TRANSPARENT BUILDINGS WITH COATED GLASS

Michael Elstner | 15 November 2018

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glasstec 2018 – Trend Topics

- Industry 4.0
- Thin Glass
- Facades
- Interior/ Smart Glass/ Crafts

What future potential do you see for the material glass in the building envelope? What functions will glass perform? (constructive, informative)

„The landscape of glass for building envelopes is changing rapidly due directly to the increasing demands we are putting on façade performance. To remain relevant innovation in how the material can be augmented to meet the performance targets while inherently allowing light in to our buildings has never been more important. We see the future of glass in buildings being one where technological advancements allow the glass to be adaptive and responsive to the performance requirements, making space comfortable to be in and reducing energy demands. There are many interesting ways in which this is being tackled many of which are in an embryonic stage. I see this as an exciting area of study and development, one which glasstec is fundamental in the promotion of."

James O. Callaghan, Eckersley O’Callaghan

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New York's 9 tallest buildings under construction in 2016

217 West 57th Street
Platin 46/31 1,550FT

30 Hudson Yards
Platin 46/31 1,296FT

111 West 57th Street
1,438FT Not Interpane

175 Greenwich Street
Platin 59/30 1,079FT

53 West 53rd Street
1,050FT Vision 50

35 Hudson Yards
Platin 47/29 1,009FT
Platin 46/31

220 Central Park South
950FT Neutral 70/39

Manhattan West
995FT Vision 50T

15 Hudson Yards
914FT Vision 50
Double Glazing

Outside: 10 mm (3/8"
Cavity: 12 mm (1/2"
Inside: 6 mm (1/4"

- Size: 1228 mm x 1432 mm
- 38.35" x 1432"
- Offset 43 mm (1.69")
53 W 53rd St NY

**Double Glazing**

**Outside:** 10 mm (3/8") ipaclear HS  
Stopray Vision 50 on #2

**Cavity:** 16 mm (5/8") air

**Inside:** 10 + 10 mm (3/8" + 3/8") ipaclear HS laminated

- Size: 2242 x 8639 mm
- 88.28 x 340.125"
Demands on Glass in Architecture

- Aesthetics
- Energy Efficiency
- Creative Liberties
- Comfort
- Indoor Climate

- Customized products
- "Flexible" products
- Special products
  Combination of function and design

- Project Consultancy
- Design Assist & Engineering
- Project Management
- Supply Management
- Order Processing
- Quality Management
- Logistics
GLASS PRODUCTS AND ITS PROPERTIES
glasstec 2018 – Trend Topics

- Industry 4.0
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How does Industry 4.0 influence the production and technological processing of glass products?

"Everything moves. Industry 4.0 revolutionizes the production and processing of glass products and presents people in this field with completely new challenges. The production process becomes more efficient and flexible, the glass products smarter. Intelligent value chains are created from the idea of a product through development, production, use and maintenance to its recycling."

Expert Wenninger, Chairman of VDMA Glastechnik
Properties of a Product

Building Material (Product)
e. g. properties, which are resulting out of the characteristic and/or the composition of the product

Manufacturing
e. g. resulting properties out the way of manufacturing and refining process

Application & Maintenance
e. g. properties, which are resulting in the kind of application; in an certain installation condition

Function
e. g. technical or functional properties
Manufacturing

Application & Maintenance

Function

Building Material
Quality

Quality is determined by the particularities of several influencing factors (e.g.)

- Geometry / Shape (tolerances)
- Type of Glass
- Dimensions
- Complexity of glass configuration
- Sequence of coatings / printings
- Manufacturing Process
- Process parameters
Visual Properties of an IGU Edge Sealing
Spacer Bar Systems
Anisotropy Effects
Anisotropies – a well known property of tempered glass

- We know
  - Anisotropy: term used in physics to characterize an object or phenomenon having different properties in different directions.
  - That the effect is an unavoidable in tempered glass
  - That anisotropy effects have a **physical origin at the heat treatment process**. **Factors** influencing anisotropy are **multiple**
  - That **current product standards** do not treat this effect as a claim but as an **inherent property** of tempered glass
  - That the extent of the visibility of anisotropies depends e. g. on the glass products, Hs or FT, glass types, low iron or clear glass, the glass thickness, the shape of the glass, the aspect ratio
  - Anisotropy **visual appearance** depends on several environmental factors
Anisotropies – a well known property of tempered glass

But things are moving on

- Current scanning methods
  - Can **on-line** measure the retardation within a tempered glass at the end of the tempering process
  - Based on first order statistics, the anisotropic effects can be quantified (p-Quantile evaluation)
  - BUT there is not a common/standardized quantification level for retardation values to specify a certain quality level
  - And they allow a general evaluation of anisotropy and permit a comparison between different units within a project
Anisotropies – Future Developments

- ASTM C14.08 Task Group objectives (L. Moreau)
  - Standard test method for measuring optical anisotropy
  - The method should be generic enough to cover all materials in architectural glazing: glass, interlayers, assemblies, etc.
  - Ensure that all stakeholders share the same language, methodology, numerical values expressed in a fundamental physic unit
  - Certify that measurements are consistent, repeatable and traceable to a known entity

- Research working group for the quantification of Anisotropies
- Working at the Expert Association for Engineering Glazing is working on a paper explaining the background of anisotropies and their origin and visibility together with first ideas of retardation values for different glass products, glass thicknesses, glass types etc..
The goal of this document is to inspire, suggest, and direct designers towards treatments of glass to render it as Bird-Friendly as possible...to mitigate and prevent deaths of birds.

Photo: “Deadfall” - Mark Thiessen, National Geographic Photographer

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Information for Bird Friendly Architecture

- Bird-Friendly Development Guidelines, July 2016, City of Toronto
- ONR 191040 Bird-safe glass — Testing of efficiency Reflected Vegetation
- Tips for Bird Protection, Schweizer Vogelschutz, SVS, BirdLife Schweiz
- http://wua-wien.at/naturschutz-und-stadtoekologie/vogelanprall-an-glasflaechen

Source: Bird-Friendly Best Practices Glass
Building Features that Influence Bird Collisions

- Awnings and Overhangs
- Exterior Screens, Grilles, Shutters and Sunshades
- Creating Visual Markers: Frit, Film and Acid-Etched Patterns
  - Opaque and Translucent Glass
  - UV Glass (or similar products)
  - Low Reflectance GlassTips for Designing
  - Visual Markers

- Ineffective Strategies
  - Angled glass
  - Blinds
  - Tinted Glass
  - Interior Screens
  - Bird Decals

<table>
<thead>
<tr>
<th>Category</th>
<th>Landings in % Reference/ Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>A – highly effective</td>
<td>Over 90 / under 10</td>
</tr>
<tr>
<td>B – limited suitable</td>
<td>80 – 90 / 10 – 20</td>
</tr>
<tr>
<td>C – little suitable</td>
<td>80 – 55 / 20 – 45</td>
</tr>
<tr>
<td>D – not effective</td>
<td>equal distribution 50 – 55 / 45 - 50</td>
</tr>
</tbody>
</table>

Source: Bird-Friendly Best Practices Glass

ONR 191040

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Product Selection

1. Choose a product from catalogue
   - Limited catalogue
   - With neutral colors

2. Few samples order

3. Mockup / Shuttle validation
   - Limited # products
   - Limited solutions
   - Limited aesthetics
   - Time consuming

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Coating on Demand

1. Choose products from virtual catalogue

2. Virtual samples on virtual buildings

3. Shuttle validation
   - Unique product
   - Unlimited # products
   - Unlimited colors
   - 1 day process
   - Choice based on aesthetics & performances
# Advantage of CoD vs other technology

<table>
<thead>
<tr>
<th>Silkscreen vs. CoD</th>
<th>Coloured pvb vs. CoD</th>
<th>Colorbel vs. CoD</th>
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<tbody>
<tr>
<td>$T_{\text{vis}}$ decreased from inside</td>
<td>$T_{\text{vis}}$ transmitted light (white walls no more white)</td>
<td>$T_{\text{vis}}$ transmission zero</td>
</tr>
<tr>
<td>Aesthetic from inside</td>
<td>Aesthetic from inside</td>
<td></td>
</tr>
</tbody>
</table>

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Digitalization

1. Choice of a scene

2. Play views …

Inside and outside views
Examples of use - Vista Tower - Chicago

<table>
<thead>
<tr>
<th>Glass</th>
<th>Id</th>
<th>LT</th>
<th>LR</th>
<th>a* (R8)</th>
<th>b* (R8)</th>
<th>SF</th>
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<tr>
<td>GL1</td>
<td>1984</td>
<td>60%</td>
<td>21%</td>
<td>-1.0</td>
<td>-2.0</td>
<td>33%</td>
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<tr>
<td>GL3</td>
<td>5810</td>
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<td>17%</td>
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<td>-3.0</td>
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<td>2758</td>
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<td>-6.5</td>
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<td>GL5</td>
<td>5814</td>
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<td>-9.6</td>
<td>-8.2</td>
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<tr>
<td>GL6</td>
<td>5813</td>
<td>41%</td>
<td>13%</td>
<td>-11.0</td>
<td>-8.7</td>
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</tbody>
</table>
Coating on Demand for Renovation of Buildings

- Main Objectives
  - Upgrade glass performance keeping the same aesthetic
Coating on Demand
8 mm Bronze tinted glass #1 - No Coating #2

Aesthetics into standard CoD composition (6-16-4)
GLASS DESIGN & ENGINEERING
Energy outside the building - Solar concentration → focal point

Real life effect...

... captured by simulation
Why do we need “angular“ dependent data for glazing units?

- Energy reflection and focal point
  - To identify if there is a focal point, what is the energy reflected on the square or on the street and what is the risk for the people around the building. On top of that, if a building is reflecting the energy on another building, where cooling and heating systems have been originally created for a certain value and at the end the energy coming through the glass is much more, the risk is to have an overheating problem.

- Glare and light reflection
  - The same as before but related to light.

- Performances
  - Today most of the engineers are calculating the heating and cooling according to solar factor and the U value of the glazing, but we know that SF is changing according to the angle.

- Angular data are also used for the visualization of glass products.
Technical Data

- Stopray Vision 50
- Stopray Ultra 50 on Clearvision
- Stopray Ultra 60
- Planibel Clearvision
EN 17037 requests

- Daylighting
- Visual Contact to the Environment
- Sun
- Glare
THANK YOU!