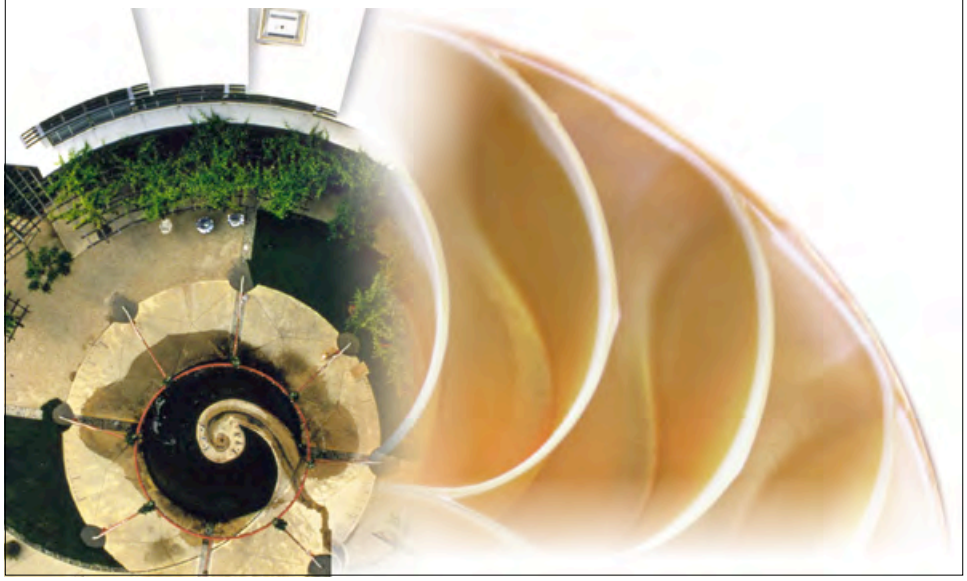
Solar Control & Shading Masks

ARCH 331/431 Spring 2008
Lecture 11



announcements 5/6/08

Panel Discussion:

How have I used my architectural degree in a non-traditional career path

Wednesday May 7, 5:30, Architecture Hall 042

(Sponsored by the Professional Advisory Council; food will be served)

Assignment 4:

Shading Model Studies

Available on the Course Website (due in sections next week)

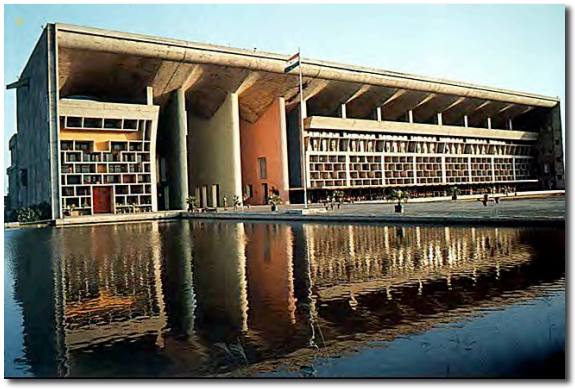
Sun Angle Calculators

http://www.sbse.org/resources/sac/index.htm

two poles of solar control

layered, thick,
directionally specific facade

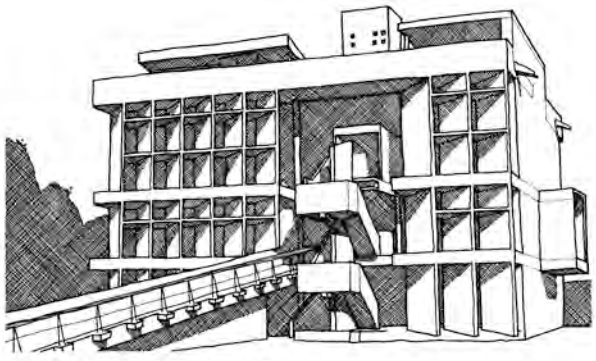
reflective glass,
smooth skin curtain wall



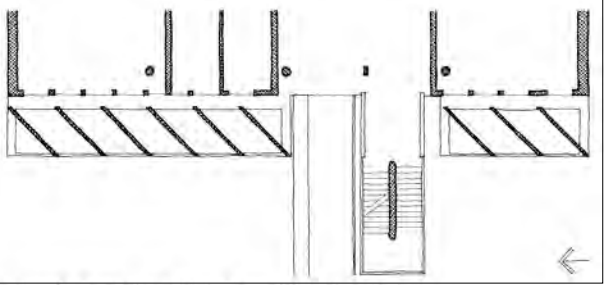
Chandigarh High Court, Le Corbusier, Punjab, 1957

Mill Owners
Association Building

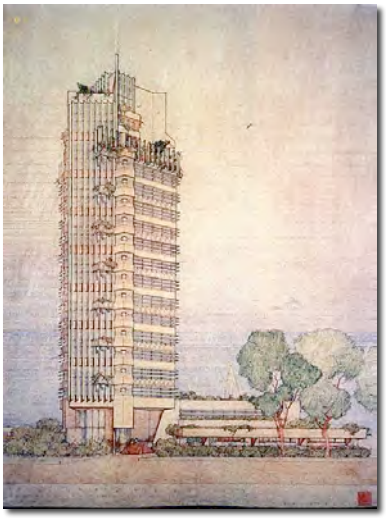
West Facade

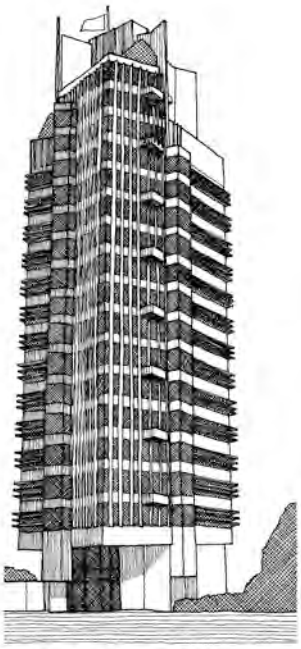


Millowner's Association Building, West Facade



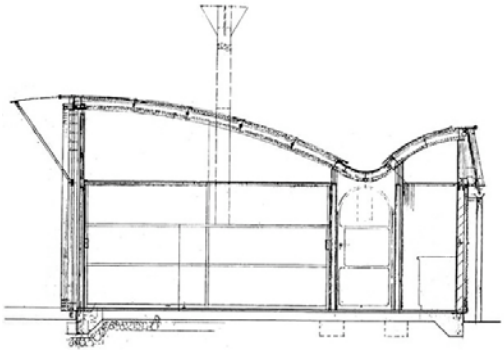
Price Tower, Frank Lloyd Wright,
Bartlesville, Oklahoma, 1952-1956.



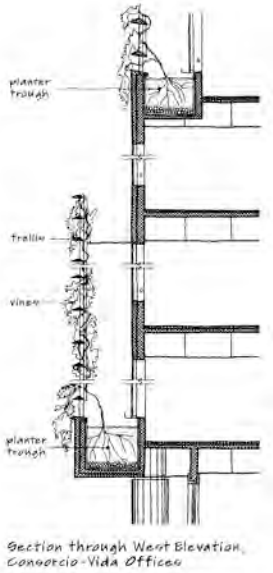


BRE Environmental Building, Feilden Clegg Design, Garston, UK. 1997

Inland Revenue Center, Michael Hopkins, England, Nottingham, UK, 1995



Magney House, Glenn Murcutt Bingi Point, NSW, 1982-1984



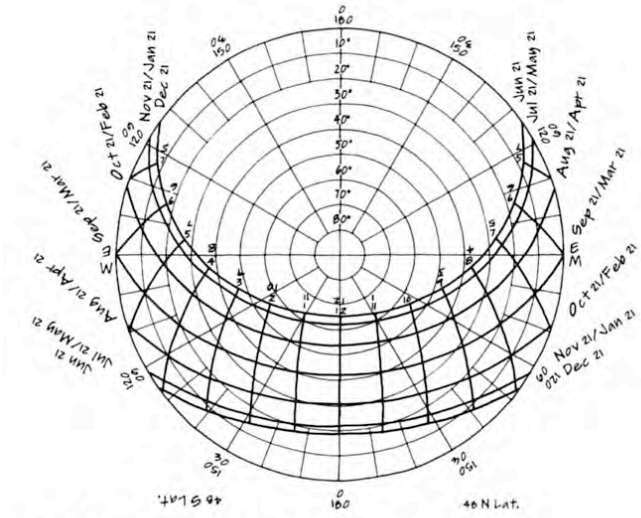
Section through West Elevation, Consorcio-Vida Offices

Consorcio-Vida Offices, Enrique Browne, Santiago, 1990-1993

Sun Path Diagra

Sun, Wind & Light
pgs. 297 - 300

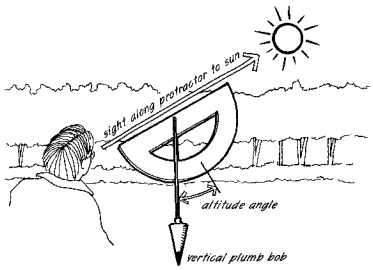
MEEB 10th Appendix D.3
pgs. 1539-1542

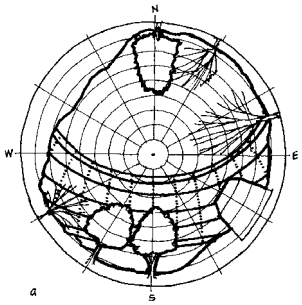


Sun Path Diagram, 46° Latitude

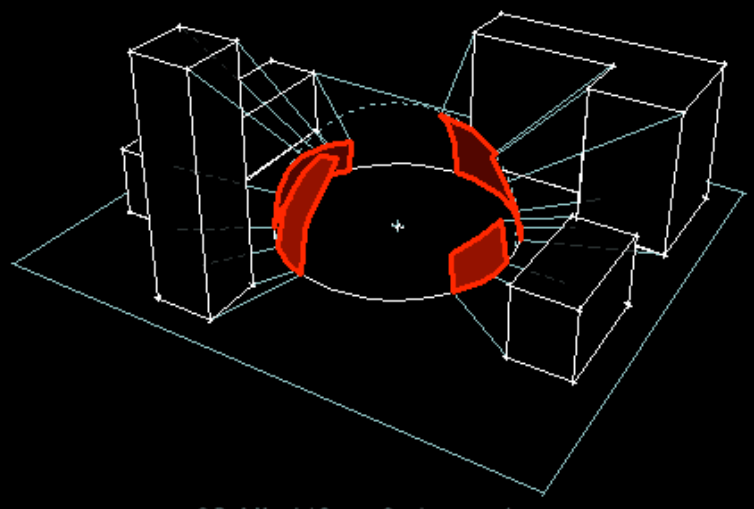
1. Site Shading Masks

*Plotting a picture of the **sun's path**, and the landforms, buildings, trees and objects that block the sun.*

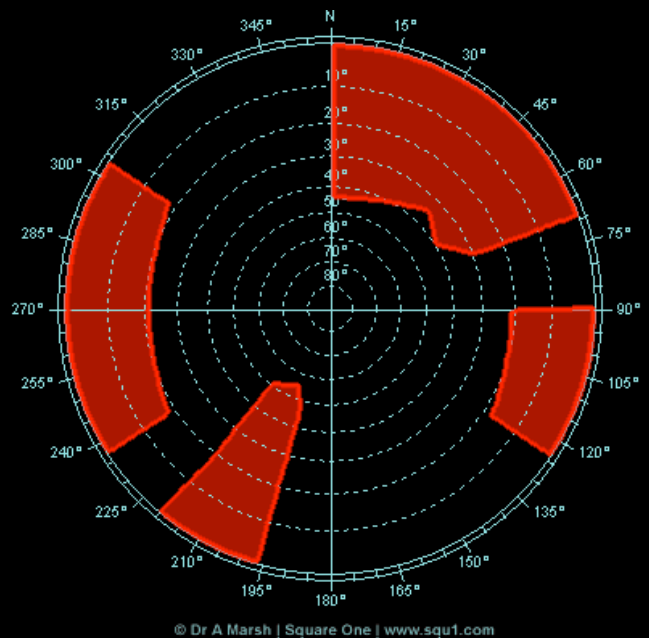




Sun Path Diagrams provide a very handy frame of reference for accessing horizon obstructions

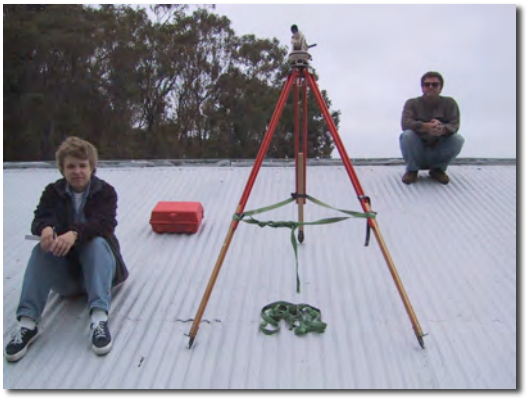


Obstructions from the previous diagram as seen on a Sun path Diagram (polar, stereographic)



Method A: Horizon Survey

*Find the **Altitude** and **Azimuth** of points along the horizon formed by trees, buildings and landforms and plot these on a **Sun Path Diagram** to make accurate predictions of solar access.*



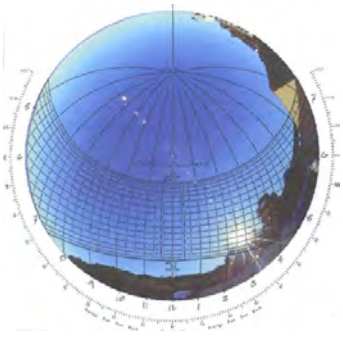
Azimuth = 30° E

Altitude = 8°

Solar Transit

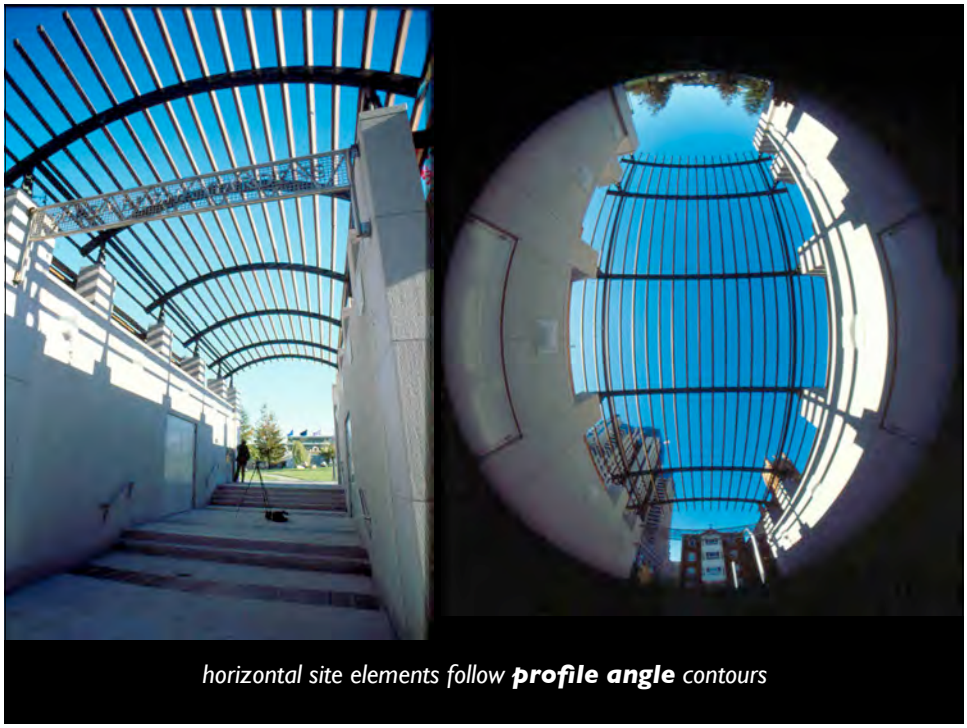
Method B: Fisheye Photography

*Fisheye images can "see" the entire sky vault and document the horizon in a single image. Overlaid on a **Sun Path Diagram**, accurate predictions of solar access can be made.*



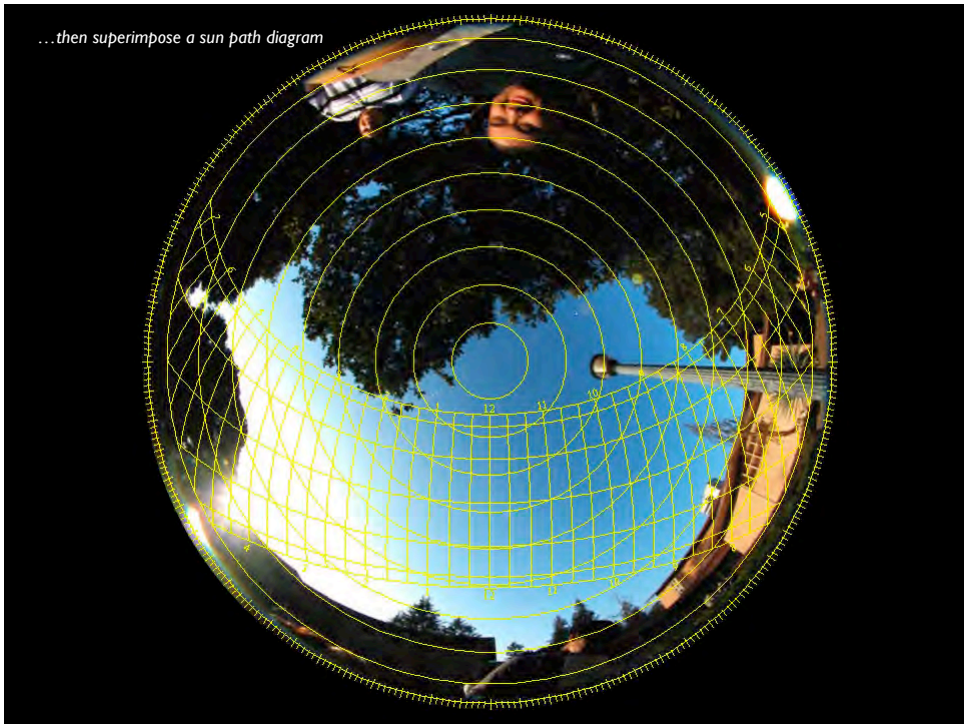

Take a fish-eye view of the sky dome...


Vertical site elements span from the horizon toward the zenith



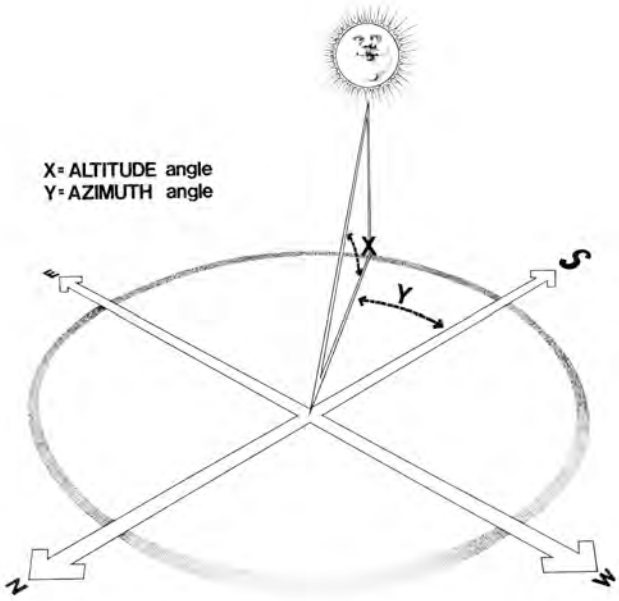
*horizontal site elements follow **profile angle** contours*


Take a fisheye photograph…

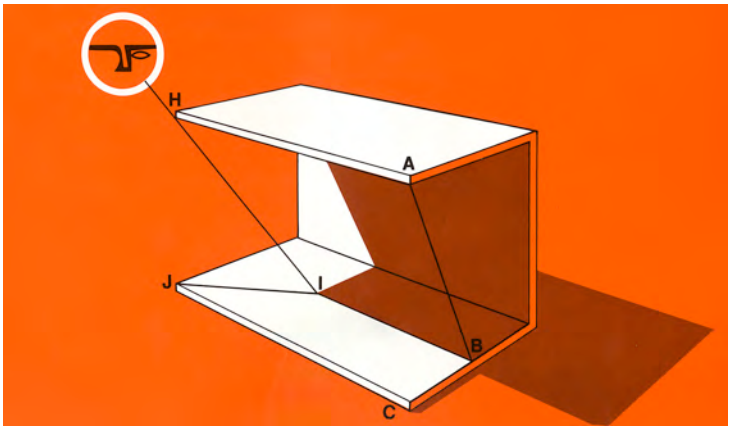


2. Window Shading Masks

*Plotting a picture of a **window shading device** and the sun's path to predict sun and shade on a window*



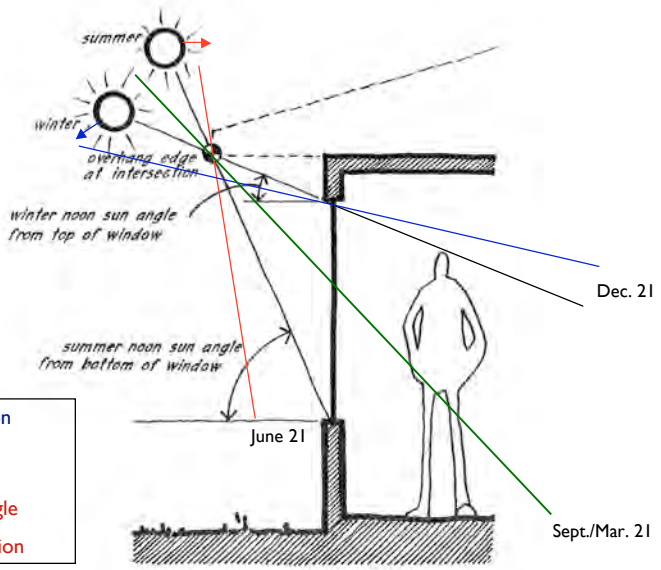
Profile Angle



J • I • H = Altitude Angle

C • B • A = Profile Angle

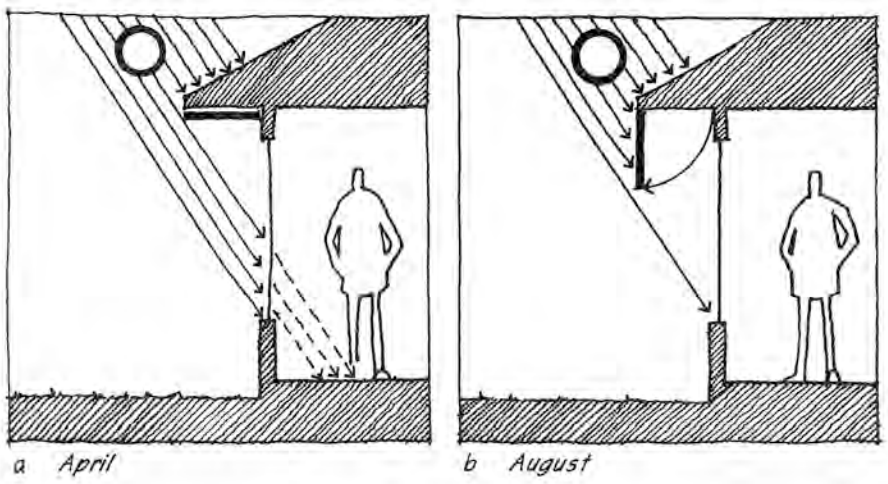
Profile Angle



Note: if this is a section through a south-facing window, at noon:

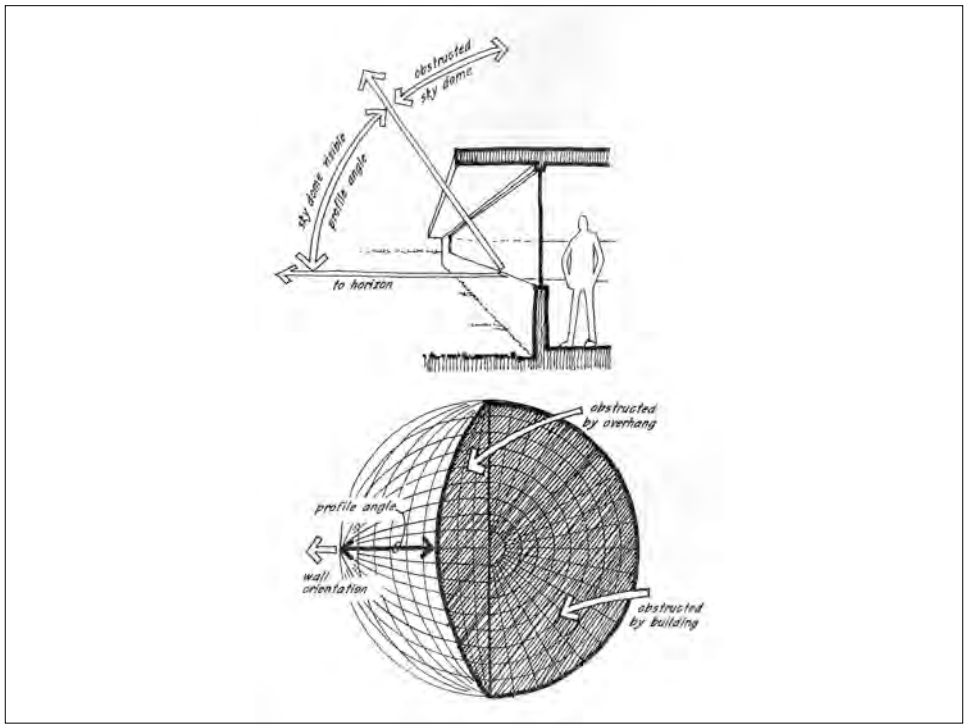
Profile Angle = Alt. Angle

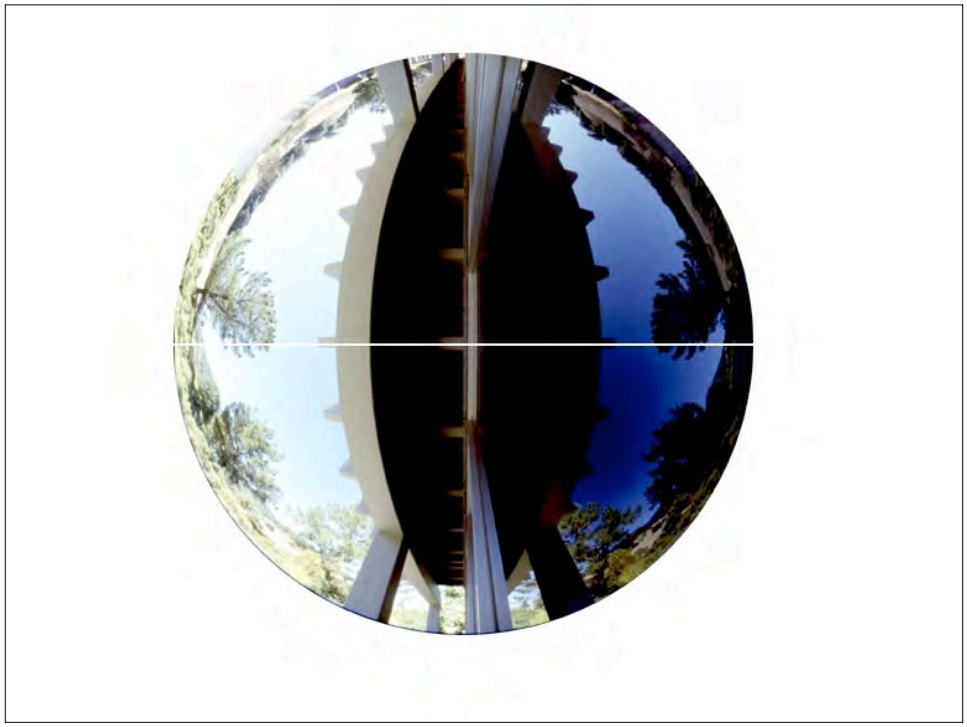
= 90° - Lat. + Declination



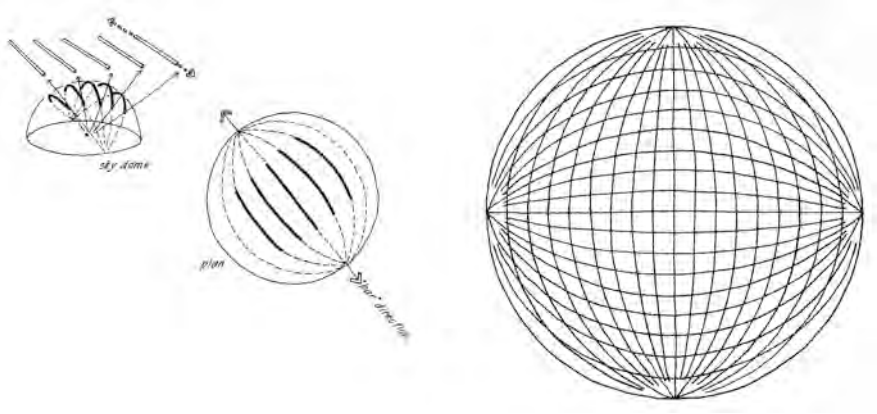
Addressing Seasonal Shading:

- Movable Shading Devices
- Deciduous Plants

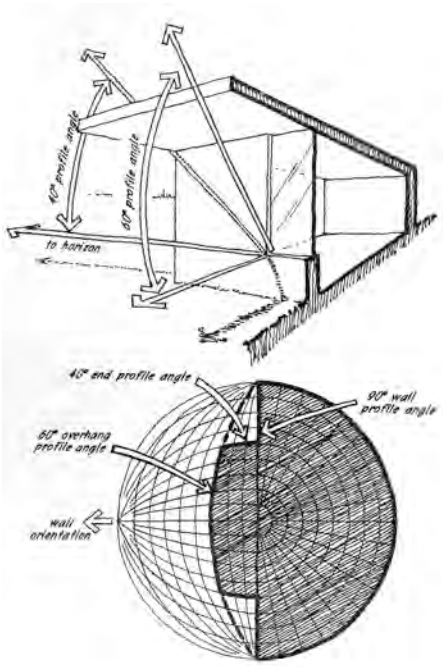

obstructed
sky dome
sky dome visible
profile angle
to horizon
obstructed
by overhang
profile angle
wall
orientation
obstructed
by building

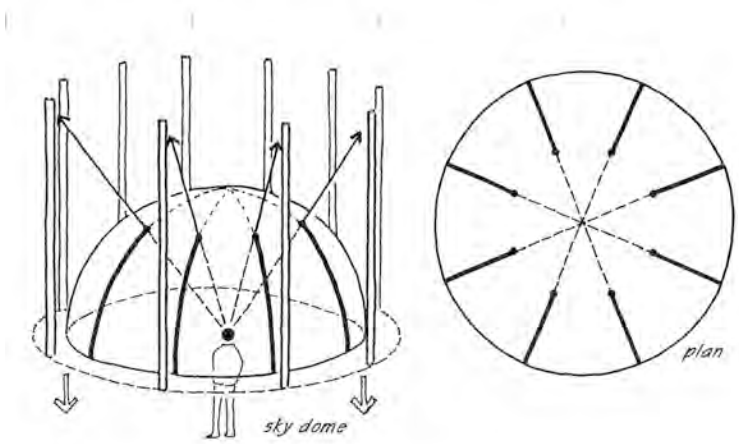


Construction a Window Shading Mask: Making a Shading Mask Protractor

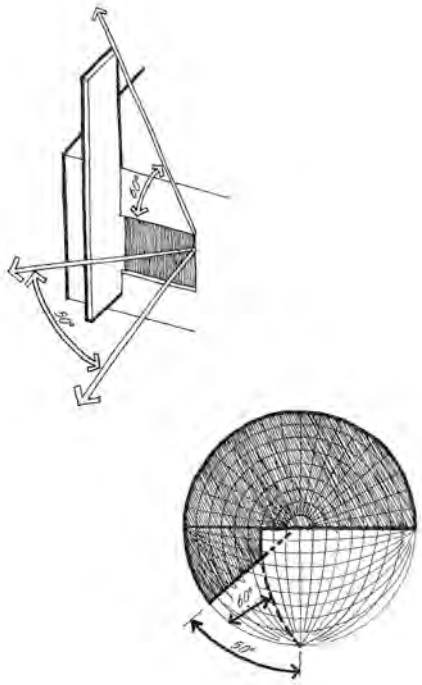


1. Horizontal Projections

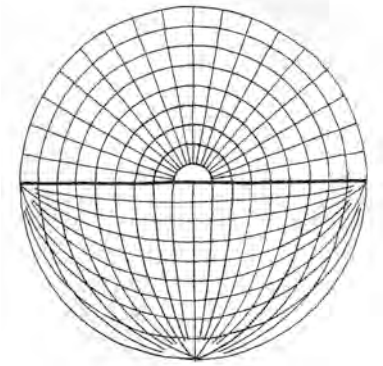




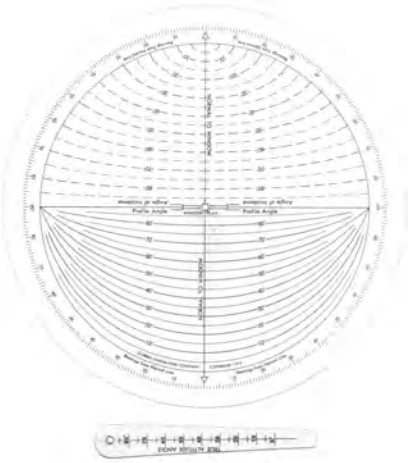
2. Vertical Projections



Sun Path Diagram Overlays

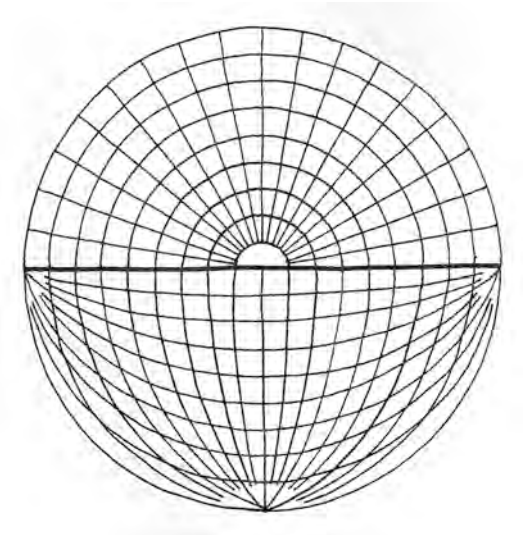


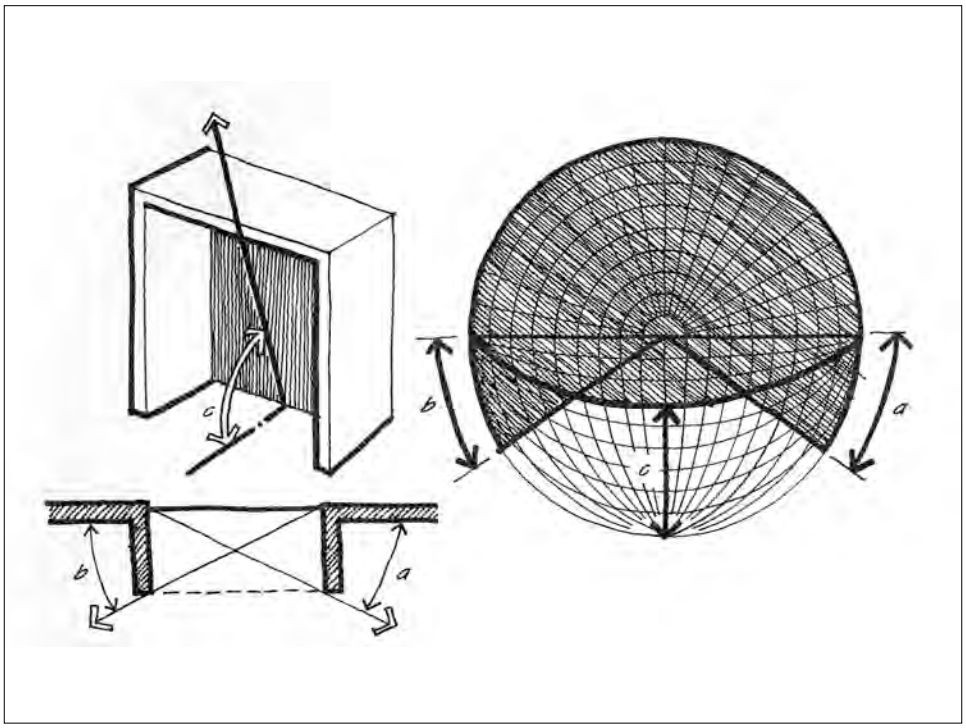
Shading Mask Protractor

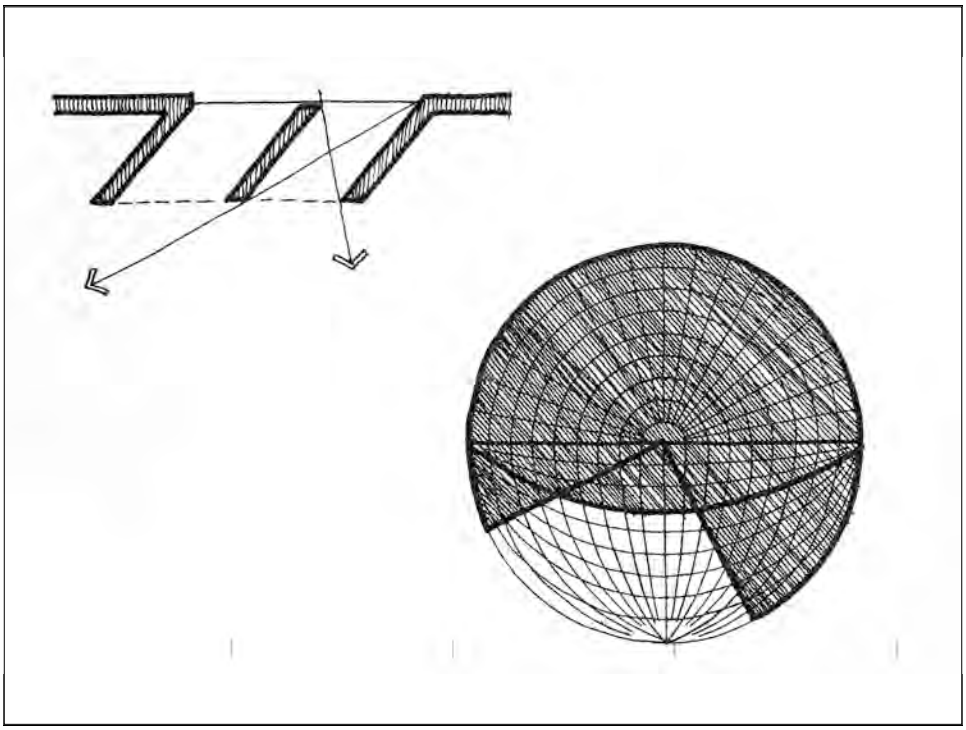


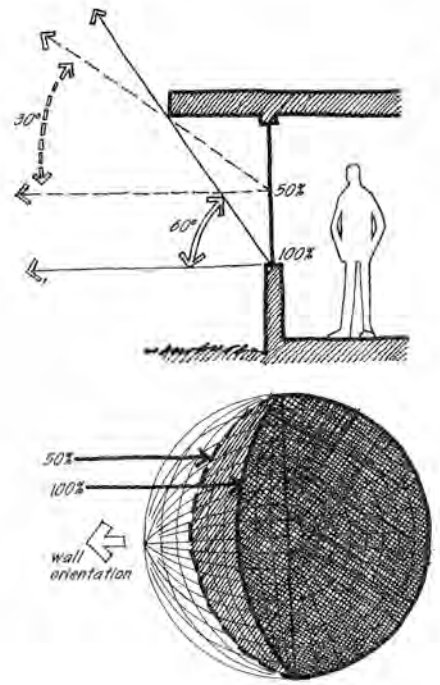
Profile Angle and
Angle of Incident Protractor

Combination Shading Mask Protractor

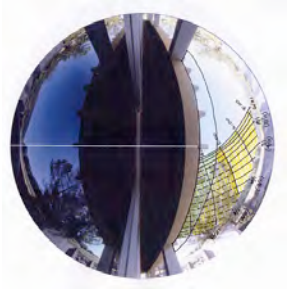


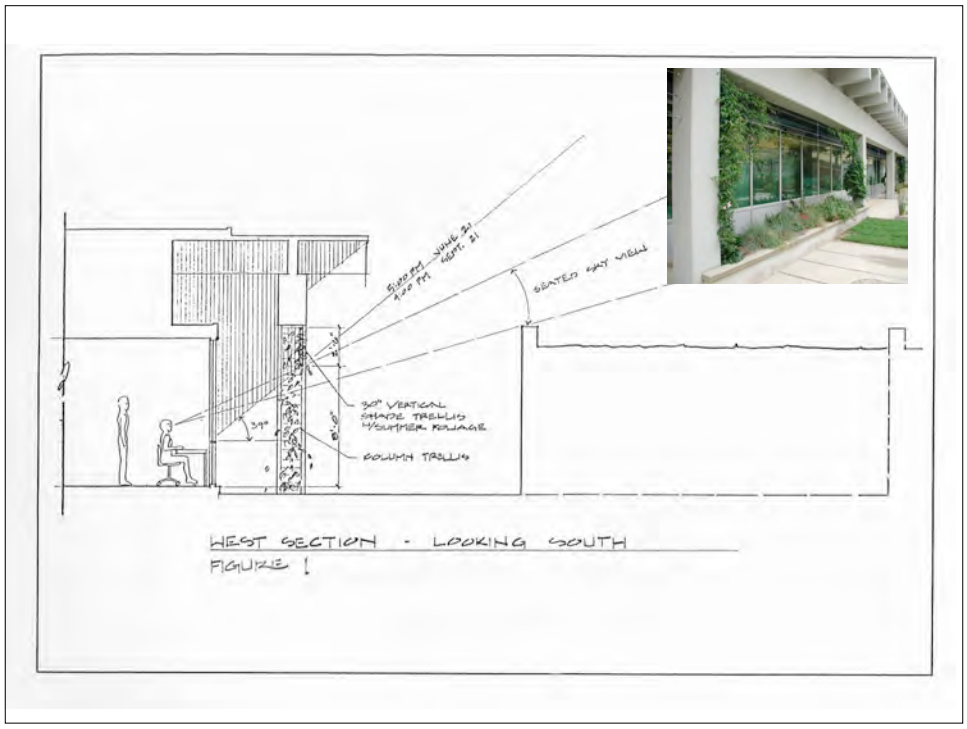

c
b
a
c
b
a

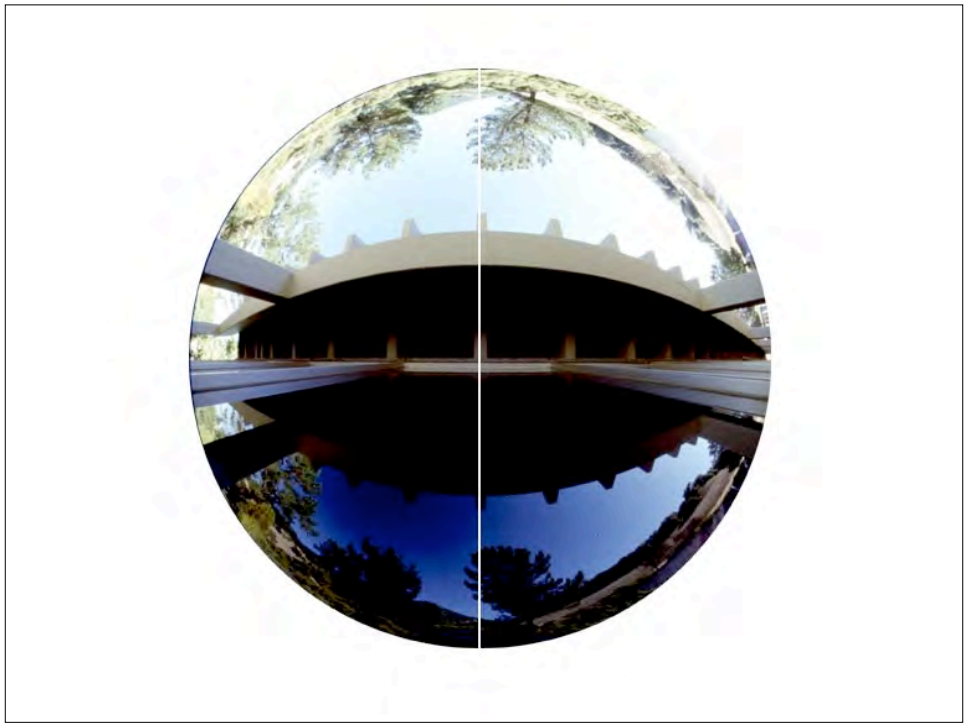


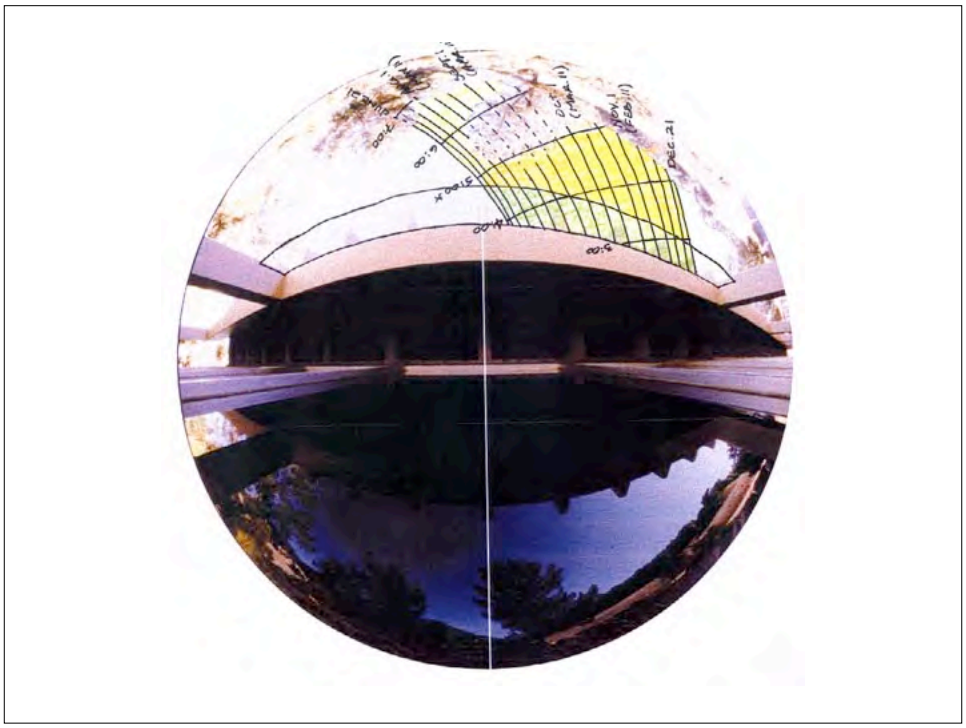


Birkenstock U.S.A.
Façade Shading and Envelope Renovation
Novato, California




SUMMER SUNSET 21 JUNE 8:00 PM
SHADED SKY VIEW
30° VERTICAL SHADE TRELLIS W/SUMMER FOLIAGE
COLUMN TRELLIS
WEST SECTION - LOOKING SOUTH
FIGURE 1





2-Hour Shading Calendar

Example: A House in San Luis Obispo

< 65° **Closed** Balance Point Temperature = **65°**

65° to 74° **Open**

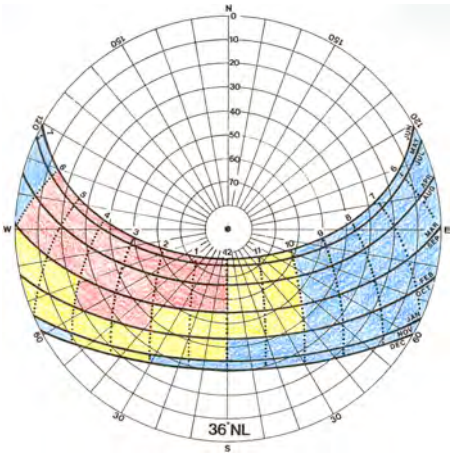
> 75° **Closed** Change-over Temperature = **75°**

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
midnight to 2am	46	48	49	51	53	56	58	59	58	56	51	47
2 to 4am	45	46	47	49	51	54	56	56	56	54	49	45
4 to 6am	43	45	45	47	49	52	54	54	54	52	47	43
6 to 8am	42	43	44	46	48	50	52	53	53	50	46	42
8 to 10am	44	46	46	48	50	53	55	56	55	53	49	45
10pm to noon	54	56	56	59	61	65	67	68	68	66	60	55
noon to 2pm	60	62	62	65	67	71	75	76	75	73	67	61
2 to 4pm	63	65	65	68	70	75	78	79	79	77	71	65
4 to 6pm	61	63	64	66	68	73	76	77	77	74	68	63
6 to 8pm	56	58	59	61	63	67	70	71	71	68	63	58
8 to 10pm	51	53	53	56	58	61	64	65	64	62	57	52
10pm to midnight	48	50	50	53	55	58	60	61	61	58	53	49

Shading Calendar + Sun Path Diagram

San Luis Obispo 36° N Sun Path Diagram

June 22 - December 21



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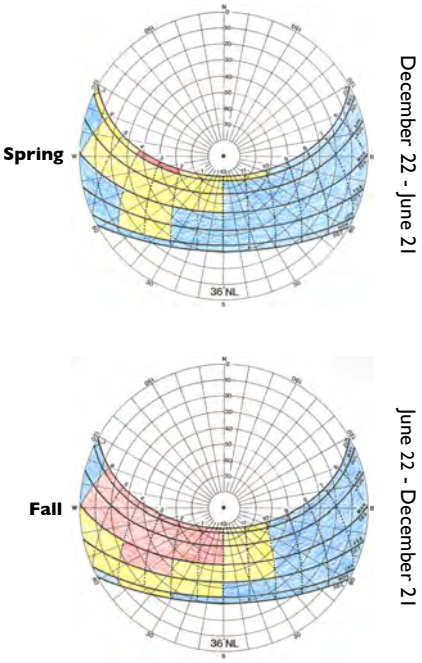
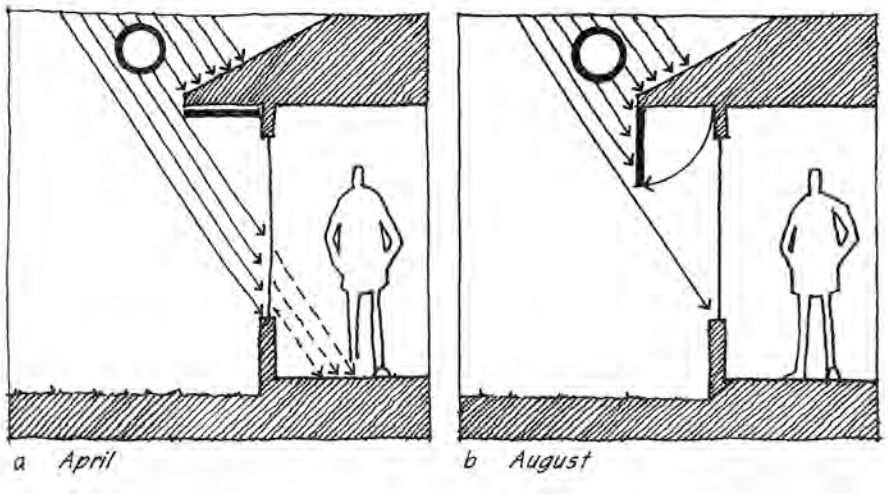
4 to 6am	43	45	45	47	49	52	54	54	54	52	47	43
6 to 8am	42	43	44	46	48	50	52	53	53	50	46	42
8 to 10am	44	46	46	48	50	53	55	56	55	53	49	45
10pm to noon	54	56	56	59	61	65	67	68	68	66	60	55
noon to 2pm	60	62	62	65	67	71	75	76	75	73	67	61
2 to 4pm	63	65	65	68	70	75	78	79	79	77	71	65
4 to 6pm	61	63	64	66	68	73	76	77	77	74	68	63
6 to 8pm	56	58	59	61	63	67	70	71	71	68	63	58
8 to 10pm	51	53	53	56	58	61	64	65	64	62	57	52
10pm to midnight	48	50	50	53	55	58	60	61	61	58	53	49

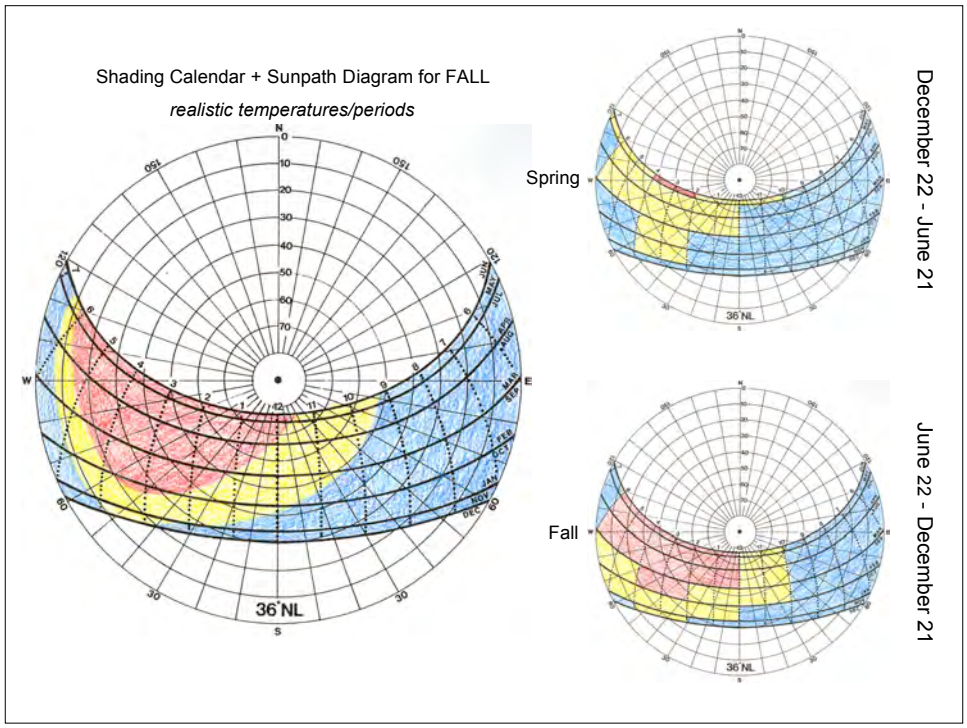
December 22 - June 21 ← → June 22 - December 21

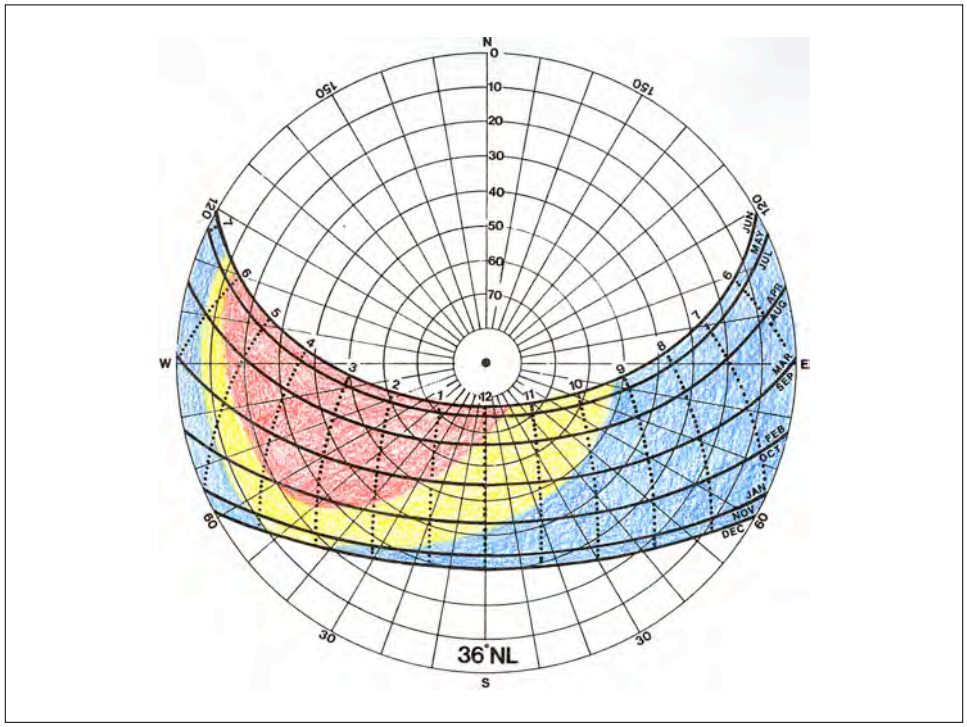


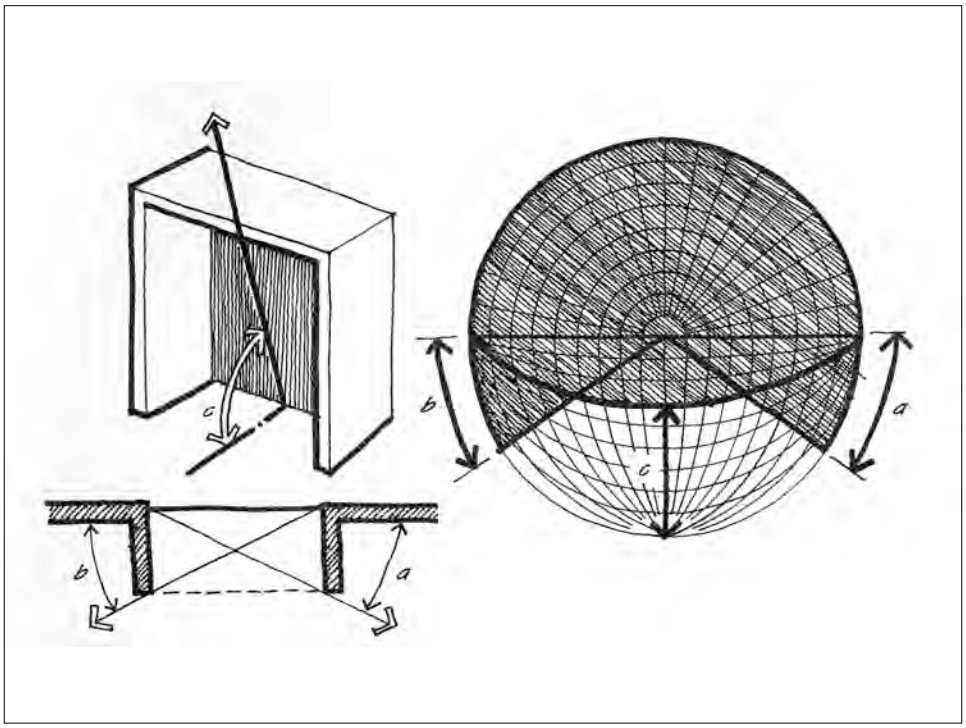
December 22 - June 21

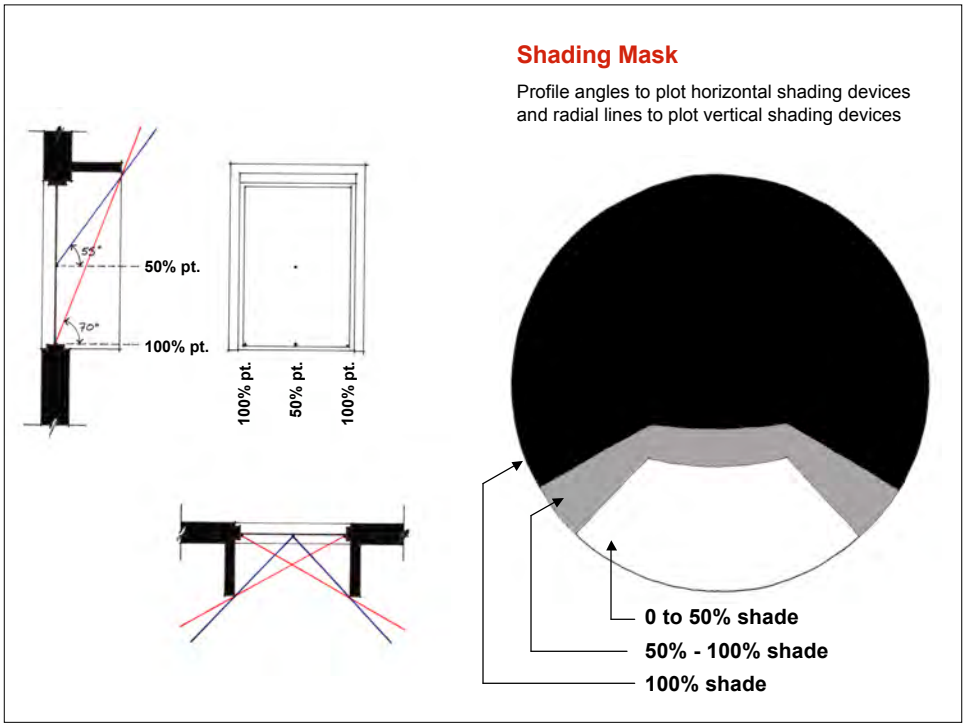
June 22 - December 21




Shading Calendar + Sunpath Diagram for FALL
realistic temperatures/periods
36˚NL
Spring
Fall
December 22 - June 21
June 22 - December 21

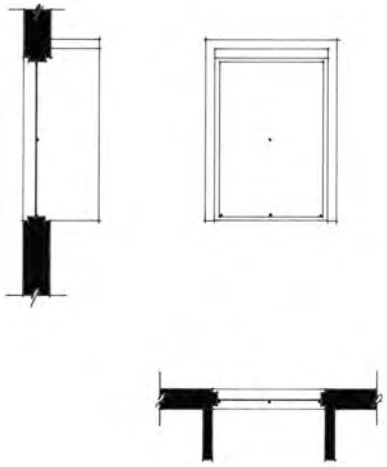

36˚NL

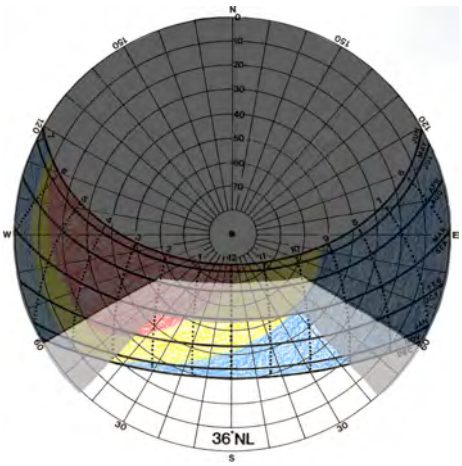

c
b
a
b
a
c


Shading Mask
Profile angles to plot horizontal shading devices
and radial lines to plot vertical shading devices
55°
50% pt.
70°
100% pt.
100% pt.
50% pt.
100% pt.
0 to 50% shade
50% - 100% shade
100% shade

Shading Mask + Shading Angles

Profile angles to plot horizontal shading devices and radial lines to plot vertical shading devices





South-facing Window