DAYLIGHTING DESIGN

Strategies for Achieving Quality Daylighting
DAYLIGHTING DESIGN TOPLIGHTING

Criteria & Preliminary Sizing

Designing W/ Natural Light

1. Determine Availability of Natural Light.
2. Identify Program Needs.
3. Identify Daylighting Design Strategies.
4. Integrate Daylighting Strategy w/ Whole Building Concept.
5. Integrate with Electrical Lighting.
7. Check and Test Design.
Sky Cover Conditions

- Predominantly Clear
- > 70%
- Moderate
  - 50% - 70%
- Heavily Covered
- > 50%

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Sky Dome Obstruction

- Check for Skydome Obstructions
- Use Sky Dome obstruction chart
- Use Vasari to verify obstruction

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Building Orientation

- Surface to Volume ratio of form
- Northern Hemisphere
  - Southern – Northern Exposure
- Low Altitudes of East and West difficult
- Link Program to Orientation

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Building Shape

- **Sidelighting**
  - Full illumination, 12–15 ft.
  - Partial Illumination 24–30 ft.
- **Increase Surface to Volume Ratio.**
- **Better Sidelighting Access**
  - Narrow elongated plans
  - L-U shaped plans

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Building Shape

- Consider Integrating Sidelighting with Toplighting

- Articulated building massing
  - Courtyard & Atrium buildings

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Building Interior Configuration

- Double Loaded Corridors
  - Bi-lateral
  - Light Corridor w/ transoms

- Place low level lighting activities
  - Furthest from the exterior envelope
  - block East and West exposures

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Building Interior Configuration

- Sidelighting Surface
  - Lower 30”
    - little contribution
  - Middle - 30” – 84”
    - Lights area closest to opening
    - Provides views
  - Upper – 84” and higher
    - Lights area furthest from opening
    - Critical for light penetration
- Ceiling height and its treatment is critical.
- Keep low lighting level activities towards the interior

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Daylighting & Energy

Small Buildings
- Envelope Load Dominated
- Lighting Load - minimal
- Heating and Cooling Load driven by Climate.
- Cold Climates
  - Daylight with Passive Solar
- Hot Climates
  - Daylight improves Efficacy

Large Buildings
- Internally Load Dominated
- Lighting Load - significant
- Cooling Load - significant
- Heating Load – minimal
- Daylight improves Efficacy
- Daylight reduces Lighting Power Load

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CONFIGURING AND SIZING

Sidelighting Strategies

Retail Center

Bay 06
1664 s.f.

Floor Plan Bay 06
1’ grid

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Sky Cover Conditions

- Predominantly Clear
- > 70%
- Moderate
  - 50% - 70%
- Heavily Covered
- > 50%
## Lighting Level Category

### General Space Illumination

| Category A — Public spaces, dark spaces | Nighttime corridors and lobbies, waiting rooms, bedrooms |
| Category B — Simple orientation        | Dance halls, dining halls, transportation terminal concourses, residential living spaces |
| Category C — Occasional visual tasks   | Daytime corridors and lobbies, reception areas, auditoriums, banks, worship spaces |

### Task Illumination

| Category D — Visual tasks of high contrast or large size | Conference rooms, office work with high-contrast tasks, factory simple assembly, residential kitchens |
| Category E — Visual tasks of medium contrast or small size | Drafting of high-contrast work, classrooms, offices, clerical tasks, factory work of low contrast or moderately difficult assembly |
| Category F — Visual tasks of low contrast or very small size | Drafting of low-contrast work, laboratories, factory work with difficult assembly |
Sidelighting Concerns

- Higher Opening the Better.
  - 7 ft. or 84” minimum
  - More depth
- Control Brightness Contrast Ratio
  - Window Head Height
  - Light shelves
  - Overhangs
Sidelighting Concerns

- Reflective Sills
  - Deep sills
  - Watch for Glare
- Secondary Sources
  - Bi-Lateral sidelights
  - Top-Lighting
- Daylighting Obstructions
  - Orient perpendicular to opening
  - Glass or low interior partitions

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Retail Center

Floor Plan Bay 06

1' grid

Bay 06
1664 s.f.

3' x 7' - 21 sf

32'

52'

1' grid

South Elevation Bay 06

6' x 7' - 42 sf

13'

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Sidelight Sizing

Window Height

- Window Height = 13’
- Window width > one half the wall length
  - Window Width 28’ in 32’
- Effective depth of Light
  - ~25 ft. Full Light
  - ~26 ft. – 35 ft. Partial Light
Sidelight Sizing

Window Area
- Floor Area = 1664 sf.
- Current Glazing = 364 sf.
- Category D – Visual Tasks
  - High – 275 sf.
  - Low – 110 sf.
- Consider Reducing to 200 s.f.
  - Cold Climate?
  - Passive Solar desired?
  - Hot Climate?
  - Shading Devices?

Diagram: WINDOW AREA

- Example
- 1000 ft² 93 m²
- 100 ft² 9 m²
- 10 ft² 1 m²

Categories:
- A – Public spaces, dark surroundings
- B – Simple orientation
- C – Occasional visual tasks
- D – Visual tasks of high contrast or large size
- E – Visual tasks of medium contrast or small size
- F – Visual tasks of low contrast or very small size

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Concept Design Decisions

Retail Center

- Glazing Height 13 ft.
- Full Daylighting - 25’
- Glazing Area – 200+ sf.
- Develop Shading System.
- Develop Alternative Strategies.
  - Light Shelf
  - Toplighting.
- Consider Sloping or Shaping Ceiling.
Q & A

Next lecture – Toplighting Strategies