

**Architecture 4.411**  
**Building Technology Laboratory**  
**Spring 2004**

**Assignment 11 Daylighting in Houses in Gujarat, India**

**April 21 and 22, 2004**

Please CAREFULLY read chapter 9 of our textbook, Joseph Murdoch's *Illuminating Engineering*. This chapter is critical for sizing windows in our Gujarati houses.

Please design roof opening(s) for your Gujarati house and test it with a second round of daylighting measurements. Please proceed as follows:

1. Design roof openings. You will need to consider:
  - a. How much light is needed to supplement what is obtained in your base case
  - b. Desired light distribution - uniform over a large portion of a room or concentrated
  - c. Desired light source - beam daylight or diffuse
  - d. Diffusion devices as needed
  - e. Orientation of the roof (compass direction)
  - f. Shading of the opening to control light and heat
  - g. Keeping rain and dust out
  - h. (IMPORTANT!!) Sizing the openings in accordance with calculations based on the equations in chapter 9 of Murdoch, to be discussed in lecture and/or lab.
2. Sketch or mock up a single roof opening at an appropriate scale, perhaps 1/4 or 1/2 scale. Use this sketch or model to express and test your concept before moving on to step 3. Please refer to William Lam's *Sunlighting as Formgiver for Architecture* for ideas about roof openings.
3. Implement your design in your model house, at an appropriate level of detail. Use as many roof openings as you think are necessary to substantially improve the interior lighting, relying on your calculations and good judgment. Over-illumination is generally not desirable.
4. Take a second round of measurements, exactly as specified for the base-case house. Compare measured illuminance levels with your targeted levels, which you have used in your calculations to size your windows.

NOTE: Please feel free to use a combination of roof and wall openings if you feel such a combination is desirable. Roof openings have the potential advantages of allowing cooking smoke to escape and may be easier to implement than punching holes in walls, but need not be considered the only type of intervention.

Following the measurements, we will have a final component of the lighting lab, to be introduced in lecture: lighting simulation using Lightscape.

Schedule adjustment: this assignment will be due in TWO weeks, May 4 and 5. Lecture on April 27 will focus on daylighting and the lecture the following week will take up simulation. If you are ahead of the game, please start to prepare the third lab report: lighting and reflectance measurements (assignment 9, parts 1-6), modeling of a Gujarati house (assignment 9, part 7), and first round measurements (assignment 10, data presentation and analysis).