Experiences with Radiance in Daylighting Design – Part II

4th Annual Radiance Conference

August 11th-12th, Montreal

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Architectural Energy Corporation

LightLouver LLC

Presentation Outline

- USDA Consolidation Laboratories
- University of Wisconsin Interdisciplinary Research Center
- NASA Exploration Sciences Building
- Indianapolis Airport MidField Terminal
- Wrigley Global Innovation Center
- Indiana State University Atrium Project
- Kinard Middle School
- Prairie School Field House
- Kruse Elementary School
- Colorado School of Mines Recreation Center

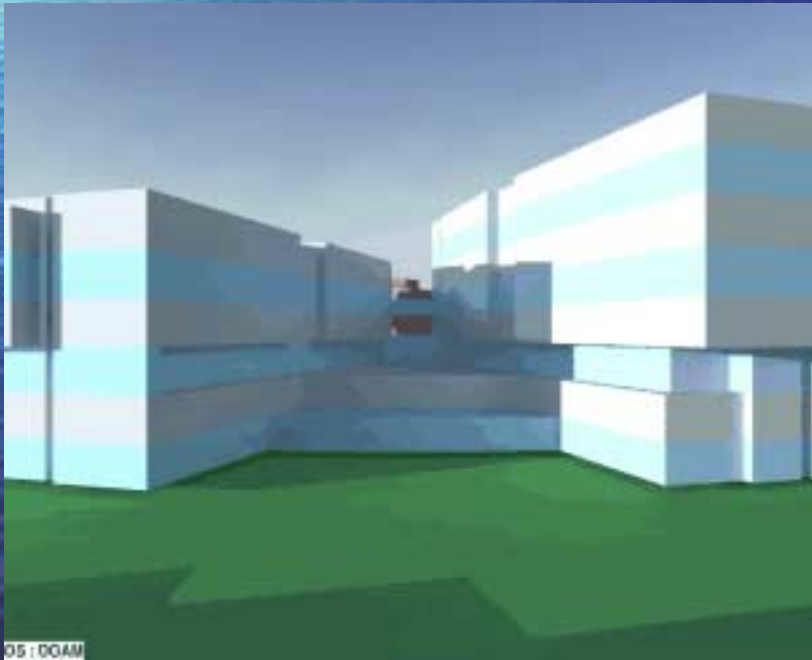# USDA Consolidation Laboratories

Ames, Iowa

- Solar heat gain control for large atrium skylights
- Balance of daylight distribution in adjacent office and laboratory spaces
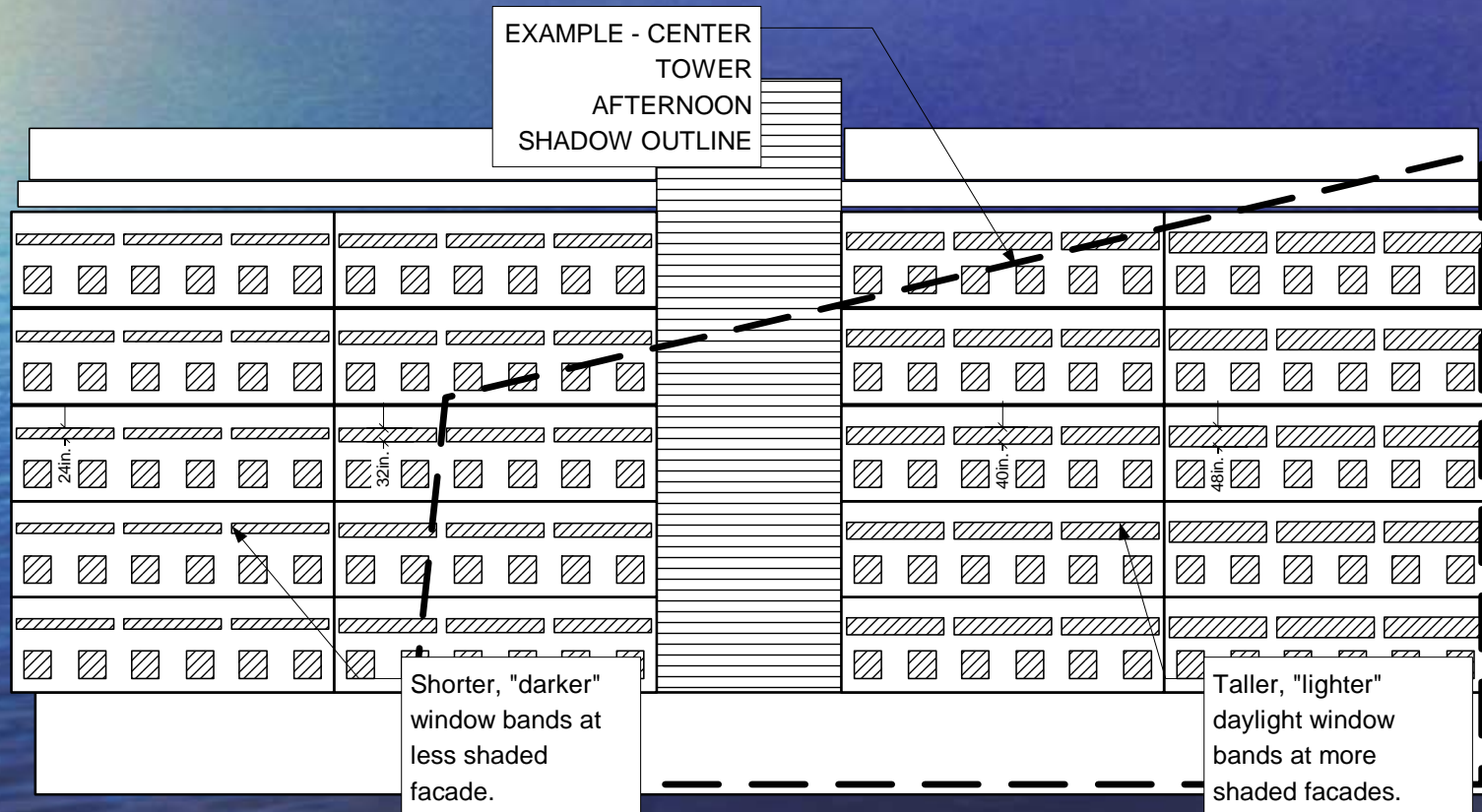
Interdisciplinary Research Center
Univ. of Wisconsin, Madison

- Low sun-angle shading from adjacent towers
- Larger fenestration areas, higher glazing transmittances, reduced overhangs considered in areas with greater shading

Interdisciplinary Research Center
Univ. of Wisconsin, Madison

EXAMPLE - CENTER TOWER AFTERNOON SHADOW OUTLINE

24in.

32in.

40in.

48in.

Shorter, "darker" window bands at less shaded facade.

Taller, "lighter" daylight window bands at more shaded facades.

Interdisciplinary Research Center
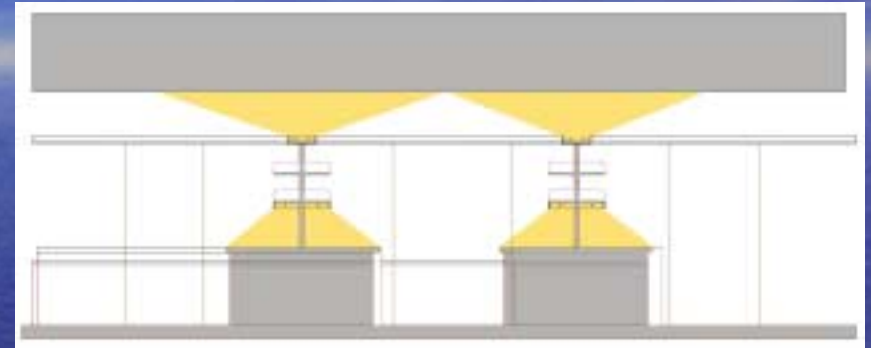## Univ. of Wisconsin, Madison

- Open Laboratory Space
- Daylight distribution comparisons
- Contrast ratios

Interdisciplinary Research Center
Univ. of Wisconsin, Madison

- Nighttime Laboratory lighting
- Task / Ambient electric lighting strategy
- Reduced daytime LPDs
- Zoned to balance luminous environment

Interdisciplinary Research Center
Univ. of Wisconsin, Madison

- Enclosed / Open office space
- Created large internal lightshelf with perimeter ceilings
- Glazing area and transmittance adjusted for location

Interdisciplinary Research Center
Univ. of Wisconsin, Madison

- Overhead view of open office block
- Animated to illustrate direct sunlight interactions
- Animated False color illuminance map for annual representation of workplane illuminance

footcandle
95
85
75
65
55
45
35
25
15
5

NASA Exploration Sciences Building
Greenbelt, Maryland

- Exterior model to study / illustrate solar shade effectiveness
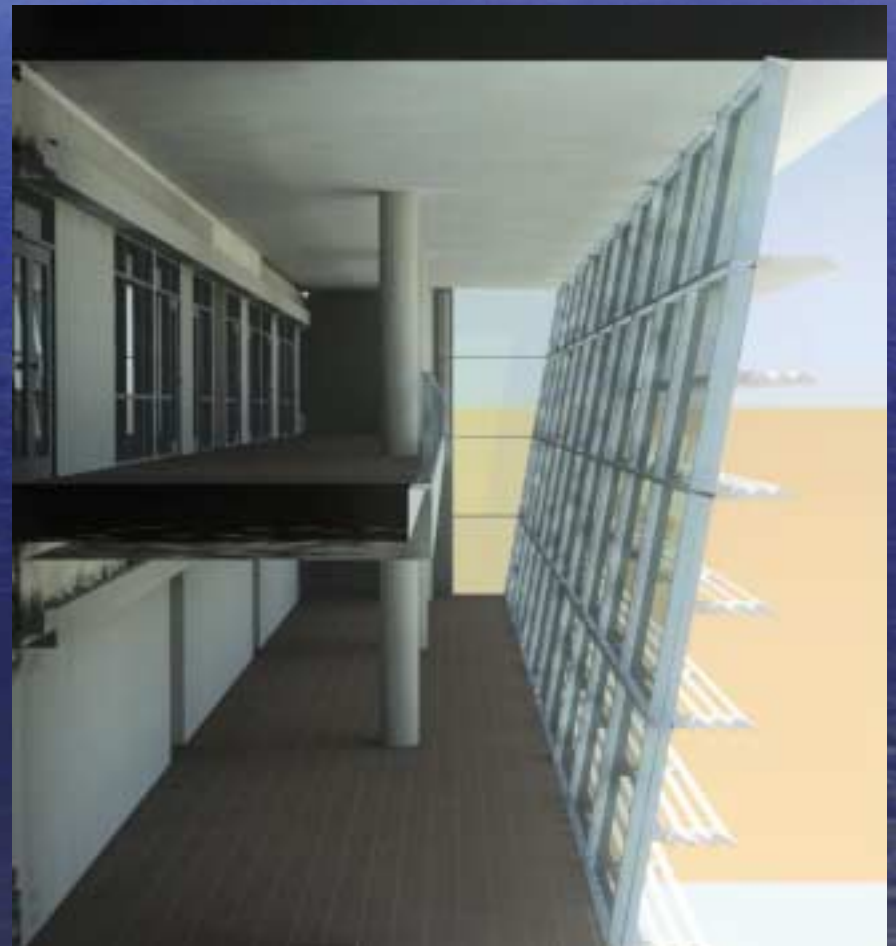- Vertical view offset to center perspective

NASA Exploration Sciences Building

Greenbelt, Maryland

- Daylight distribution
- Direct sunlight penetration

NASA Exploration Sciences Building
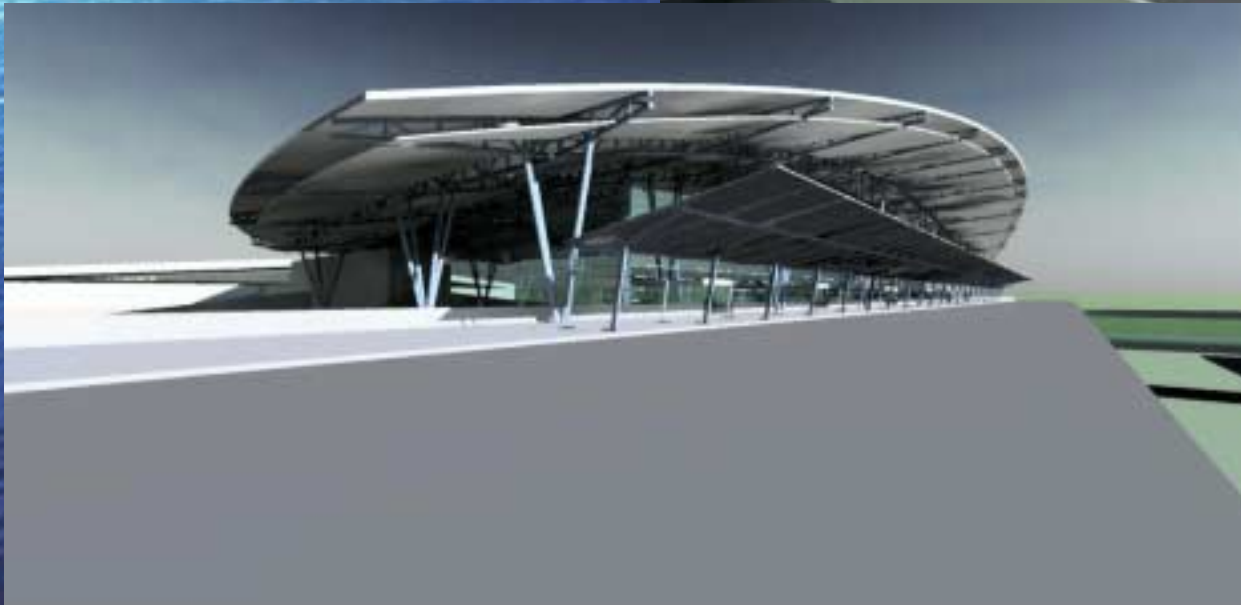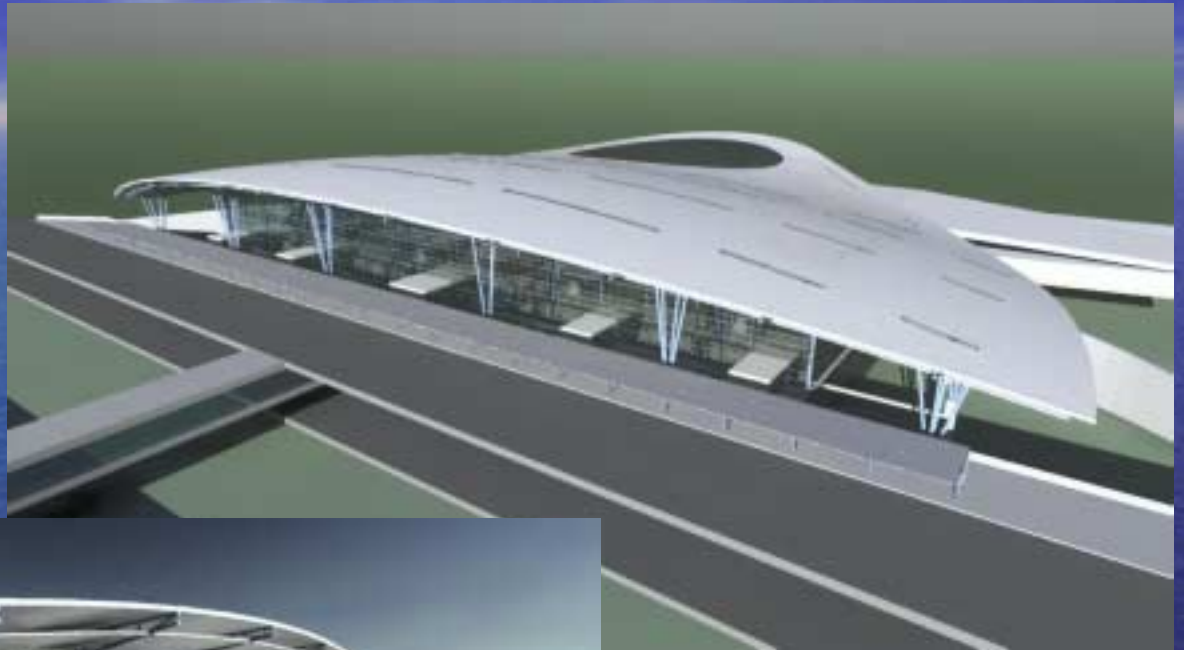## Greenbelt, Maryland

- Electric lighting integration

MidField Terminal
Indianapolis Airport, Indiana

- Exterior shading studies
- Over-arcing roof / buildings inside a building

MidField Terminal
Indianapolis Airport, Indiana

- Punched skylights to distribute daylight
- Afternoon solar gains mitigated with frits

MidField Terminal
Indianapolis Airport, Indiana

- Glare control studies for workers
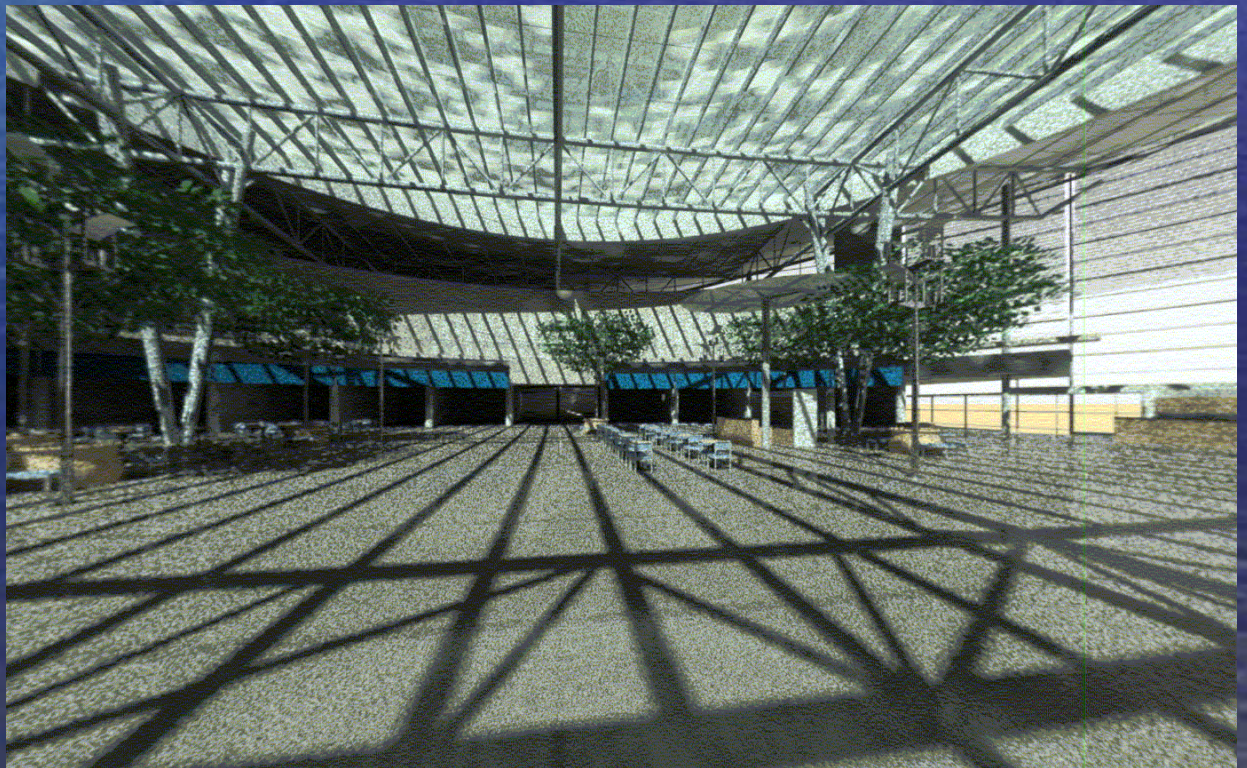- Lightwells provide daylight saturation onto 1st floor baggage claim

MidField Terminal
Indianapolis Airport, Indiana

- Civic Plaza
- Solar gain control
- Plant health
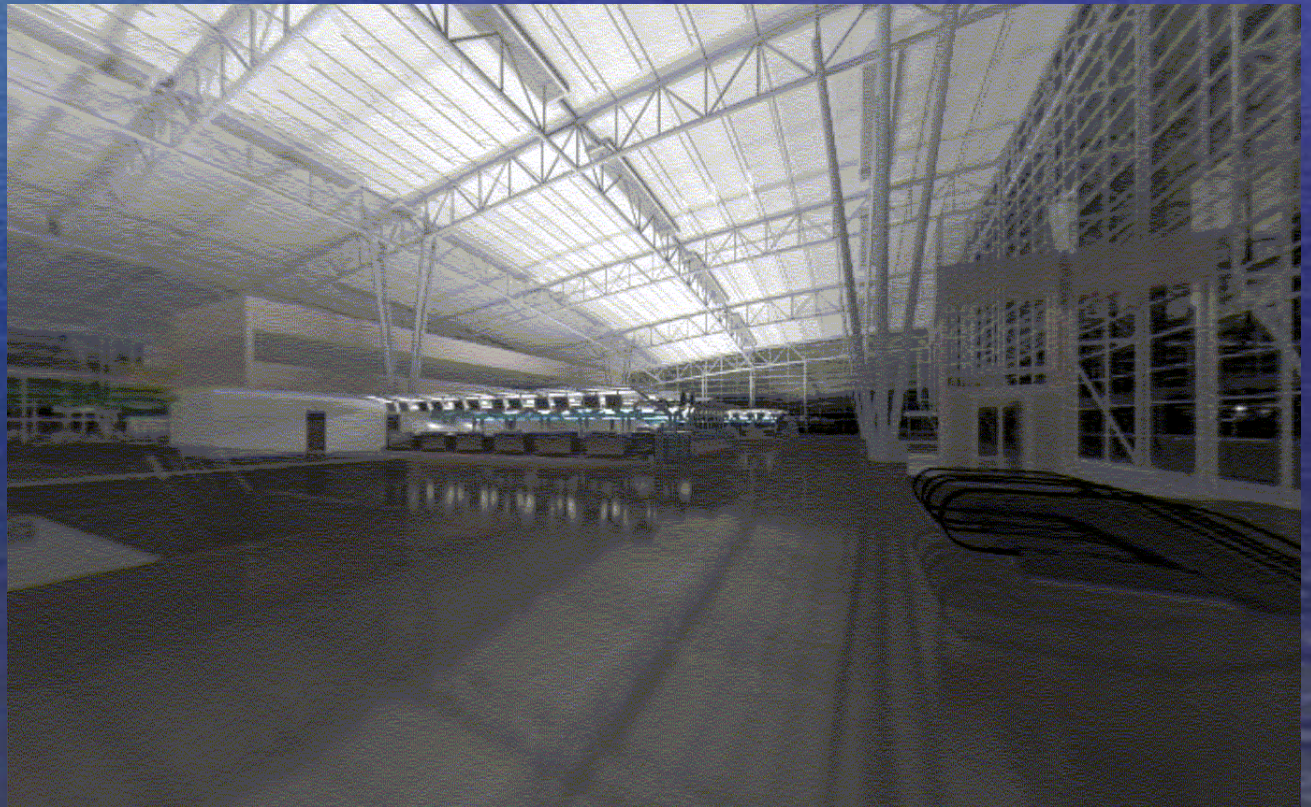- Luminous balance
  with adjacent spaces

MidField Terminal
Indianapolis Airport, Indiana
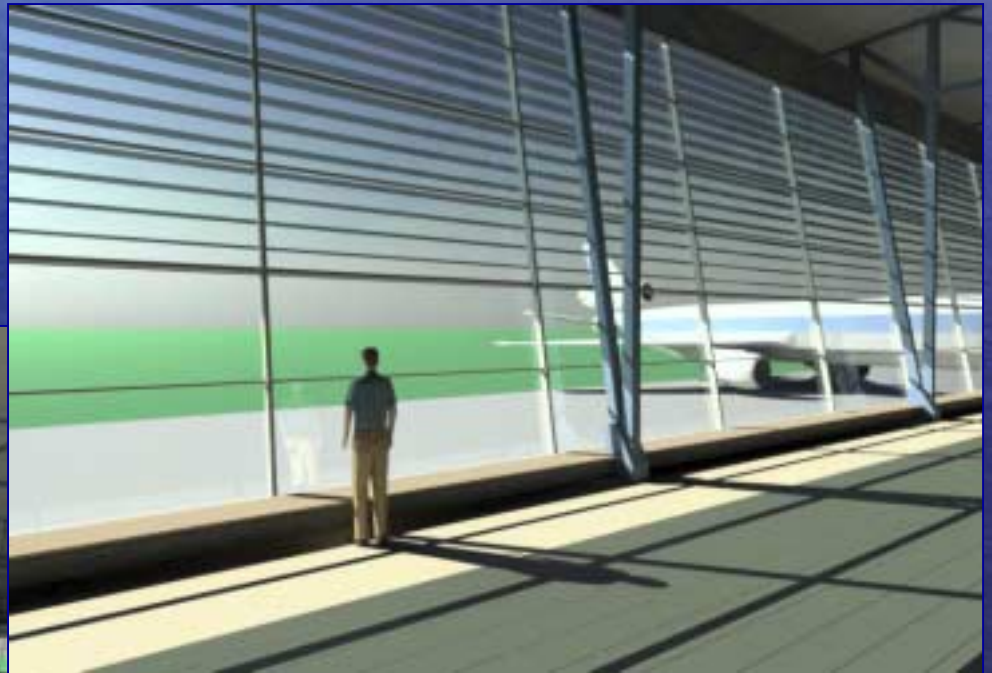
- Electric Lighting Integration
- Task / Ambient approach

MidField Terminal
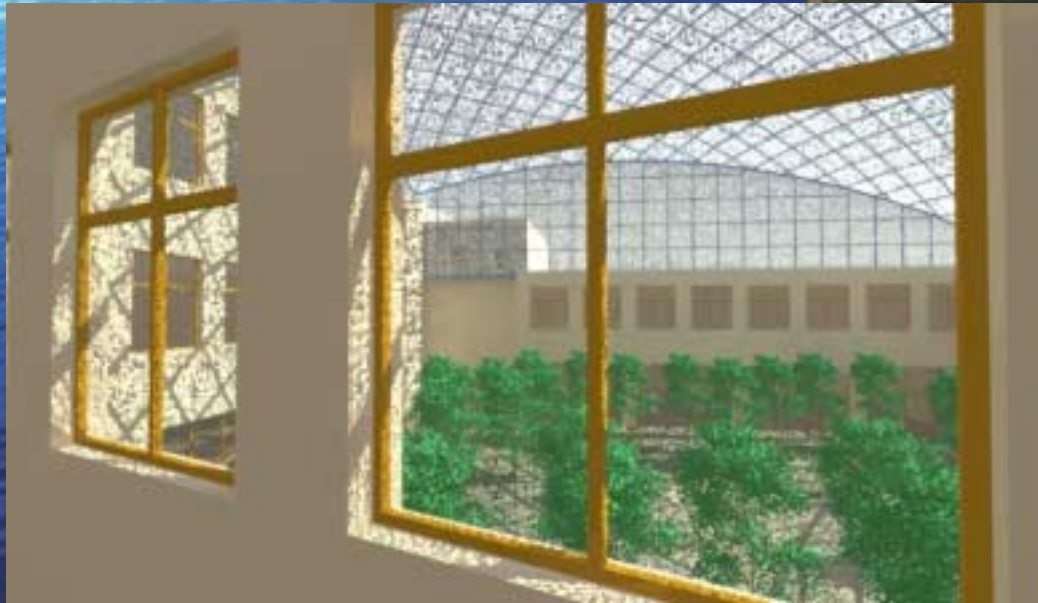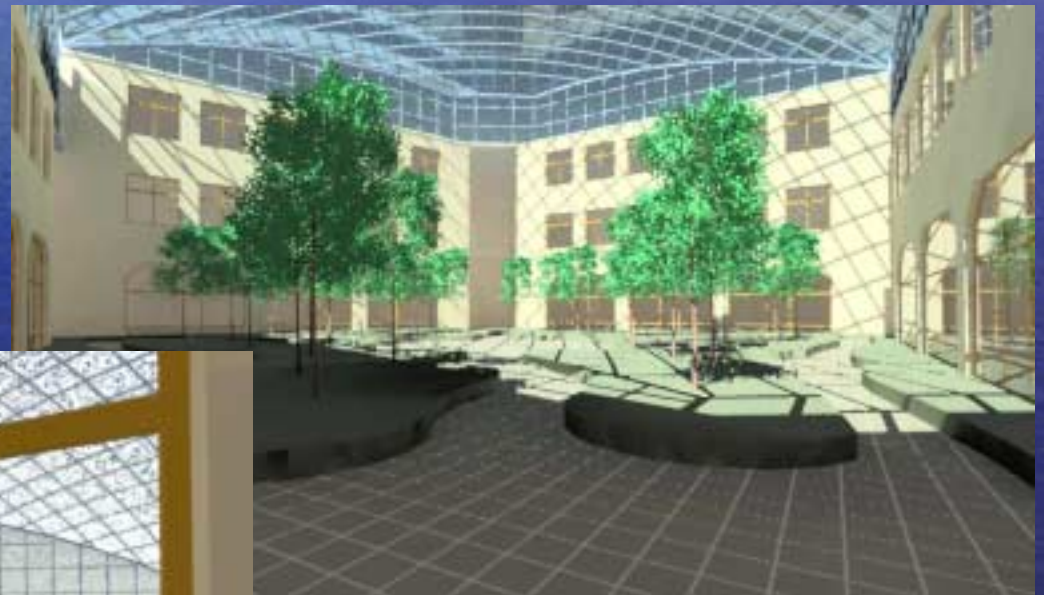## Indianapolis Airport, Indiana

- Glare control for concourses
- Dynamic solar animations

Wrigley Global Innovation Center
Chicago, Illinois

- Winter Garden Atrium break area
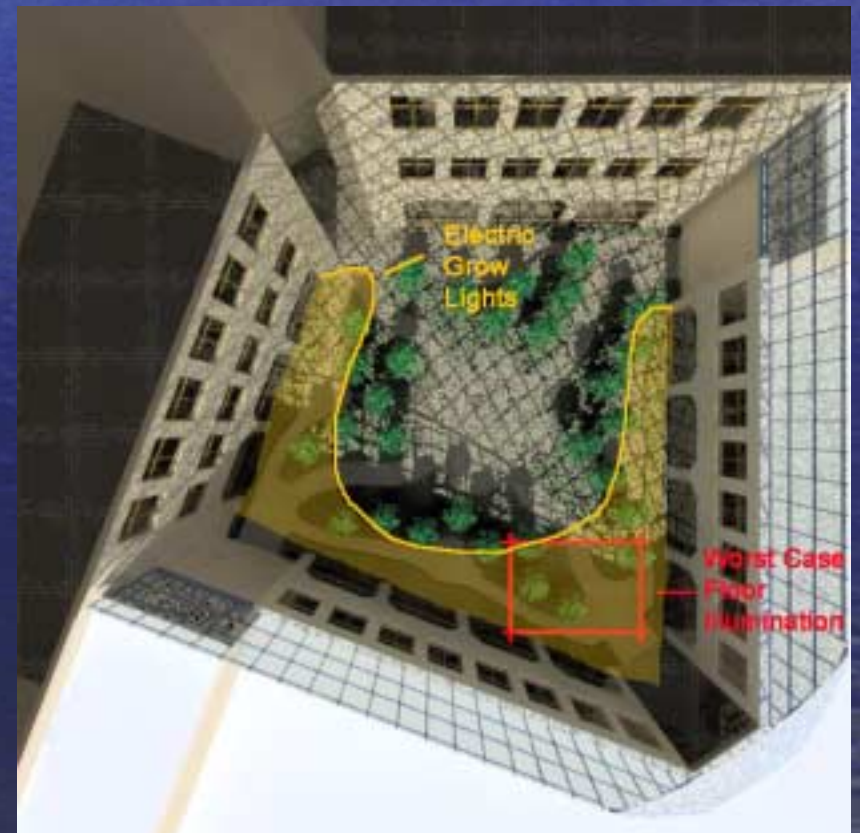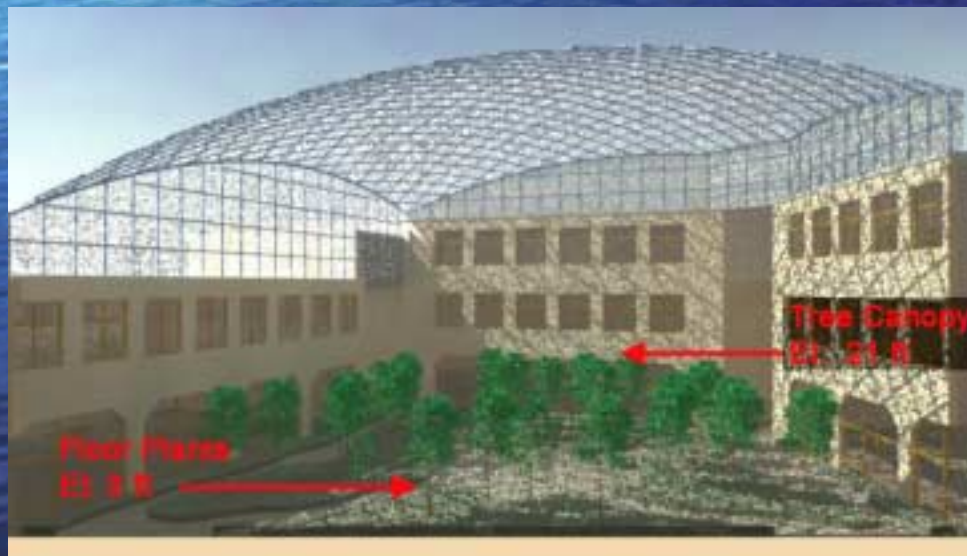- Views from adjacent offices

Wrigley Global Innovation Center
Chicago, Illinois

- Illuminance-hour requirements for Ficus trees
- Identified shaded areas of inadequate daylight illuminance for supplemental electric lighting

Atrium Project
Indiana State University

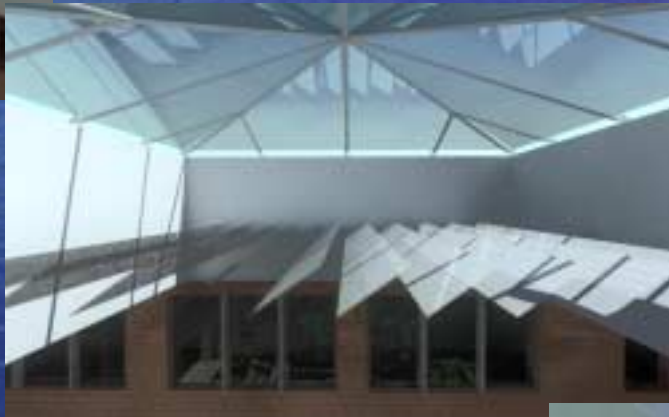

- Optimized skylights relative to solar heat gain and light transmittance
- Illuminance-hour requirements for plantings

Atrium Project
Indiana State University

- Studied variety of solar control strategies

Kinard Middle School
Fort Collins, Colorado

- North classrooms glare north daylight balanced with Solatubes
- Dynamically scaled IES files used for annual daylight illuminance

Kinard Middle School
Fort Collins, Colorado

- Electric lighting designed to supplement daylight when inadequate
- Open loop continuous dimming control used

Kinard Middle School
Fort Collins, Colorado

- Southern classrooms utilize LightLouver Daylighting redirection system
- Solatubes balance daylight in rear of space
- Electric lighting used to balance luminous environment

Kinard Middle School
Fort Collins, Colorado

- Classroom wing corridors and locker areas
- Artistic solution explored for south glass facade

Kinard Middle School
Fort Collins, Colorado

- Solatubes used to balance glass daylight contribution
- Open floorplan allows daylight to saturate 1st floor areas

Prairie Field House
Racine, Wisconsin

- Optimized glazing locations and properties
- Used renderings for fund-raising activities for High School

Kruse Elementary School
Fort Collins, Colorado

- Hired to fix glare issues on 8 prototype elementary schools

Kruse Elementary School
Fort Collins, Colorado

- Used calibrated Radiance model to compare glare control strategies
- Non-lambertian diffuse film had been used with extreme "hotspots"

Colorado School of Mines Rec Center
Golden, Colorado

- Solar penetration studies for all daylit spaces
- Glazing location optimized to reduce afternoon and summertime solar gains
- Morning, winter time gains control to help warmup and improve heating loads

Winter 08:00AM

Colorado School of Mines Rec Center
Golden, Colorado

- Veiling reflections, due to directional vertical daylight illuminance, overcome with overhead daylight contribution

- Walkaround panoramics used to help visualize luminance environment of various spaces