Analysis of Reflected Glare: Electrochromic Glazing Performance in an Office Building

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Overview of Electrochromic Glass
GLASS AT DIFFERENT TINT LEVELS

4 States Ranging From 60% Visible Light Transmission Down To 1%
EC Control Criteria

- **Glare Control**: is the main part of the EC zone operation algorithm. It finds all the zones that cause direct glare and limits it to 1% VLT at every time step. Sun angle and sky conditions are two of the important factors that affect glare control.

- **Daylight Control Algorithm**: mainly balances the daylight level in the space. The amount of light received by each window depends on sun angle, window orientation, and sky condition.

- **Color Rendering Algorithm**: ensures that the pattern provides natural color rendering in the space.

- **Thermal Comfort Algorithm**: maximizes human comfort and energy saving in the buildings by reducing solar heat gain in the summer and maximizing passive heating in the winter months.
The hourly risk of reflected glare of two neighboring buildings was studied for an office building on north and south facades. This analysis was conducted based on project 3D model and Baltimore-Washington Intl. Ap_MD_USA TMY3 weather data. In this simulation, the whole façades of building 1 and 2 were assumed to be reflective. All the hours that have risk of reflected glare and zones that receive reflection were identified.
Raytracing Algorithm

North Facade

Solar ray
- Reflected ray
- Blocked solar ray
- Area with risk of reflected glare
Reflected Glare
North Facade

Analysis of reflected glare from building one to UT north facing façade.

January to June

*The solar rays that are blocked by site obstruction are not shown in this animation.
Reflected Glare
North Facade

Analysis of reflected glare from building one to UT north facing façade.

July to December

* The solar rays that are blocked by site obstruction are not shown in this animations.
Hours with Risk of Reflected Glare

North Facade

Jan 21st 13:00
Jan 21st 12:00
Jan 21st 11:00
Jan 21st 16:00
Jan 21st 15:00
Jan 21st 14:00
Hours with Risk of Reflected Glare
North Facade

Feb 21st 13:00

Feb 21st 16:00
Feb 21st 15:00
Feb 21st 14:00
Hours with Risk of Reflected Glare
North Facade

Mar. 21st 16:00
Mar. 21st 17:00

Sep. 21st 16:00
Sep. 21st 17:00
Hours with Risk of Reflected Glare
North Facade

Oct 21st 13:00
Oct 21st 14:00
Oct 21st 15:00
Oct 21st 17:00
Nov 21st 10:00
Hours with Risk of Reflected Glare
North Facade

Nov 21st 11:00
Nov 21st 12:00
Nov 21st 13:00
Nov 21st 14:00
Nov 21st 15:00
Nov 21st 16:00
Hours with Risk of Reflected Glare
North Facade

Dec 21st 10:00
Dec 21st 11:00
Dec 21st 12:00
Dec 21st 13:00
Dec 21st 14:00
Dec 21st 15:00
Reflected Glare
South Facade

Analysis of reflected glare from building two to UT south facing façade.

January to December

21 JAN 8:00
Hours with Risk of Reflected Glare
South Facade

Jun.

Jun 21st 5:00
Jun 21st 6:00
Jun 21st 7:00

May.

May 21st 5:00
May 21st 6:00
Hours with Risk of Reflected Glare
South Facade

Jul 21st 6:00
Analysis Summary

- All the identified hours and zones are an over-estimation of reflected glare hours, because the whole façade of Building 1 and 2, was assumed to be reflective.

- Among the identified hour, only times that solar ray hit the occupant eyes, there would be reflected glare problem.

- In south facing façade among some of the hours with risk of reflected glare, the reflected solar ray may get blocked by external shading.
DGP Analysis
Analysis of EC performance

Feb 21st 13:30
DGP Analysis
Analysis of EC performance

Nov 21st 12:30
DGP Analysis
Analysis of EC performance

Nov 21st 13:00
Thank You


Labib, L., (2017) Shading and reflection analysis-Plugins