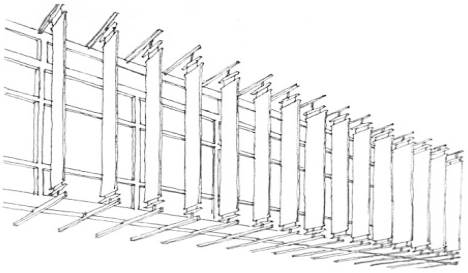

ARCHITECTURE 331/431

Environmental Control Systems

A4: Shading Model Study

INTRODUCTION

Physical models provide a quick, direct and effective means to test the effectiveness of window shading devices. In this exploration you'll combine 2-hour temperature data with sun path diagrams for your location to guide the design of a window shading device, then test your design using a physical model.

OBJECTIVES

To design window shading devices that effectively match a building's need for sun or shade over the course of the year.

EQUIPMENT

- A transparent **shading protractor** and a copy of the **sun path diagram** for the latitude closest to location of your climate city. These can be downloaded from the course website.
- A two-hour temperature plot for your climate city (use the 2-hour temperature spreadsheet on the course website)
- A photocopy of the sun peg diagram (sun dial) for your latitude.
- Foam core, chip board, museum board or corrugated cardboard for making a model of a small portion of your building's façade and interior and extra material for the shading devices.
- Exacto knife or box cutter, cutting board, pins and/or tape and glue.
- A digital camera to document your studies.

METHODOLOGY

You may choose to do this study with your building located in Seattle or alternatively, in your climate city from previous exercises. If you don't have a design studio project to work with, use either a previous studio project or develop shading devices for at least two windows for a building on the UW campus.

Ideally, you should work in a group of three, as you'll need three sets of hands when it comes time to test your designs. If you work as an individual or a pair, help each other out when it comes time to test your models. You can document your work in one report or submit individual summaries, but you should collaborate with your colleagues throughout this exploration.

PART I. BASE MODEL

Based on preliminary elevation designs for your studio project, construct a model of a portion of your building containing the window or windows you wish to explore. The model will include a portion of the façade, an interior ceiling, floor and one or two interior walls in order to create a self-supporting model that allows you to view the indoor space. The model does not need to replicate the actual interior room volume, but should contain enough of the room to analyze the sun's penetration in the space. The scale for your model should be at least ½" = 1'-0". Assemble your base model according to the directions given in lab. There will be one model for each student.

Mount a **sun peg chart** on your model at the correct orientation relative to your window. Make sure that you understand how to mount the sundial to represent the chosen orientation BEFORE you glue or pin it down

PART II. SHADING DEVICE DESIGN AND ANALYSIS

1. Create a colored **two-hour temperature chart** for Seattle or your climate city using a balance point temperature of **55°F** and a change-over temperature of **77°F**, as illustrated in lecture. Next, transfer the colored cells in this chart to their corresponding cells on (2) plots of the **sun path diagram**, one for June 22 - December 21 and December 22 - June 21, to create a pair of "**two-hour sun path diagrams**."

2. Based on your analysis of the building's need for either solar gain or shade, sketch a series of **window shading mask** overlays on your *2-hour sun path diagrams* that address your building's thermal needs. The **shading protractor** will help you draw shading masks for the window shading devices you conceive.

   Alternatively, design shading devices for your window and *then* draw a corresponding shading mask to overlay on your 2-hour sun path diagram. Working in either manner, your aim is to create a window shading device that corresponds your building's need for sun and shade.

   (Because your building's need for sun and shade will be different in the "fall" half of the year versus the "spring" half of the year, it is virtually impossible to satisfy your building's sun and shade requirements with fixed shading devices alone. Suggest compromises or strategies for addressing these conditions.)

3. Model your window shading device and test it by taking your model outside and rotate it (guided by your sun peg chart) to simulate the passage of the sun across the face of your building during the year. Observe whether or not your model study conforms to your shading mask's predictions, and if you're getting sun and shade on your window when it's needed. Revise or fine-tune your shading device until you're satisfied with both the performance and appearance of your window shading device.

4. Identify critical or transitional times of year to demonstrate the effectiveness of your shading device. Cover the opening(s) with trace in order to more easily view the proportion of the window in sun or shade, then take your model outside and test your building at these times. Document your findings with either photographs or sketches recording the time/date and showing the sun/shade on the window, and compare this to your building's need for sun/shade as indicated on your two-hour temperature chart or sun path diagram. This analysis will be facilitated with the help of two colleagues: one to hold and rotate the model, one to take photographs or sketches of the window, and one to direct and record the study.

5. OPTIONAL: You may also want to do this study by exploring the penetration of sun into your building. Do step (4) with your window uncovered and view/photograph the penetration of direct sun into your space.

PART III. DESIGN DOCUMENTATION

1. Document your study with photographs, shading mask(s), and two-hour temperature charts/sun path diagrams, that illustrate the performance of your window shading device at significant times during the year.

2. Write a **brief summary** about your design, your design intent, and possible alternative strategies for shading your window(s). Submit your documents in 8-1/2" x 11" format and as a PDF digital file. You may do one report for your team or individual reports. Bring your model to discussion section on the due date.