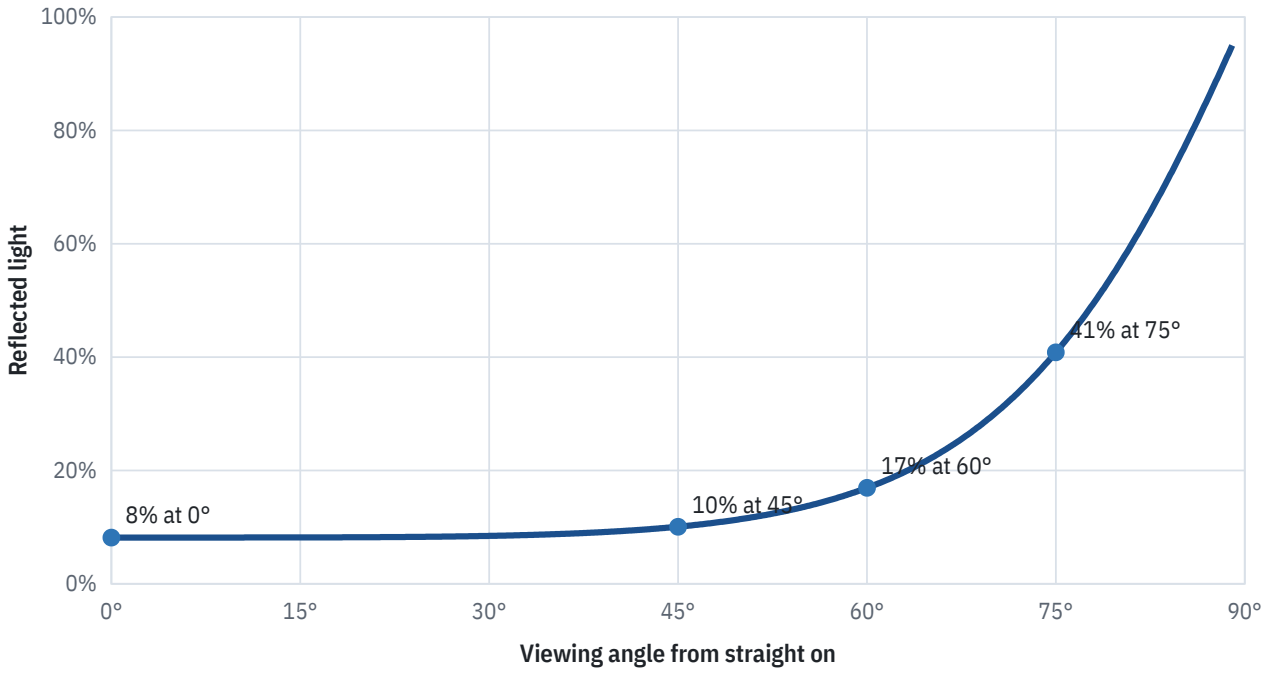
FIELD GUIDE NO. 24

Glass color depends on the coating, the substrate, the unit, the light, the viewing angle, and what is behind it. Small samples hide most of that.

Why glass looks different on the building

Reflected and transmitted color differ. From outside, you see mostly reflected color. From inside, you see transmitted color. Both matter, and they are often different.

Reflectivity climbs with angle. Glass reflects more light the further you look from straight on. The chart below shows uncoated glass; coated glass behaves differently, but the trend is the same. A facade seen from the street at a steep angle will look more reflective than a sample held straight on.



Reflection from uncoated glass (two surfaces) by viewing angle, from the Fresnel equations. Coated glass behaves differently; review real samples and manufacturer data.

What is behind the glass changes it. Interior lighting, ceilings, blinds, and dark spandrel cavities all change how vision glass reads, especially at night.

How to review samples

1. **Bring large samples.** Review a large sample, and a full-size insulating unit when you can. Small hand samples hide color.
2. **Look outdoors,** in the light the building will see: morning, afternoon, overcast, and clear sky.
3. **Check both sides.** Review reflected color from outside and transmitted color from inside.
4. **Change the angle.** Look straight on and at a slant, the way people will see the facade from the street.
5. **Match the process.** If the production glass will be heat-treated, ask for heat-treated samples, since heat treatment can shift color and reflectance slightly.
6. **Compare to neighbors.** Hold samples next to the spandrel, metal panels, and other finishes they will sit beside.
7. **Approve in writing.** Record the approved sample, its makeup, its source, and the date, so production matches.

Spandrel glass

Spandrel glass is opaque glass that hides slab edges, mechanical spaces, and structure. The common approaches are:

- **Ceramic frit spandrel,** with an opaque ceramic coating fired onto the glass during heat treatment.
- **Coated spandrel,** with a silicone or other opacifier applied to the inside surface.
- **Shadow box,** with vision-type glass in front of a backpan set back from the glass, which gives depth and a closer match to vision glass.

Spandrel areas can run hot, so spandrel glass is generally heat-treated. Matching spandrel to vision glass is one of the hardest color problems on a facade; review the two together at full size, in daylight.

Frit and patterns

Frit is a ceramic pattern fired onto glass during heat treatment. It is used for shading, privacy, branding, and bird-friendly design (Chapter 7). Frit density and color change light, heat gain, and appearance, so treat a fritted lite as its own glass type with its own performance data.

Mockups beat samples

A sample shows color. A mockup shows how color, reflectivity, joints, spandrel, and distortion work together at scale. For prominent facades, review a full-size visual mockup before production.

CHAPTER 7

Bird-friendly glazing

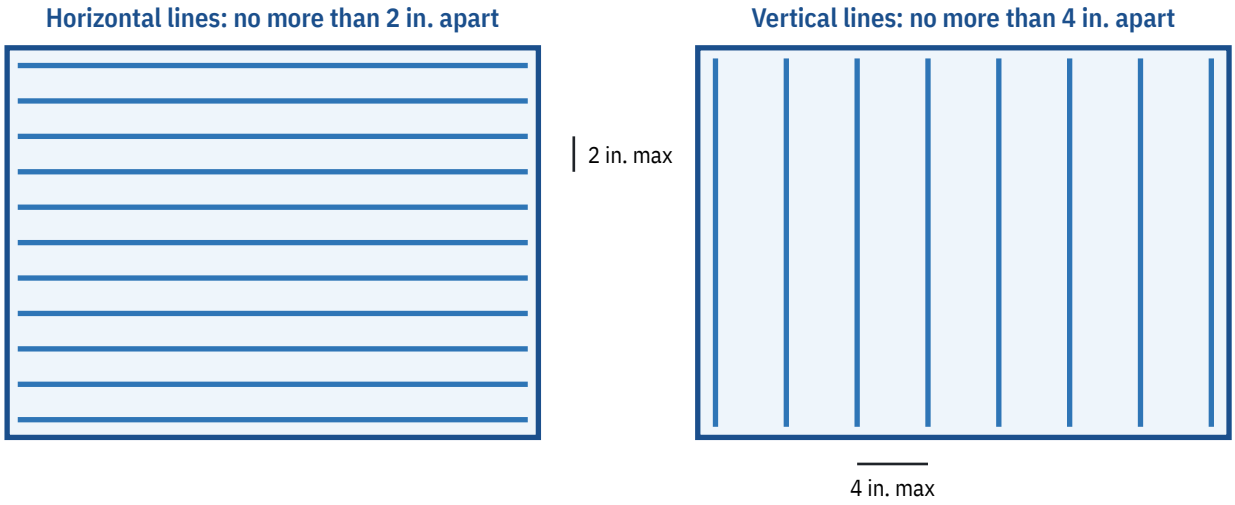
FIELD GUIDE NO. 18

Birds don't see clear or reflective glass as a barrier. They strike reflections of sky and trees, or fly toward plants they see through the glass. Collisions are most common in the lower floors, near vegetation, and where glass creates a see-through path, such as corners, bridges, and railings.

What works: visible patterns

Visible patterns on the glass break up reflections and tell birds the glass is there. Common approaches include ceramic frit, acid etching, patterned films, and screens or exterior shading in front of the glass.

The 2 by 4 rule is a widely used guideline: horizontal elements no more than 2 inches apart, or vertical elements no more than 4 inches apart. Tighter spacing, such as 2 by 2 inches, improves detection for smaller birds.



The 2 by 4 rule: horizontal lines no more than 2 inches apart, vertical lines no more than 4 inches apart.

Surface matters

Patterns on surface 1, the outdoor face, are usually the most effective, because reflections on the outer surface can hide patterns behind them. Patterns on interior surfaces tend to work less well, especially on reflective glass.

Threat factor ratings

Bird-friendly materials are rated by threat factor, determined by tunnel testing under the American Bird Conservancy's reference standard. The scale runs from 0 to 100; lower means fewer collisions. Programs and ordinances set their own thresholds. For example, New York City's Local Law 15 of 2020 requires materials with a

maximum threat factor of 25 on the exterior wall up to 75 feet above grade, among other areas. Many programs treat 30 or lower as bird-friendly.

Codes, incentives, and views

Some cities and green building programs require or reward bird-friendly design. Check local requirements early, since patterns affect glass selection, cost, and appearance. Patterns also affect views and daylight; review samples and a mockup at full size, from inside and out.

BASIS AND LIMITS

Guidelines vary by program and city. Confirm which standard your project must meet and review product test data.

CHAPTER 8

Security, ballistic, impact, and blast glazing

FIELD GUIDE NO. 15

Security, ballistic, impact, blast, and fire-rated glazing each answer a different threat. They are tested to different standards, and a rating in one says nothing about the others. Most importantly, **these ratings belong to tested systems.** The glass, the frame, the anchors, and often the surrounding wall must be rated to match.

Security glazing: forced entry

Security glazing is built to resist forced entry, not bullets. It is usually laminated glass or glass-clad polycarbonate with thicker or multiple interlayers, rated by how long it holds up to a standard attack. Common standards include ASTM F1233 and UL 972. ASTM F3561 tests forced-entry resistance of fenestration systems after a simulated active-shooter attack, increasingly specified for school entrances. It is not a ballistic rating.

Ballistic glazing: bullet resistance

Bullet-resistant glazing is a multi-layer laminate, often glass and polycarbonate. **It is rated by the threat it stops, not by its thickness.** In the U.S., UL 752 is the most common standard.

The 12th edition of UL 752 replaced the familiar Level 1 to 10 scale with three non-hierarchical tables by firearm type: handgun (UL-HG), rifle (UL-RF), and shotgun (UL-SG). A product that passes more than one test carries each rating separately. Many specifications still cite the earlier levels, so check which edition the spec references.

Earlier UL 752 level	Threat	Shots
Level 1	9 mm handgun	3
Level 2	.357 Magnum handgun	3
Level 3	.44 Magnum handgun	3
Level 4	.30-06 rifle	1
Level 5	7.62 mm NATO rifle	1
Level 6	9 mm submachine gun	5
Level 7	5.56 mm rifle	5
Level 8	7.62 mm NATO rifle	5
Level 9	.30-06 armor-piercing rifle	1

Earlier UL 752 level	Threat	Shots
Level 10	.50 caliber rifle	1

Levels 1 to 3 build on each other. Above Level 3, the levels describe different threats rather than a simple ladder, which is one reason the 12th edition moved to separate tables.

Impact glazing: windborne debris

Hurricane impact glazing resists windborne debris and the pressure cycling that follows. It is tested to ASTM E1886 (the test method) and ASTM E1996 (the specification), and in Florida's high-velocity hurricane zones to the Miami-Dade TAS protocols. The building code defines windborne debris regions from the design wind speed and distance to the coast; check the project's wind maps early.

Blast-resistant glazing

Blast-resistant glazing is designed so the glass stays in the opening, or fails in a controlled way, under an air blast. Glazing is tested to standards such as ASTM F1642, and federal and defense projects often follow criteria such as UFC 4-010-01. Blast design typically uses laminated glass in an engineered system with anchors and supporting structure designed for the load.

Where special function glazing lives in the spec

Section	Title
08 81 00	Glass Glazing
08 87 23	Safety and Security Films
08 88 00	Special Function Glazing
08 88 13	Fire-Resistant Glazing
08 88 19	Hurricane-Resistant Glazing
08 88 53	Security Glazing
08 88 56	Ballistics-Resistant Glazing

CSI MasterFormat numbers. Despite its title, 08 88 13 is commonly used for both fire-protective and fire-resistive glazing (Chapter 9). Projects may number or combine sections differently.

CHAPTER 9

Fire-rated glazing

FIELD GUIDE NO. 15

Fire-rated glazing is tested and listed as a complete assembly: the glass, the frame, and the installation. Substituting any part can void the rating. Ratings run from 20 minutes up to 3 hours.

Fire-protective and fire-resistive

	Fire-protective glazing	Fire-resistive glazing
What it does	Blocks flames and smoke for the rated time	Blocks flames and smoke, and limits radiant heat transfer
Tested as	Fire door and fire window assemblies	Wall assemblies
Typical use	Openings in rated walls, within the code's size and area limits	Areas that must perform like a rated wall, including larger glazed areas
Heat transfer	Not limited; the glass can get hot	Limited, so occupants can pass close by

Reading the label

Each lite of fire-rated glazing carries a permanent mark that tells the inspector how it was tested and where it can go. The marks are defined in the IBC (Section 716).

Mark	Meaning	Test standard
W	Meets wall assembly criteria	ASTM E119 or UL 263
OH	Meets fire window assembly criteria, including the hose stream test	NFPA 257 or UL 9
D	Meets fire door assembly criteria	NFPA 252, UL 10B, or UL 10C
H	Meets the fire door assembly hose stream test	NFPA 252, UL 10B, or UL 10C
T	Meets the 450°F temperature rise criteria for 30 minutes	NFPA 252, UL 10B, or UL 10C
FC	Meets floor and ceiling criteria	ASTM E119 or UL 263
Number	The fire rating in minutes, such as 45, 90, or 120	

A label reading "D-H-T-90," for example, describes glazing tested for use in a 90-minute fire door, including the hose stream and temperature rise tests.

BASIS AND LIMITS

Security, ballistic, impact, blast, and fire ratings apply to tested systems, not just the glass. The project specification, the building code, and the authority having jurisdiction decide what is required. Confirm listings with the manufacturer.

CHAPTER 10

Writing the glass type schedule

A complete glass type schedule is the single most useful thing an architect can give a glazing contractor. It lets every bidder price the same glass and lets the fabricator build it without an RFI.

What each glass type should state

- ☐ **A type tag** used on the elevations, such as GL-1, matching every location on the drawings.
- ☐ **The full makeup from the outside in:** each lite's thickness and substrate (clear, low-iron, tinted), the air space width, and the inner lite.
- ☐ **Heat treatment for each lite:** annealed, heat-strengthened, or fully tempered, and whether heat soaking is required.
- ☐ **Coatings and their surfaces:** the basis-of-design low-E, with surface number, and any second coating.
- ☐ **Frit, patterns, or etching,** with pattern, color, coverage, and surface.
- ☐ **Gas fill and spacer:** argon or air, and spacer type and color.
- ☐ **Laminated lites:** interlayer type and thickness, and which lite is laminated.
- ☐ **Performance targets:** VT, SHGC, U-factor, and outdoor reflectance, stating whether values are center-of-glass.
- ☐ **Safety glazing,** where required, with the standard and category.
- ☐ **Special ratings:** fire, impact, security, ballistic, blast, or bird-friendly threat factor, with the standard cited.
- ☐ **Basis of design and equals,** with permission for equal coatings where the performance and appearance match.

A sample entry

Item	GL-1, typical vision glass
Outboard lite	1/4 in. clear, heat-strengthened, triple-silver low-E on surface 2
Air space	1/2 in., 90% argon, warm-edge spacer, black
Inboard lite	1/4 in. clear, heat-strengthened
Performance (center-of-glass)	VT 60% minimum, SHGC 0.28 maximum, U-factor 0.25 maximum
Basis of design	Vitro Solarban 70, or equal approved by the architect
Notes	Fully tempered where required by IBC 2406; mark each tempered lite

The sample is illustrative. Its limits are set so more than one triple-silver coating in Chapter 5 can meet them, which keeps "or equal" real. Confirm current data and adjust to your project's energy code and design.

Common gaps

- A glass type shown on the elevations but missing from the schedule, or the reverse.
- Safety glazing required by location but not called out, so the glass is priced as heat-strengthened.
- Spandrel glass with no makeup, color, or opacifier defined.
- Performance targets that no listed product can meet together.
- A coating named without its surface or substrate.

Our Glazing Design and Specification Manual covers writing the rest of the glazing section: read it here.

Choosing glass for a project?

We're glad to walk through the options with you, arrange samples, or review a glass schedule while you're in design.

estimating@bcmglassco.com · **bcmglassco.com**

CHAPTER 11

Sources and basis

This manual reflects BCM Glass's practice as a commercial glazing contractor, manufacturer-published data, and the standards below. Standards and codes are revised periodically; use the editions the project and jurisdiction reference.

- ASTM C1036, standard specification for flat glass. ASTM International.
- ASTM C1048, standard specification for heat-strengthened and fully tempered flat glass. ASTM International.
- ASTM C1172, standard specification for laminated architectural flat glass. ASTM International.
- ASTM E2190, standard specification for insulating glass unit performance and evaluation. ASTM International.
- EN 14179, heat soaked thermally toughened soda lime silicate safety glass. European Committee for Standardization.
- International Building Code, Sections 2405 (sloped glazing and skylights), 2406 (safety glazing), and 716 (opening protectives). International Code Council.
- CPSC 16 CFR 1201, safety standard for architectural glazing materials. U.S. Consumer Product Safety Commission.
- ANSI Z97.1, safety glazing materials used in buildings. American National Standards Institute.
- NFRC 100 and NFRC 200, procedures for determining fenestration product U-factors, and solar heat gain coefficient and visible transmittance. National Fenestration Rating Council.
- Vitro Architectural Glass, Guardian Glass, and Cardinal Glass Industries, published performance data for the coatings named in Chapter 5.
- American Bird Conservancy, Bird Collision Deterrence Material Threat Factor Reference Standard, and published guidance on bird-friendly glass patterns.
- New York City Local Law 15 of 2020, bird friendly materials.
- ASTM F1233, UL 972, and ASTM F3561, security glazing and forced-entry resistance standards.
- UL 752, standard for bullet-resisting equipment, 12th edition, and earlier editions for the level table.
- ASTM E1886 and ASTM E1996, impact and windborne debris standards. Miami-Dade County TAS 201, 202, and 203.
- ASTM F1642, test method for glazing and glazing systems subject to airblast loadings. UFC 4-010-01, DoD minimum antiterrorism standards for buildings.
- ASTM E119, UL 263, NFPA 252, UL 10B, UL 10C, NFPA 257, and UL 9, fire test standards referenced by the IBC fire-rated glazing marks.
- CSI MasterFormat, Construction Specifications Institute.

General guidance only. The project specification, the building code, and the authority having jurisdiction decide what is required. Prepared by BCM Glass, Ashland, Virginia. Questions: estimating@bcmglassco.com.