

Architecture 4.411
Building Technology Laboratory
Spring 2004

Assignment 9 Daylighting in Houses in Gujarat, India

April 7 and 8, 2004

Please read Chapters 1 and 2 of our textbook, Joseph Murdoch's *Illuminating Engineering*. How to do this? You will find the latest edition (1994) on reserve in Rotch and an earlier edition (1985) in the stacks in Barker and in the humanities library. You may have already purchased one from the Coop or found it on-line. We will make use of five of the 11 chapters in the book.

Please take on the following tasks:

1. Illuminance measurements. Use an illuminance meter to record light levels in residential spaces, including those used for food preparation, reading, and such detailed manual labor as sewing or electronics repair (i.e., a home shop or work room). Take readings on a clear day, a cloudy day, and at night with electric lights turned on. Daytime readings with supplemental electric lights are useful as well. With the measurements, note your subjective impressions about the quantity and quality of light. Adequately describe the spaces, with at least a plan sketch and notes about windows. Note measurement locations on the sketch.
2. Review IES illuminance criteria (from Murdoch or, better, the IES Handbooks which are in the lab and in the Rotch reference collection) for activities you think appropriate for a Gujarati house.
3. Define desired lighting levels and any issues about light quality for a Gujarati house, on the basis of Tasks 1 and 2.
4. Use the illuminance meter to estimate reflectances for typical walls and floors, including those in your test rooms. Reflectance is approximately the ratio of the readings obtained with the meter pointing toward the surface and (in the denominator) away from the surface.
5. Review IES data on surface reflectances.
6. Define desired wall, floor and ceiling reflectances for upcoming daylighting models of Gujarati houses.
7. Select a Gujarati house, select modeling materials, and construct a model. Please pay attention to:

- a) Accurate dimensions, with careful notes about choices when available information is inadequate.
- b) Accurate surface reflectances. Please document measurements you make of your models and compare these with targets you have established.
- c) Model construction that readily supports changes. Consider a wood frame and card-stock or wood panels. Anything sturdy, opaque, and capable of being modified is fine.
- d) A scale that is large enough to get at least two illuminance readings in at least two locations per room. Consider 1/2" or 3/4" to 1'. For a very small dwelling, 1" to 1' may be a better bet. For those who naturally think metric, 1/2" scale is 1:24.
- e) Provide a horizontal surface for attaching a sun-peg diagram and provide holes in the base for the illuminance meter. Plan on about 4-6 measurement points, more if your house has a second story.
- f) Choose an orientation for the house (N, S, E, and W, referenced to the normal direction from the front of the house).
- g) Window sizes. We will start with as-built dimensions and later progress to modifications.

During the second week of this assignment we will begin an intensive series of measurements under a range of lighting conditions.