Building Physics
- Energy
- Daylight
- Thermal comfort
- Acoustic comfort
- Maintenance-Repair
- MFREE-S CCF

Daylight
Electric lights
Light Control
Dynamic glazing and façade systems

**Steady state systems**
- Spectrally selective Low-E
  - $Tv = 0.41$
  - $SHGC = 0.23$

**Dynamic glazing**
- Electro-chromic glazing, Daylight or Glare
  - $Tv = 0.56-0.02$
  - $SHGC = 0.42-0.09$

**Dynamic Façade systems**
- Variable properties !!
- DSF (e.g. IW)
  - $Tv = 0.67-0.02$
  - $SHGC = 0.58-0.12$

Energy saving by daylight and active glazing/facades

Energy/Demand Management with Active Façades + Daylighting Controls

- Typical commercial building load profile
- Reduced Solar Gain
- Dimmed Lighting
- Peak demand reductions during curtailments
  - Lighting: 75%
  - Air conditioning: 25%
  - Other: 10%
Energy consumption

Different façade types

SSF
Single Skin Facade

IW
Interactive Wall®

AW
Active Wall®

CCF
Closed Cavity Facade®

Shard (UK)

London CIBSE TR V Weather Data
Energy performance dynamic facades

- From component to whole building calculations

The need for using detailed software tools to be able to calculate the dynamic performances of current and new dynamic facade systems

Target:
To be able to design advanced facade systems that result in an optimal energy performance of the building and increased comfort of the occupant

Dynamic Facades – Variable characteristics
Thermal Comfort

- 50% energy reduction: $0.60
- 5% productivity increase: $6.50

Source: Building Owners and Managers Association; Electric Power Research Institute; Statistical Abstract of the United States 1991
Thermal comfort: internal wall surface temp.

E.g. Effect solar radiation on façade temperature

The internal surface temperature does not only have an effect on the comfort (and therefore the productivity of the office workers) but also on the energy consumption (as a secondary effect).

Use of 3D Detailed Dynamic Energy & Thermal Comfort analysis of interaction of facades and mechanical (HVAC) systems (Cooling ceiling/Floor heating), thermal mass, ...

Acoustic Comfort
Acoustic performance

Acoustic comfort prediction tool for double skin facades and LARGE

LARGE
Accredited Laboratory for Acoustic Research on Glass and large Envelopes

<table>
<thead>
<tr>
<th>Glazing Type</th>
<th>Acoustic Comfort (Rw, dB)</th>
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</thead>
<tbody>
<tr>
<td>4-12-4 glazing</td>
<td>R_w = 49(-1; -4)dB</td>
</tr>
<tr>
<td>6-12-4-4 glazing</td>
<td>R_w = 56(-1; -4)dB</td>
</tr>
<tr>
<td>8-12-8/120/6 glazing</td>
<td>R_w = 50(-1; -4)dB</td>
</tr>
</tbody>
</table>

Rw [dB]

Massive wall  Double glass  Acoustic glass  Double facade
Maintenance – Repair

Access in the ventilated cavity of LBT – Bespoke blind connection system
**MFREE-S Closed Cavity Facade (CCF)**

Low maintenance Closed Double Skin Façade with dry pressurized air supply.

**Benefits**
- No Condensation!
- Low maintenance

**Dry air distribution system**

**Tightness - measuring - checking - using**

**Quality Control: Components - blind & motor durability**

- Carry out blind motor selection and controls system evaluation
- Cyclic tests in “hot box”
- Note failures such as cord fraying, motor malfunction, blind blocking and binding, dust and debris
- Develop motor system external to façade cavity, accessible inside building
- R&D experience has proven that many blinds DO NOT pass their claimed warranty performance.
Permasteelisa have developed the system over a 5 year period

**Various R&D actions**
- External long term environmental tests
- Dry air distribution system
- Condensation risk analysis software
- System performance testing
- System sizing software
- Accelerated durability tests of components
- FMEA (Failure Modes & Effects Analysis)
- Design solutions
- Financial and organizational implications

**MFREE-S Closed Cavity Façade (CCF): UCLH (London, UK)**

- **Project:**
  - UCLH 4A Phase 3 - Cancer centre
- **Owner and client:**
  - UCLH (University College London Hospitals)
- **Contractor:**
  - Skanska
- **Architect:**
  - Hopkins Architects Ltd.

**Façade area:**
8200 m²

**Scope of the work:**
Façade cladding, including 2500 m² Closed Cavity Façade (CCF)

**Installation period:**
July 2010 - August 2011

**Clients requirements:**
- Interactive wall not desirable: pollution of blinds
- Active wall not desirable for hygienic reasons
- High occupant comfort (patients/churgents)
- Low maintenance --> low running costs
- Environmental hospital targetted
**Clients requirements:**
- Low maintenance -> low running costs
- No use of “exterior” blinds at a high rise building
- High transparency when the blinds are up (visible primary steel structure behind the wall is important for the architect)
- Natural ventilation not required
- Visual diagrid is determining everything!

**Project:**
ABR - Bau 5 Administrationsgebäude

**Owner and Client:**
Roche Diagnostics Ltd, CH-Rotkreuz

**Representation of the owner and Project Management:**
projektrofense, CH-8044 Zürich

**Architect:**
Burckhardt + Partner AG Architekten Generalplaner, Basel

**Façade Area:**
6.200 m²

**Scope Of Work:**
Closed Cavity Façade
CCF (Double Skin) with supply of dry air

**Installation Period:**
February 2010 - October 2010

**MFREE-S Closed Cavity Façade (CCF): Roche (Switzerland)**

**Fraunhofer Ioltras Center**
Duisburg, Germany.

**Roche (CH)**

**Poseidonhaus - Frankfurt (D)**

**Opple Lighting, Wu Jian, Jian Su, China.**

**Richti Zurich, Switzerland**

**Roche Q2K – Kaiseraugst (CH)**

**Fraunhofer inHaus2 Center**
Duisburg, Germany.

**Roche Q2K – Kaiseraugst (CH)**

**UCLH (UK)**
BREEAM-Excellent Hospital
Thanks for Your Attention!

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