Assignment F

Design comfort for split climate conditions of summer and winter:

Shouldn't cool down to much during winter

Shouldn't heat up to much in the summer.

Solar:

-Large apertures on eastern face walls and small apertures on west walls(during the summer this could result in uncomfortable conditions during the night)

-Lightshelves for rooms' twenty feet deep

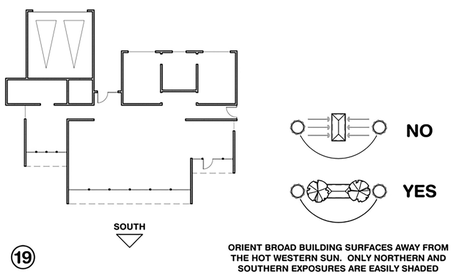
-East west orientation

Trombe wall
Water wall
Solar wall
Attached greenhouse

-South wall shouldn't have many surfaces(windows) that are a thermal bridge

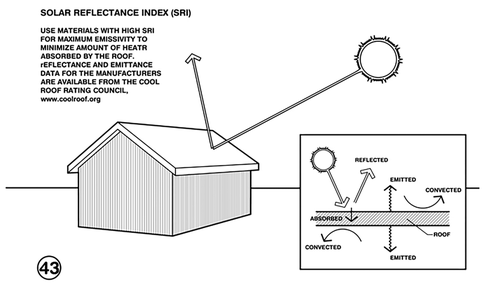
-Large apertures on eastern face walls and small apertures on west walls(during the summer this could result in uncomfortable conditions during the night)

-Keep reflectivity and emissivity in mind for heat gain.
emissivity(shiny metals have low emissivity)
Wood .95
Glass .94
Paint, average of 16 colors .94
Brick, common red .93
Concrete .92
Plaster, rough coat .91
for thermal
material



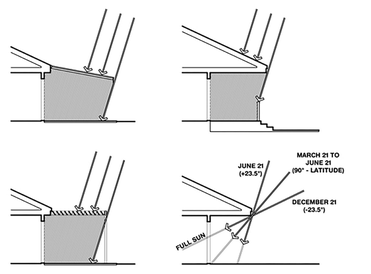
19

For passive solar heating face most of the glass area south to maximize winter sun exposure, but design overhangs to fully shade in summer



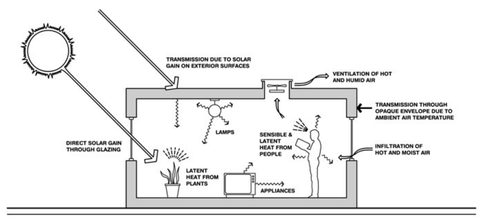
43

Use light colored building materials and cool roofs (with high emissivity) to minimize conducted heat gain



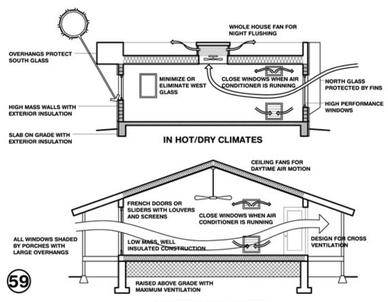
37

Window overhangs (designed for this latitude) or operable sunshades (awnings that extend in summer) can reduce or eliminate air conditioning



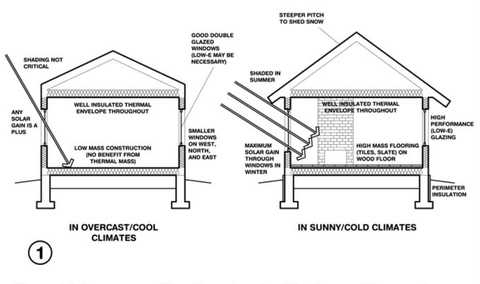
11

Heat gain from lights, people, and equipment greatly reduces heating needs so keep home tight, well insulated (to lower Balance Point temperature)



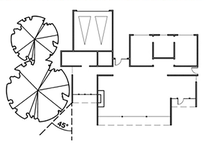
59

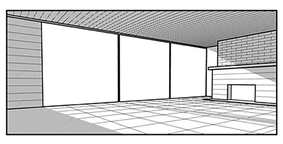
In this climate air conditioning will always be needed, but can be greatly reduced if if building design minimizes overheating



1

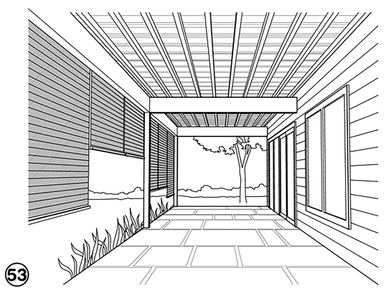
Tiles or slate (even on wood floors) or a stone-faced fireplace provides enough surface mass to store winter daytime solar gain and summer nighttime 'coolth'





31

Organize floorplan so winter sun penetrates into daytime use spaces with specific functions that coincide with solar orientation



53

Shaded outdoor buffer zones (porch, patio, lanai) oriented to the prevailing breezes can extend living and working areas in warm or humid weather

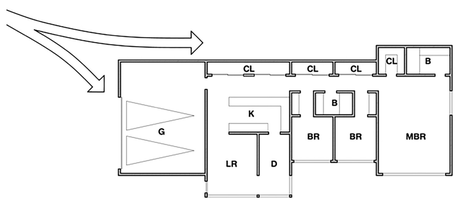
Wind:

-Design circulation of building parallel to prevailing breezes in humid and hot summer season for natural ventilation

-Protection from chilly winds during winter time

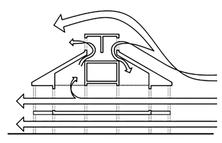
-Air tight construction is good for hvac usage

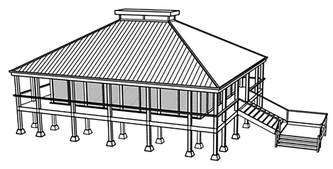
-Winter chill winds need to be controlled, but this doesn't mean that the design solution kills the overall wind flow for it will make the building passively uncomfortable for summer



14

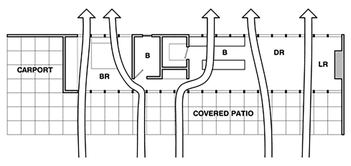
Locate garages or storage areas on the side of the building facing the coldest wind to help insulate

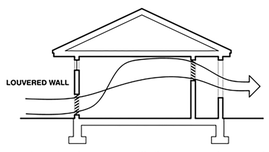




27

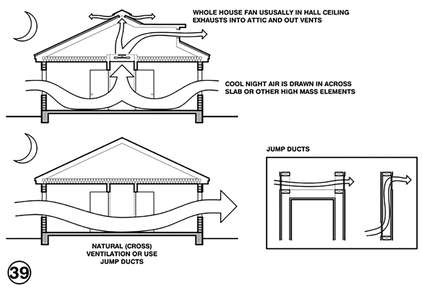
If soil is moist, raise the building high above ground to minimize dampness and maximize natural ventilation underneath the building





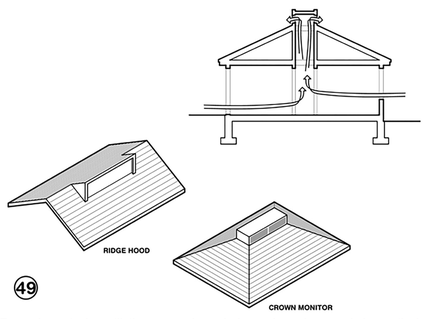
47

Use open plan interiors to promote natural cross ventilation, or use louvered doors, or instead use jump ducts if privacy is required



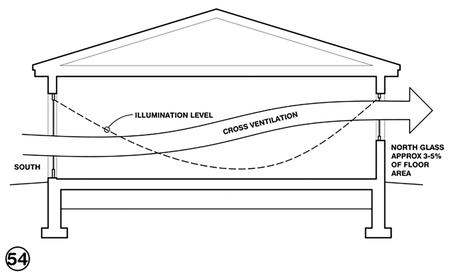
39

A whole-house fan or natural ventilation can store nighttime 'coolth' in high mass interior surfaces (night flushing), to reduce or eliminate air conditioning



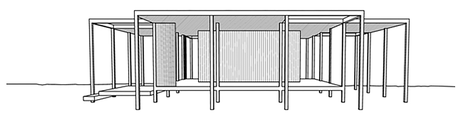
49

To produce stack ventilation, even when wind speeds are low, maximize vertical height between air inlet and outlet (open stairwells, two story spaces, roof monitors)



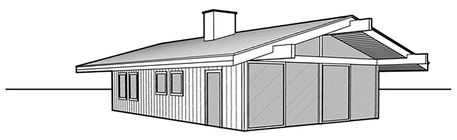
54

Provide enough north glazing to balance daylighting and allow cross ventilation (about 5% of floor area)



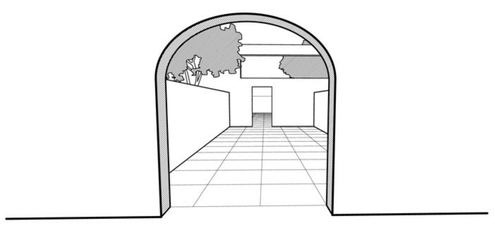
58

This is one of the more comfortable climates, so shade to prevent overheating, open to breezes in summer, and use passive solar gain in winter



55

Low pitched roofs with wide overhangs works well in temperate climates

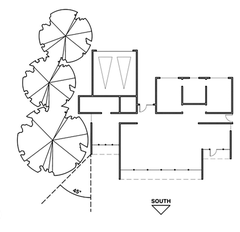


8

Sunny wind-protected outdoor spaces can extend living areas in cool weather (seasonal sun rooms, enclosed patios, courtyards, or verandahs)

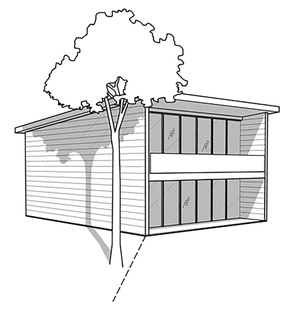
Flora:

-Use tree line to direct or help natural ventilation occur
-Winter wind should be controlled by conifers trees
-Conifers trees grow faster than decidious
-Summer shading should be implemented by deciduous.
-Shading
-



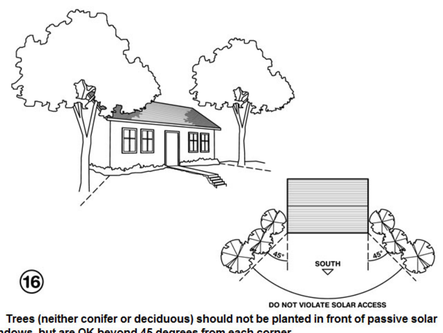
17

Use plant materials (bushes, trees, ivy-covered walls) especially on the west to minimize heat gain (if summer rains support native plant growth)



32

Minimize or eliminate west facing glazing to reduce summer and fall afternoon heat gain

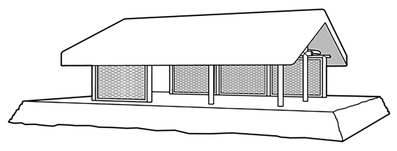


16

Trees (neither conifer or deciduous) should not be planted in front of passive solar windows, but are OK beyond 45 degrees from each corner

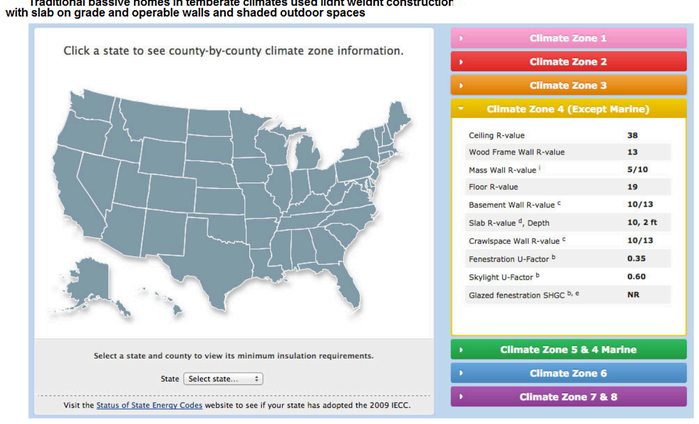
Earth:

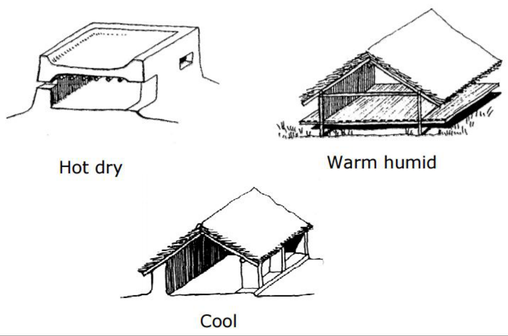
-Heavy thermal conductive material on the ground level and light construction on top.
-Thermal battery walls and floors should have a lag time of 9 to 12 hours.
-Southern slope is warmer.
-Drain water away from building.
-Moisture is deadly for the life span of building



62

Traditional passive homes in temperate climates used light weight construction with slab on grade and operable walls and shaded outdoor spaces





Pros and Cons of glazing walls versus punched openings in solid walls

Pros:

-Aperture options without uncontrolled thermal bridging.
-Controlled solar radiant heat intake on building:
reduces lighting and HVAC cost by 10-40 percent.
-Custom filter options for ultraviolet and infrared solar rays.
-Only economic if installed on east, south, and east facing walls.
-Color and tint options ex: gothic churches
-Trap solar heat for passive warming in winter session.
-Acoustical insulation
-Emissivity value is chemically adjustable

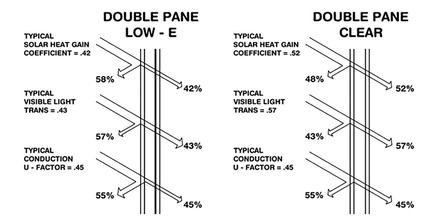
Cons:

-Expensive for skin dominated building
-If installed without proper calculation it becomes source of condensation and water build up that is bad for building.
-single glaze wall bad for coastal areas.
-Thermal Bridge
-No solar shading

Reflectance Values for Exterior Surfaces

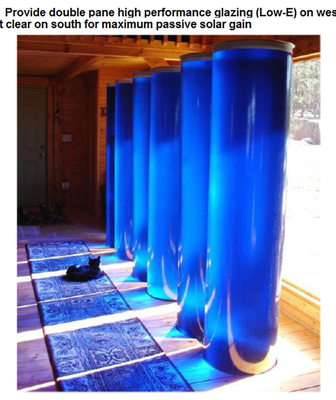
		% Reflected	% Absorbed
Roofing Material (1)			
Single-Ply Roof Membrane	Black EPDM	6%	94%
	Gray EPDM	23%	77%
	White EPDM	69%	31%
Asphalt Shingles	Black	5%	95%
	Medium Brown	12%	88%
	Green	19%	81%
	Grey	22%	78%
	White	25%	75%
Metal Roof	Aluminum	61%	39%
	Metal White	67%	33%
Exterior Wall Material (2)			
Brick	Light Buff	45%	55%
	Dark Buff	40%	60%
	Dark Red	30%	70%
Concrete	Light	55%	45%
	Medium	20%	80%
	Dark	15%	85%

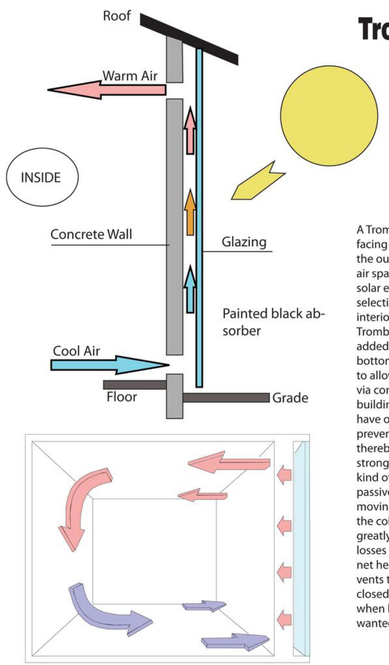
(1) Source: Berdahl 2000. "Cool Roofing Material Database," LBNL
(2) Source: 1981 IES Lighting Handbook



20

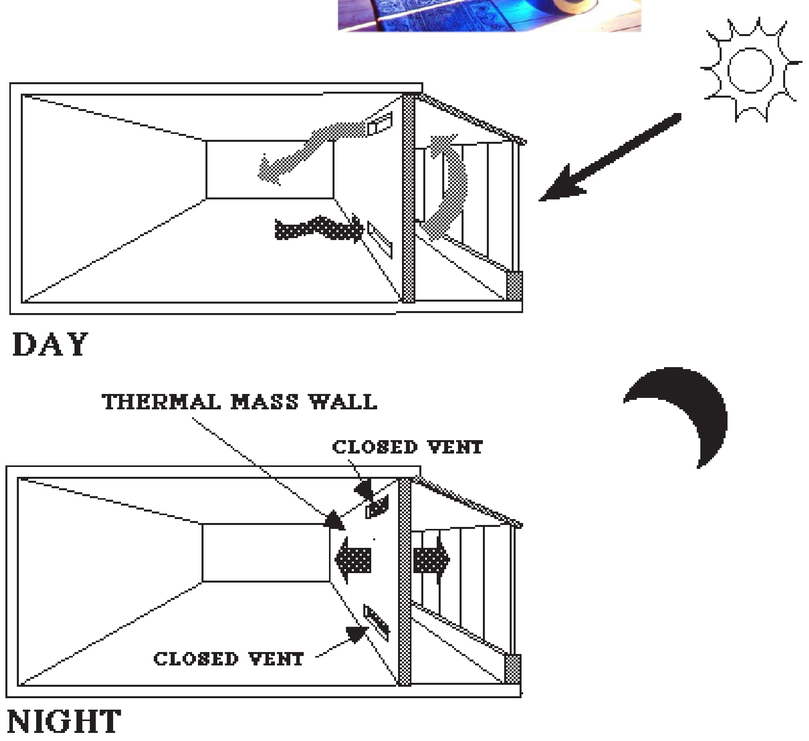
Provide double pane high performance glazing (Low-E) on west, north, and east, but clear on south for maximum passive solar gain

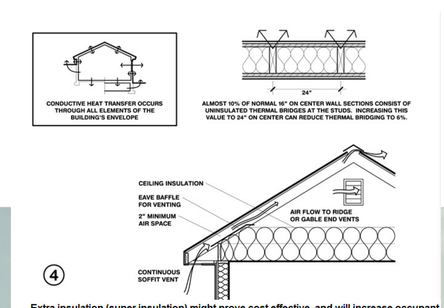




Trombe Wall

A Trombe wall is a sun-facing wall separated from the outdoors by glass and an air space, which absorbs solar energy and releases it selectively towards the interior at nightModern Trombe walls have vents added to the top and bottom of the interior wall, to allow heated air to flow via convection into the building interior. The vents have one-way flaps which prevent convection at night, thereby making heat flow strongly directional. This kind of design is an indirect passive thermal collector. By moving the heat away from the collection surface, it greatly reduces thermal losses at night and improves net heat gain. Generally, the vents to the interior are closed in summer months when heat gain is not wanted.





4

Extra insulation (super insulation) might prove cost effective, and will increase occupant comfort by keeping indoor temperatures more uniform