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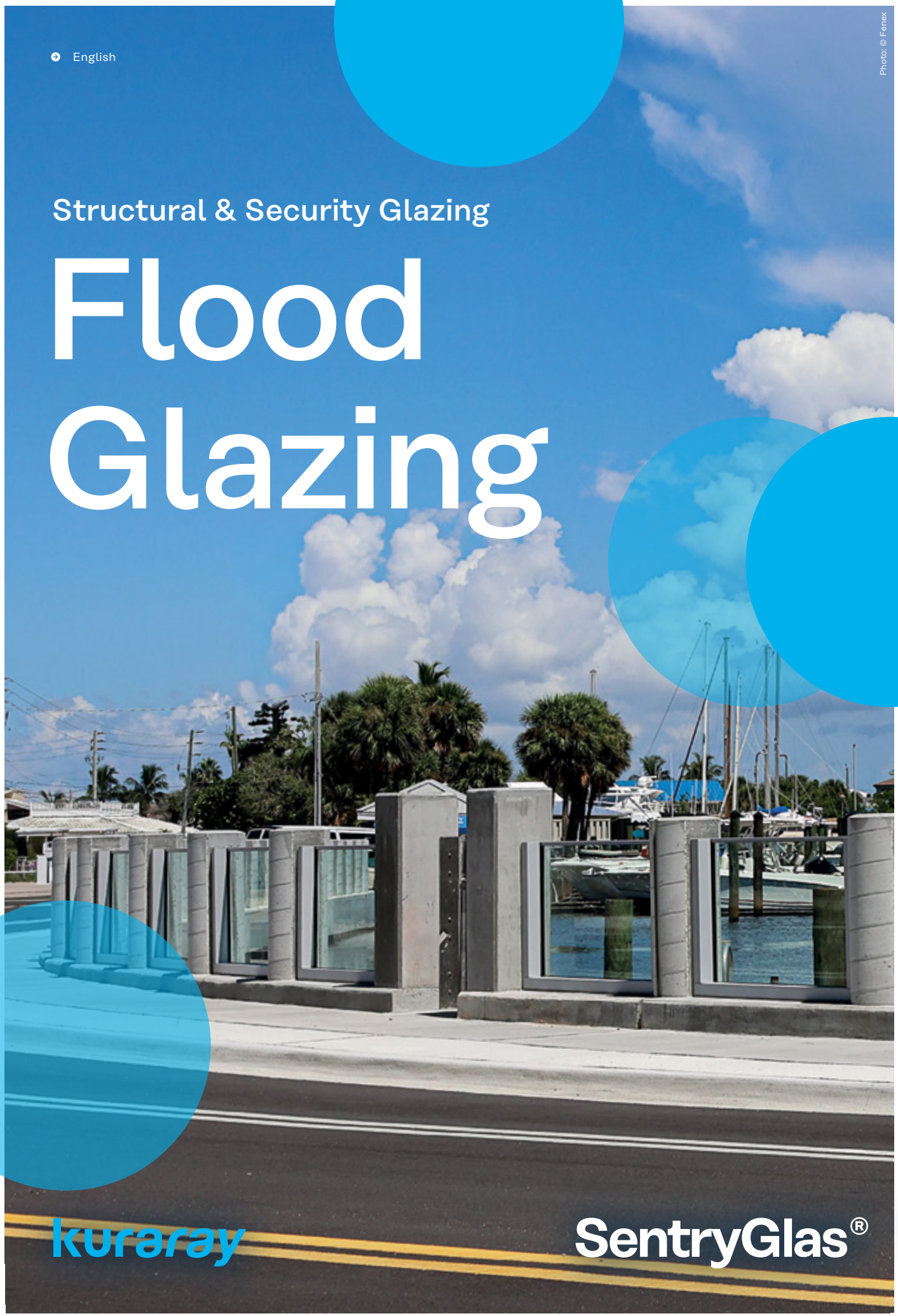

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Structural & Security Glazing

Flood Glazing

kuraray

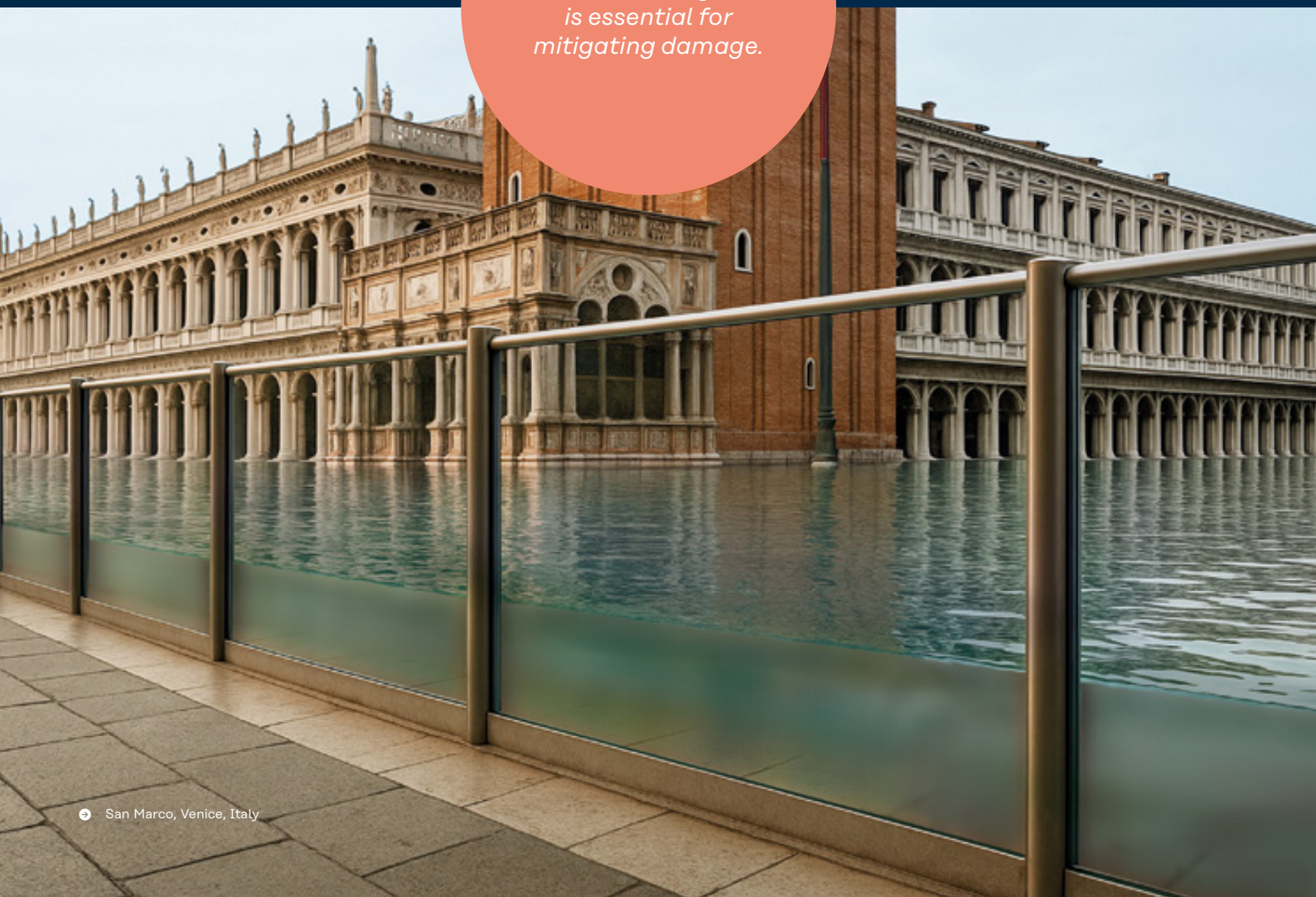
SentryGlas®

THE FINANCIAL IMPLICATIONS OF FLOODS ARE INCREASING, AND THERE IS A GROWING NEED FOR EFFECTIVE MITIGATION STRATEGIES. Commercial and residential properties are at risk of significant and increasing flooding. Resilient glazing systems are being offered by manufacturers as a means of reducing the impact of floods. These systems offer passive protection and eliminate the necessity of boarding up apertures, deploying storm shutters, or positioning sandbags. Many of these flood-resistant glazing systems have utilized laminated glass with Kuraray's SentryGlas® (SG®) and SentryGlas Xtra® (SGX®) ionoplast interlayer.

Laminated glass is an important part of resilient glazing systems because of its ability to remain intact after impact and/or glass breakage. The interlayer that connects the glass is essential for mitigating damage from high winds, rain, tornadoes, hail, and inundation.

Kuraray is the exclusive manufacturer of SG® and SGX® ionoplast interlayer, which has a long history of use in extreme weather systems such as hurricanes, typhoons, and tornadoes. It is currently being demonstrated in glazing systems that are capable of withstanding floods.

The interlayer that connects the glass is essential for mitigating damage.



San Marco, Venice, Italy

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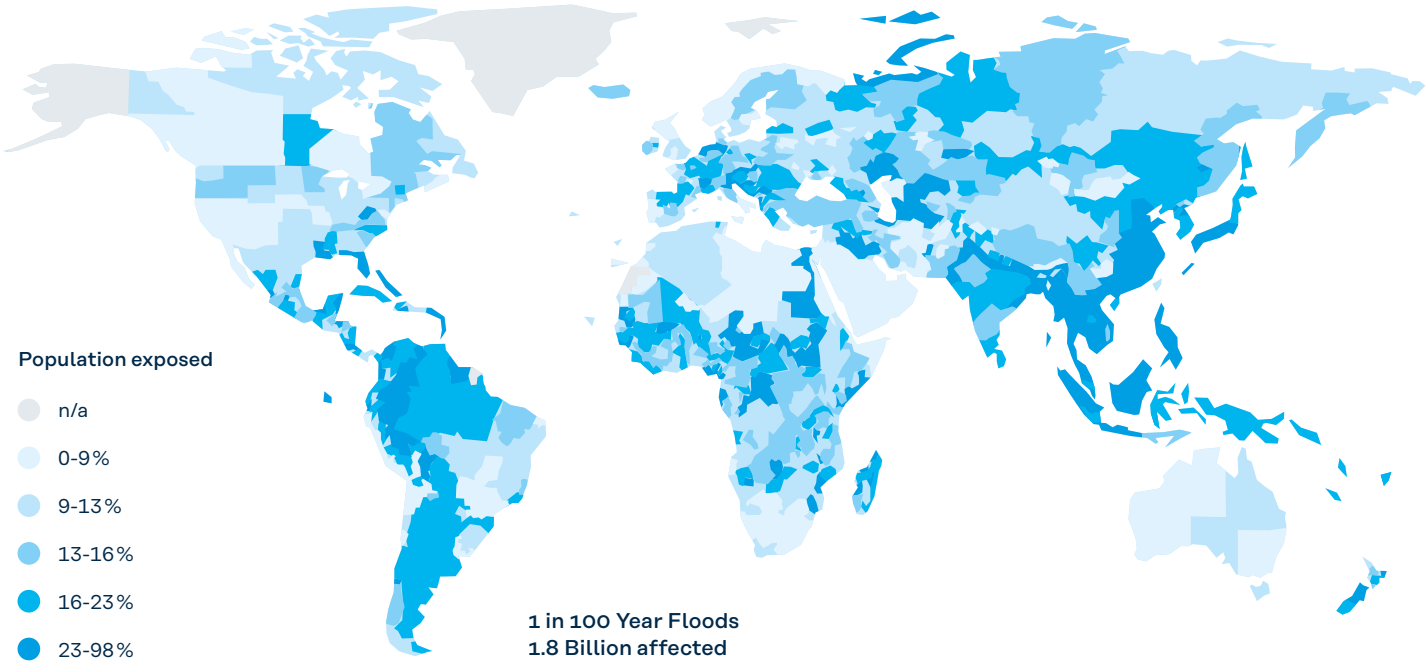
Risk of flooding is increasing globally

The rise in global sea levels is a result of the thawing of glaciers, thermal expansion, and the change in weather systems. Flash floods, tidal surges, and prolonged inundation pose a growing hazard to coastal cities, including Jakarta, Lagos, Miami, and Rotterdam. Flooding in Mokwa, Nigeria, in 2025, resulted in the displacement of thousands due to excessive rainfall and dam failures. In July 2025, the Guadalupe River in Central Texas, USA, experienced catastrophic flooding, resulting in the fatalities of over 100 individuals. Additionally, Southern China experienced record-breaking rainfall and typhoons, which prompted mass evacuations in Guangdong Province.

Furthermore, the United Kingdom, Germany, and Belgium experienced tragic floods in 2021, which underscores Europe's susceptibility to severe weather. Similar patterns are observed in cases from Brazil, Spain, Japan, India, Indonesia, and Bangladesh. These incidents are not isolated. In addition to flood-resistant glazing, they represent a systemic global trend that necessitates resilient building solutions.

Flood Exposure and Poverty in 188 Countries (2022)



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CAUSES OF FLOODING

- **Rising Sea Levels**
  Rising levels, coastal erosion, storm surges, silt build up
- **Increased storm frequency**
  Wind patterns intensify, warmer sea surface temperatures create air movement, off shore currents changing
- **Urbanization**
  Increased density, impermeable surfaces causing run off. Stretch on waste water management
- **De-Forestation**
  Increased run off, land erosion, less water absorption.

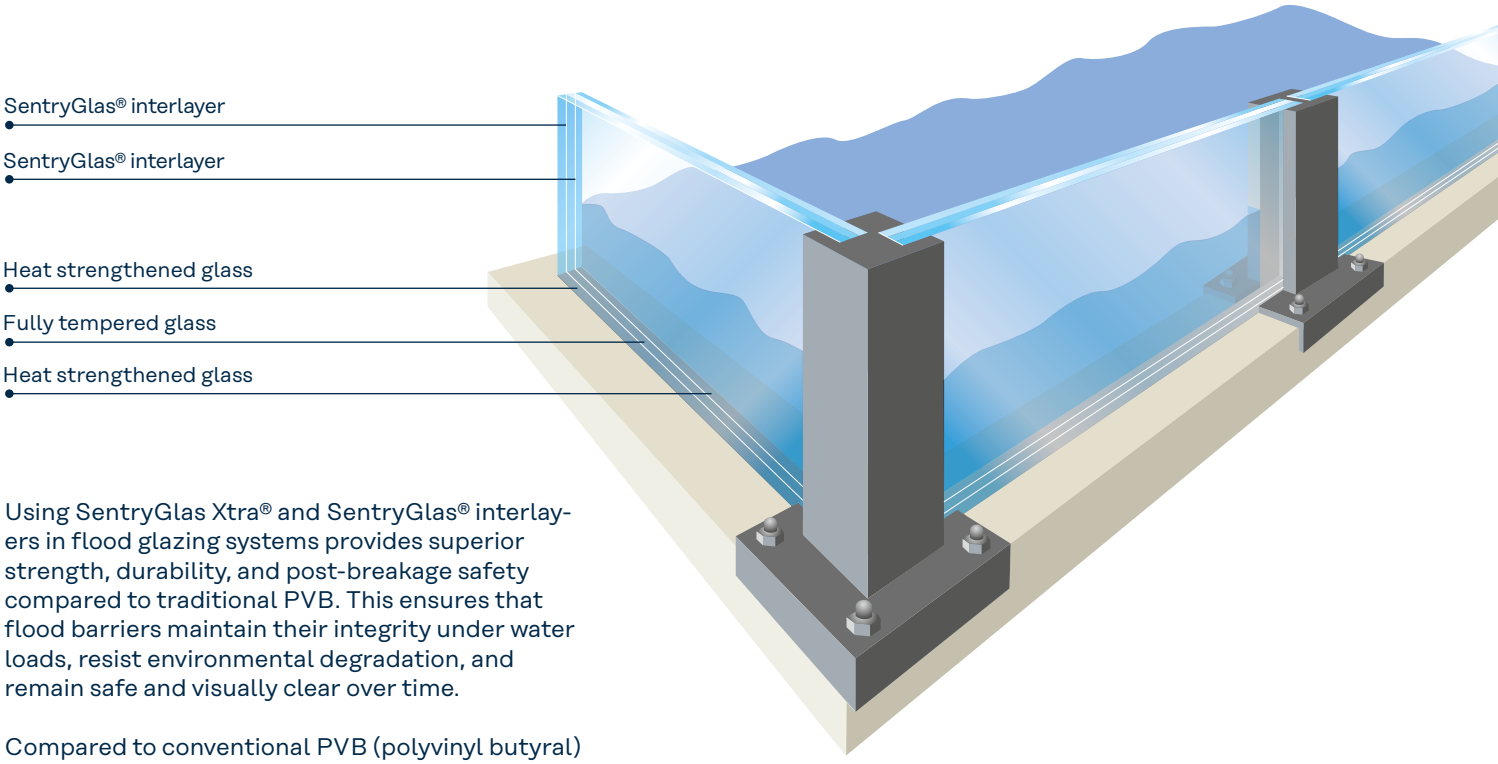
CAUSES OF RIVER FLOODING

- **Extreme rainfall**
  Climate change leads to more intense precipitation events.
- **Urbanization**
  Increases impermeable surfaces, leading to runoff
- **Water management**
  Example: 2019 Spencer Dam collapse in Nebraska caused a **12-foot wave** of floodwaters.

CAUSES OF COASTAL FLOODING

- **Storm Surges**
  Increase of 6-10 feet in sea level during hurricanes, high tides.
- **Rising Sea Level**
  NOAA projects up to 2 feet of sea level rise by 2100, increasing flood frequency
- **Erosion**
  Loss of 100+ feet of coastline annually in some areas

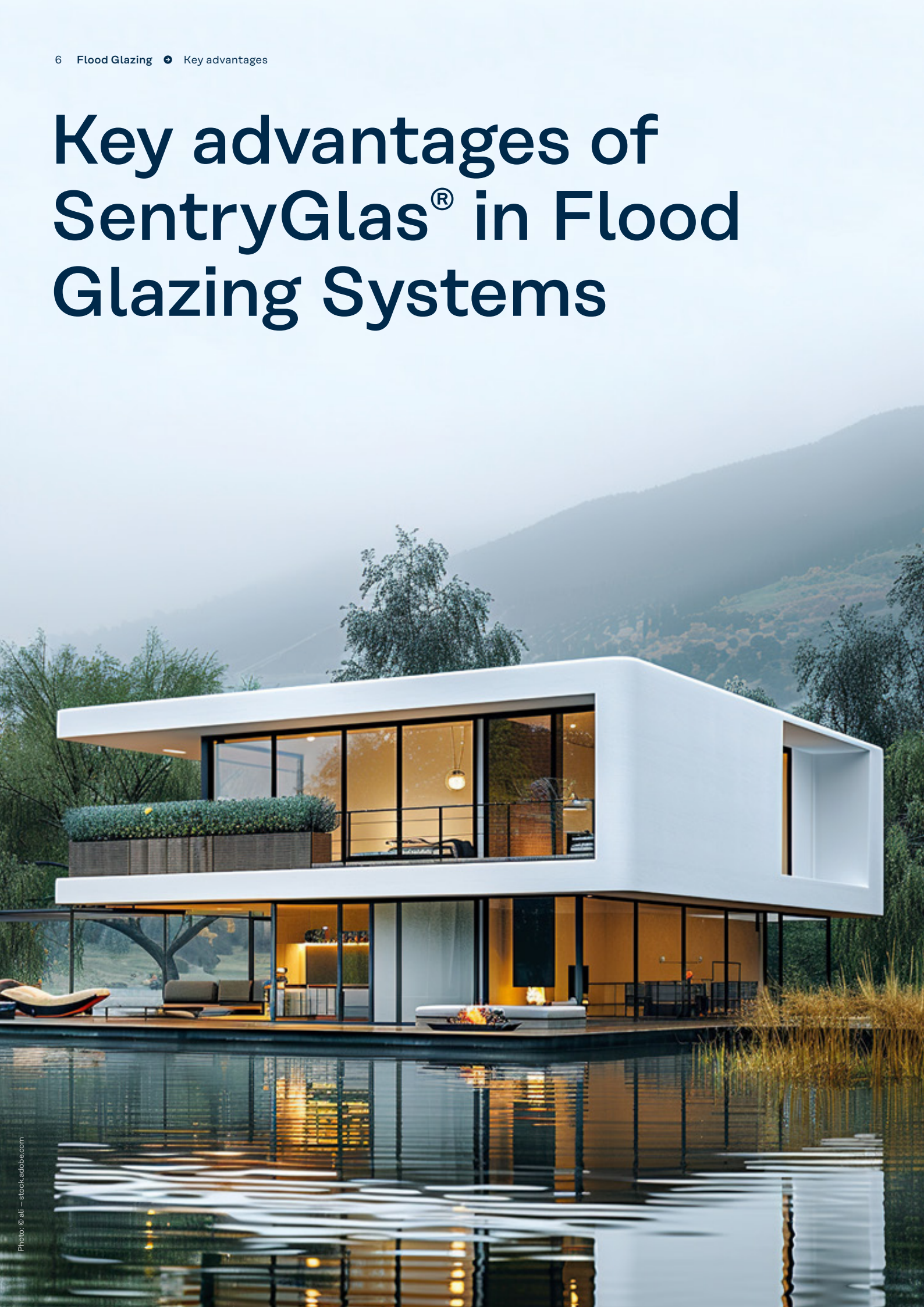
Flood Glazing System



Using SentryGlas Xtra® and SentryGlas® interlayers in flood glazing systems provides superior strength, durability, and post-breakage safety compared to traditional PVB. This ensures that flood barriers maintain their integrity under water loads, resist environmental degradation, and remain safe and visually clear over time.

Compared to conventional PVB (polyvinyl butyral) interlayers, SG® and SGX® offers several advantages.

Key advantages of SentryGlas® in Flood Glazing Systems



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➔ NYU Langone, New York City, USA

1. IMPROVED STRUCTURAL PERFORMANCE

- SentryGlas® is about 100 times stiffer and 5 times stronger than standard PVB.
- SentryGlas® allows flood glazing panels to withstand higher hydrostatic pressures and larger spans with reduced deflection.

2. SUPERIOR POST-BREAKAGE SAFETY

- SentryGlas® provides greater residual load-bearing capacity
- Even if the glass cracks under flood pressure, SentryGlas® maintains barrier integrity longer, reducing the risk of catastrophic water breach

3. OPTIMIZED MOISTURE & EDGE STABILITY

- SentryGlas® offers exceptional resistance to moisture ingress and edge defects, which is critical in continuous contact with floodwater
- This is especially important in flood-prone areas where glazing may be exposed to high humidity, water contact, and prolonged sunlight
- This leads to longer service life and lower maintenance.

4. BEST LONG-TERM DURABILITY

- SentryGlas® offers improved UV stability, clarity, and resistance to delamination
- Clarity and stability over decades

5. HIGHER SAFETY MARGINS AGAINST IMPACT

- SentryGlas® has enhanced energy absorption, giving it the best performance against floating debris impacts (wood, metal, etc.) carried by floodwaters
- Higher level of resilience beyond static water pressure
- Maintains its stiffness and bond strength even in warm, humid conditions

6. WIDER DESIGN FLEXIBILITY

- Design possibilities with thinner glass or larger panel sizes without compromising safety
- This reduces weight, supporting frame costs, and installation complexity

7. TEST PERFORMANCE

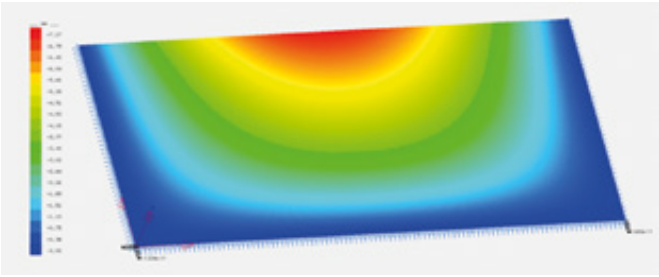
- SentryGlas® outperforms all standard test methods and codes
  - Glass stress: Four Point Bend Test
  - EN 16612:2019 Glass in building Determination of the lateral load resistance of glass panes by calculation
  - EN 16613:2019 Glass in building – Laminated glass and safety glass – Determination of interlayer mechanical properties
  - ANSI FM2510
  - BSi BS 851188 1/2

Structural performance of Flood Barrier Glazing constructions

Constructions

Construction	Laminate construction
Construction A	3 x 10 mm heat strengthened glass (HS) + 1.52 mm SentryGlas® interlayer
Construction B	2 x 10 mm Heat Strengthened glass (HS) + 1.52 mm SentryGlas® interlayer 1 x 12 mm Fully Toughened glass core (FT)
PVB Construction	3 x 10 mm heat strengthened glass (HS) + 1.52 mm PVB interlayer

TAB 1



Construction A – Static Water Pressure Load

Glass temperature	Interlayer E(t)-Modulus [MPa]	Deflection [mm]	Glass stress [MPa]	Comment
30 °C	35.00	7.17	9.60	Stable
30 °C (1 glass layer broken)	35.00	20.63	19.92	Still safe

TAB 2

Construction B – Static Water Pressure Load

Condition	Interlayer E(t)-Modulus [MPa]	Deflection [mm]	Glass stress [MPa]	Comment
30 °C	35.00	6.03	8.51	Very stable
30 °C (1 glass layer broken)	35.00	15.99	16.93	Still stable

TAB 3

PVB Construction – Static Water Pressure Load

Condition	Interlayer E(t)-Modulus [MPa]	Deflection [mm]	Glass stress [MPa]	Comment
30 °C	0.01	48.90	25.88	Exceeding the limits
30 °C (1 glass layer broken)	0.01	70.41	39.04	Higher breakage probability

TAB 4

DYNAMIC SOFT BODY IMPACT / 50 KG FROM 1200 MM HEIGHT

Construction A – Dynamic Impact

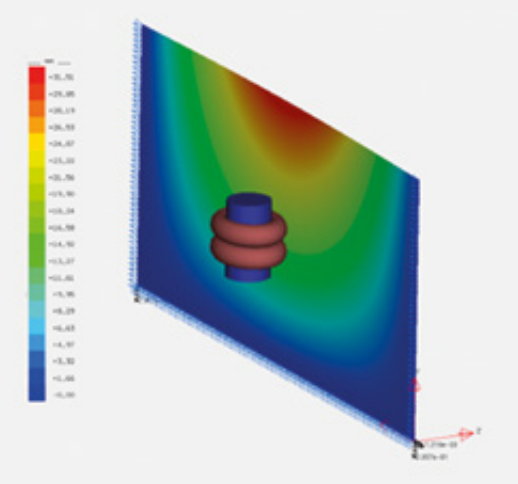
Condition	Interlayer E(t)-Modulus [MPa]	Deflection [mm]	Glass stress [MPa]	Comment
30 °C	443.00	31.51	83.31	Okay
30 °C (1 glass layer broken)	443.00	54.65	95.81	Still stable

TAB 5 ➔

Construction B – Dynamic Impact

Condition	Interlayer E(t)-Modulus [MPa]	Deflection [mm]	Glass stress [MPa]	Comment
30 °C	443.00	26.85	69.22	Okay
30 °C (1 glass layer broken)	443.00	49.38	87.54	Still stable

TAB 6 ➔



Structural performance of Flood Window Glazing constructions

Dimension of the glazing panel

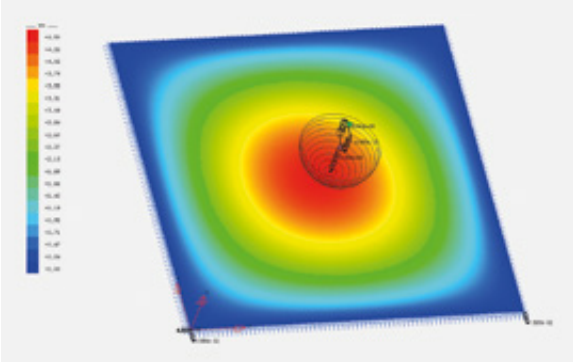
1800 mm (w) x 1800 mm (h)

Supported on all 4 sides
in a strong glazing profile

Vertical position / 90°

Water Pressure of max. 18.00 KPa at 30°C for 1 month duration

Linear decreasing from 18.00 KPa
to 0.00 KPa at the top of the panel



Limits

Max. allowable glass stress 24.00 Mpa for HS-Glass (acc. ASTM E.1300 for a duration of 1 month)

Deformation shall not exceed 1/120 of the span = 15.00 mm

Glazing construction shall be still stable when one outer glass layer will fail ("sacrificial layer")

Construction A – Static Water Pressure Load

Condition	Interlayer E(t)-Modulus [MPa]	Deflection [mm]	Glass stress [MPa]	Comment
30 °C	35.00	3.07	11.23	Very stable
30 °C (1 glass layer broken)	35.00	8.26	23.58	Still stable

TAB 7

Construction B – Static Water Pressure Load

Condition	Interlayer E(t)-Modulus [MPa]	Deflection [mm]	Glass stress [MPa]	Comment
30 °C	35.00	2.58	9.91	Very stable
30 °C (1 glass layer broken)	35.00	6.52	20.04	Still stable

TAB 8

PVB Construction – Static Water Pressure Load

Condition	Interlayer E(t)-Modulus [MPa]	Deflection [mm]	Glass stress [MPa]	Comment
30 °C	0.01	3.61	11.49	Okay
30 °C (1 glass layer broken)	0.01	10.09	23.54	Borderline

TAB 9

DYNAMIC SOFT BODY IMPACT / 30 KG FROM 800 MM HEIGHT

Construction A – Dynamic Impact

Condition	Interlayer E(t)-Modulus [MPa]	Deflection [mm]	Glass stress [MPa]	Comment
30 °C	443.00	4.58	23.63	Okay
30 °C (1 glass layer broken)	443.00	15.64	47.15	Still stable

TAB 10 ➔

Construction B – Dynamic Impact

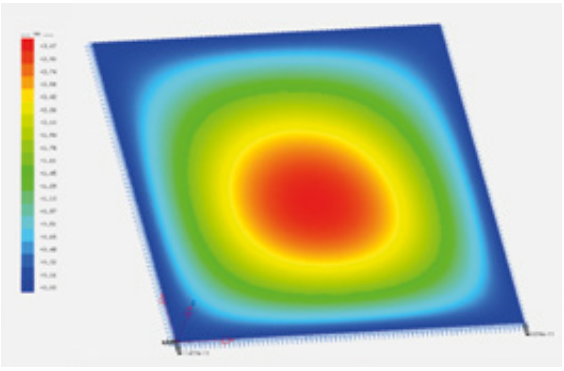
Condition	Interlayer E(t)-Modulus [MPa]	Deflection [mm]	Glass stress [MPa]	Comment
30 °C	443.00	3.61	13.27	Okay
30 °C (1 glass layer broken)	443.00	21.37	46.26	Still stable

TAB 11 ➔

PVB Construction – Dynamic Impact

Condition	Interlayer E(t)-Modulus [MPa]	Deflection [mm]	Glass stress [MPa]	Comment
30 °C	2.80	17.74	41.33	Okay
30 °C (1 glass layer broken)	2.80	22.87	55.10	Still stable

TAB 12 ➔



Comparison of SentryGlas Xtra®, SentryGlas® and PVB in Flood Glazing systems

PVB laminates are durable, but moisture sensitive.

Some PVB laminates may experience discoloration and edge delamination due to excessive moisture exposure or processing issues.

This table compares SentryGlas Xtra®, SentryGlas®, and PVB (Polyvinyl Butyral) interlayers for flood glazing systems. SGX® is considered the most advanced and recommended solution, followed by SentryGlas®, while PVB is generally unsuitable for demanding flood applications.

Comparison of SentryGlas Xtra®, SentryGlas® and PVB in Flood Glazing systems

Property	SG® and SGX®	PVB (Polyvinyl Butyral)	Relevance for Flood Glazing
Strength & Stiffness	Highest stiffness and strength, allows maximum design freedom	Relatively weak and flexible	SG® and SGX® provides unmatched resistance to hydrostatic pressure, PVB is inadequate
Post-Breakage Integrity	Superior residual strength and integrity even after glass breakage	Loses most of its integrity when glass breaks	SG® and SGX® ensures ultimate safety barrier, PVB unsafe
Moisture Resistance	Exceptional resistance to moisture and edge stability	Susceptible to delamination and defects	SG® and SGX® provides the longest durability, PVB unsuitable for flood-prone environments
UV & Weathering Resistance	Best-in-class clarity, UV resistance, and long-term performance	Yellows, hazes, and weakens over time	SG® and SGX® maintains aesthetics indefinitely, PVB deteriorates quickly
Impact Resistance	Highest resistance to debris impacts and blasts	Low resistance	SG® and SGX® gives ultimate protection, PVB inadequate
Temperature Stability	Maintains stiffness and integrity at extreme temperatures	Softens and weakens with heat	SG® and SGX® ideal for hot/humid climates, PVB unreliable
Panel Design Flexibility	Enables thinnest glass and largest spans with safe performance	Requires thicker glass and smaller spans	SG® and SGX® reduces structural costs most, PVB not practical
Aesthetic Longevity	Best optical clarity and edge stability over decades	Edge defects and discoloration over time	SG® and SGX® ensures aesthetics long-term, PVB degrades

SGX® interlayers are the premium solution for Flood Glazing systems in all critical aspects: load resistance, durability in wet conditions, safety after breakage and long-term clarity.

SentryGlas® laminates perform, even when edges are exposed to the elements.

NYU Langone, New York City, USA

Photo: © Fenex

Contact

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FOR FURTHER INFORMATION
on products from Kuraray, please visit www.kuraray.com.
You can find further information on our Trosifol® and SentryGlas® products at www.trosifol.com.

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3/2026

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