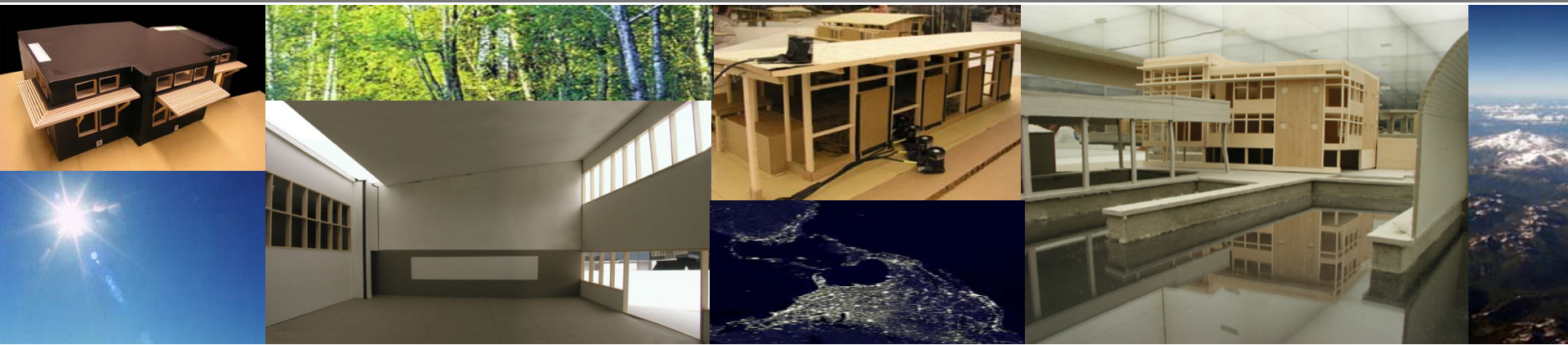




INTEGRATED DESIGN LAB | Puget Sound
College of Built Environments

BUILDING DAYLIGHTING MODELS



Always contact the IDL before building a daylighting model. We can help you get the best value for your efforts.

206.616.6566 phone 206.616.8915 fax

Select a scale appropriate to the phase of design.

- It is difficult to photograph the interior of most spaces using models smaller than $3/8" = 1'-0"$
- $3/8" = 1'-0"$ or $1/2" = 1'-0"$ scale is recommended for spaces with ceilings less than 15'-0". These are the most commonly used scales for building sections or single spaces.
- Smaller scales such as $1/4" = 1'-0"$ work for large spaces such as gymnasiums or warehouses.
- The model should not exceed actual dimension of 3.5 feet in length, width or height. This is the effective area that the testing equipment can accurately evaluate/accommodate.

DESIGN TIMELINE:



For the North Mall State Office Building by Yost Grube Hall Architects in Portland, OR, the Daylighting Lab conducted a series of tests over a seven month period beginning in schematic design and proceeding through contract drawings. The architects built different study models that addressed daylighting questions ranging from site scale to specific façade shading detailing.

Use your preexisting Site Scale Model to evaluate sun on the site.



Often **Site Scale Models** are built for larger projects to help communicate design intentions to the owner or client. These models can be used effectively in the first stages of daylighting analysis.

Placing models on the heliodon sun simulator, we can quickly and accurately identify patterns of direct sun on the facades, adjacency shading of one building element by another, and determine opportunities and challenges related to building orientation. Video recordings of site sun patterns over the course of a day or year may be produced to aid in design decision making.

A quickly built model can satisfy the criteria for a good daylighting study. ⁴

Time and Effort Efficiency



One day's labor
St. Joseph's Hospital, NBBJ Design



Several days labor
Montlake Library, Weinstein AU

REMEMBER: Understand the questions that need answers; build a model that answers the questions efficiently and effectively.

The majority of daylighting models should take no more than eight hours of labor. Repeated model studies help develop a more complete daylighting analysis. It is necessary to find a balance between **time**, **budget**, and **quality** in model construction.

Always include a true north arrow on the model.

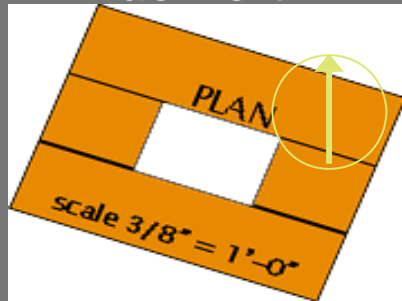
Note the **appropriate latitude** (or your Shanghai building may be tested for Seattle)

Include the **model scale**.

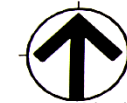
Also include project name, and architect and the date of submission.

It seems simple, but this information is often omitted and is the most common cause of errors.

True North



Project Title, Project Architects
48 North Latitude
Seattle, WA



Plan North



True North

Hanford High School
Typical Classroom


$\frac{3}{8}'' = 1'-0''$

46° 10' 28" N Latitude

1.5°

Label Template.


Copy or print this label and glue it on the base of your model, or make one on your own with the pertinent information.



True North

Note: Building is off true north _____

Latitude



Project Architects

Project Title

Project Location

Submission Date

Model Scale

Project Contact Person

Specify True North and Latitude

Use value-appropriate colored construction paper to simulate finishes that are matte (non-specular) even if the surfaces are white.



Olson Sundberg Kundig Allen

Accurately representing the light receiving and reflecting surfaces is the most crucial component of a realistic daylight model.



Ridgeview Elementary School, ALSC Architects

If simulation of reflective surfaces is desired, use a shiny material or cover colored paper with acetate. We generally consider the reflectance of a ceiling to be 80%, walls to be 60% and floors to be 20%.

Do not use bare white foam core!

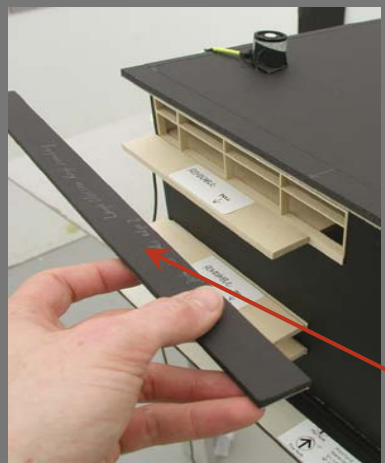
Bare foam core is extremely reflective and shiny. White foam core is also somewhat translucent.

Cover the inside of the model with appropriate surface reflectance and color materials. Paste construction paper on interior visible surfaces, even white surfaces. It is often easier to spray mount construction paper to foam core before cutting it. This will reduce modeling time significantly

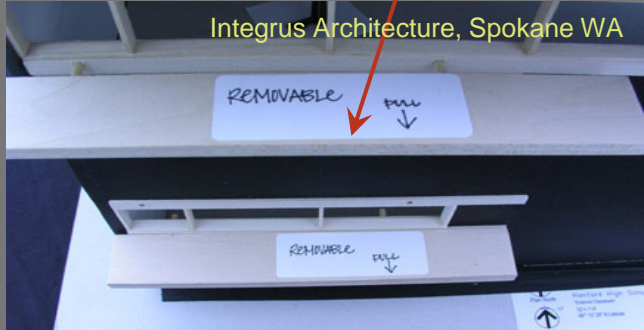


Make a modular model with interchangeable parts to test multiple schemes with a single model.

Build Modular Models



Easily removable pieces allow testing of a variety of architectural options.



Integrus Architecture, Spokane WA



North facade



South facade



West facade



East facade



Louvers on facade



Lightshelves on facade

Issaquah High School, Mahlum Architects

It is easy to test multiple facade or skylight options with one generic model. There may be multiple permutations of the building-site orientation or multiple building permutations within the same site orientation. **Clearly label interchangeable parts.** Provide an outline of requested permutations when you deliver the model.

When modeling vertical window glazing, leave openings clear.

Mullions can be added to the openings to provide a more realistic simulation, and they also provide a proper sense of scale.



The daylight data that we will provide to you after the model has been tested will be reduced by a factor depending on the light transmittance of the glazing that you specify. We will also factor in loss of transmittance due to mullions not in the model and dirt accumulation on the surface of the glass.

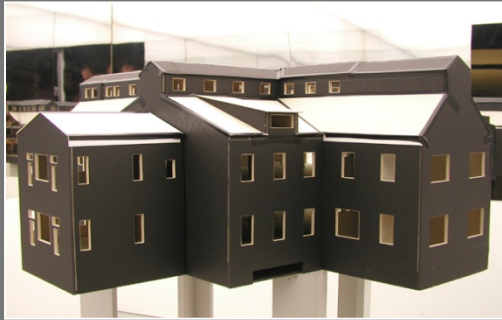
For modeling translucent materials such as skylight glazing, apply one layer of trace paper over the opening. This in combination with glazing reduction calculations simulates the 50% transmittance that is typical of a translucent skylight. Each additional layer of trace paper will reduce the visible light transmittance by roughly 25%.

Cover the floor with 20% reflective, dark gray paper.

The swatch below is an appropriate floor value for most buildings. It is important not to overestimate the brightness of floor surfaces, especially in spaces where furniture is not modeled.



Eliminate light leaks. Cover white foam core with black or colored paper.



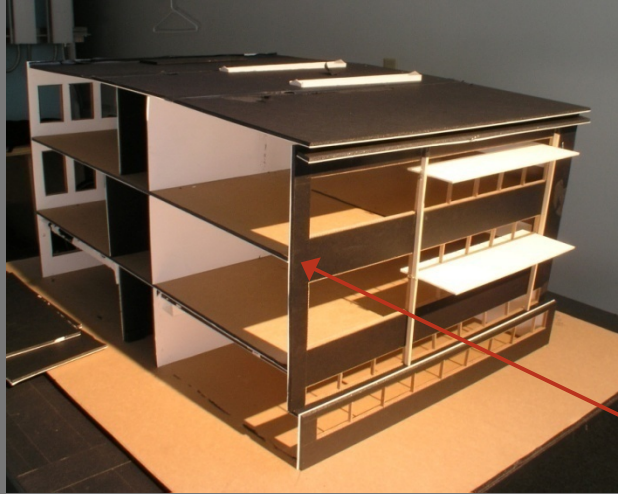
Untaped seams and bare foamcore will glow under simulated lighting conditions. This will distort overcast sky data.

As seen in the photo at right, bare foam core is slightly translucent and tends to glow. This can affect the accuracy of simulations as well as creating misleading photography.

Black foam core with value appropriate paper on the interior surfaces works best. **Tape all edges and corners** with black tape to avoid glowing seams inside the model.

Removable or hinged side walls are critical for getting good photographs and videos of interior spaces.

Locate removable walls so that the interior view you wish to evaluate is easy to photograph.



Label each removable wall. The minimum possible opening for a lens is a 2" diameter hole, but a *wall size opening will yield the best results as the camera will be able to back away to capture the whole room*. Small rooms need space generally another ½ a structural bay beyond the room of interest so the camera has room to back away. If you wish, we will cut walls out of your models; provide to us the views that you wish to have photographed.



Small view ports in tight spaces make poor photography. Try to consider what is to be photographed and how we will get a camera positioned to capture the image.



UW Architecture Hall, Thomas Hacker Architects, Portland, OR



Pierce County Combined Maintenance Facility, TCF

Scale People and Furniture

Adding scale furniture and/or people can increase the model budget, but if done it can be highly beneficial to daylight model appearance and performance. Note that furniture, cubicles, workstations, etc. can be daylight blocking elements which have a strong impact on the light levels in a given space. Any partition systems or permanent furniture such as lab tables should be modeled as they have a significant impact on the interior light levels.

Mirrors

Mirrors enhance the depth of a model and are especially useful in large spaces with repetitive plans. The lab has a number of mirrors for use with models that have been designed with their use in mind.

Note: Mirrors can only be used in the overcast sky condition. On the heliodon, the direct sun would reflect on the mirror into the space, creating inaccurate repetitions.

Daylighting Lab Services *Include:*

1. *Daylighting Consultations*
2. *Model Studies and Documentation in our Test Facilities*
3. *Computer Modeling/Simulations*
4. *Expected Energy Savings Calculations*
5. *Product Evaluations and Technical Review*
6. *Coordination of Utility Incentive Programs with Specific Projects*
7. *Glazing Specifications Review/Extensive Sample Library*
8. *Daylighting Classes/Seminars (AIA LU & CEU)*
9. *Integrated Design Services through BetterBricks*



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