Effect of Dynamic Shading Devices on Daylighting and Energy Performance of Perimeter Office Zones

OBJECTIVES:
The main objective of this research is to evaluate the effectiveness and energy savings potential of several types of commonly used dynamic shading devices coupled with electric lighting control in perimeter office spaces with different types of glazing systems through full-scale experiments and testing.

TEST LOCATION & METHODOLOGY:
Full-scale testing is conducted at the Iowa Energy Center’s Energy Resource Station in Ankeny, IA with 3 sets of parallel test rooms.

Full-scale experimental testing & data collection: Test dynamic roller shades and venetian blinds in a perimeter office space;
Method for evaluation of energy savings potential and occupant comfort: Develop a methodology that can be used to evaluate the energy savings potential of a combination of dynamic shading devices and lighting controls;
Development/testing of control algorithms: Develop and test control algorithms that control lights and shading devices to achieve energy savings and maintain a comfortable environment for occupants.

BACKGROUND:
Commercial buildings (primarily office buildings) are responsible for a large amount of the 40% and 72% of energy and electricity consumption from buildings.
Modern office buildings have a strong potential for energy savings (Poirazis et al. 2008) but must also provide thermal and lighting comfort to occupants to facilitate a productive work environment.

Dynamic shading and lighting devices have been developed by various companies in attempt to conserve energy, however there has been limited full-scale controlled testing to understand what the measured energy and occupant comfort benefits are of these devices.

Energy use and occupant comfort are significantly impacted by the following, all of which are tested in this work:
- Orientation of the building façade(s)
- Type of window
- Type of shading device
- Type of control strategy

PRELIMINARY RESULTS
Normalization testing was conducted first to ensure the parallel test rooms are equal.

Use of the dynamic shading and lighting controls reduces the high levels of vertical illuminance, hence preventing glare, when glare is said to occur when threshold of DGP (daylight glare probability) is reached.

CURRENT STATUS
Continue conducting tests at the ERS for different combinations of windows, shading devices, control strategies, and times of the year.