

GREEN+ 2026

Session 4 - Passive Solar Design in Texas



GREEN+

2026

SUSTAINABLE DEVELOPMENT
10 TRAINING SESSIONS

hosted and supported by

TEXAS ASSOCIATION OF COMMUNITY
DEVELOPMENT CORPORATIONS

Why Do We Need a Green CDC Training in Texas?

- Nearly one-third of Texans face high energy burdens, with low-income, minority, and rural communities disproportionately affected due to aging homes and inefficient infrastructure.
- Rising utility costs, grid upgrades, and new industrial demands like data centers threaten to worsen affordability and reliability across the state.
- While conservation and clean energy is a potential solution, public understanding is low and opinions are deeply divided along partisan lines, highlighting a need for broader education and policy focus on both supply and demand.
- Nearly 45% of households pay over \$200 a month on average for summer electricity. About one-third of Texans spend 7% or more of their income on energy — surpassing the high energy burden threshold of 6%.





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GREEN+**

DSGN - Architect / Director of
Sustainability/ Principal



Intro to Green Building and
Overview of Types of 3rd
Party Certifications

Session 1
Today - January 13



Designing For Resilience

Session 2
February 10th



March 29 - 31
TACDC Conference



Passive Solar Design in
Texas

Session 4
April 14



Basic Energy Modeling &
Why We Do It

Session 5
May 12



Renovation & Reuse: The
Hidden Power of Existing
Buildings

Session 6
June 9



LEED & The Living Building
Challenge

Session 7
July 14



WELL, Fitwell, & Healthy
Materials

Session 8
August 11



Net Zero Energy (NZE)

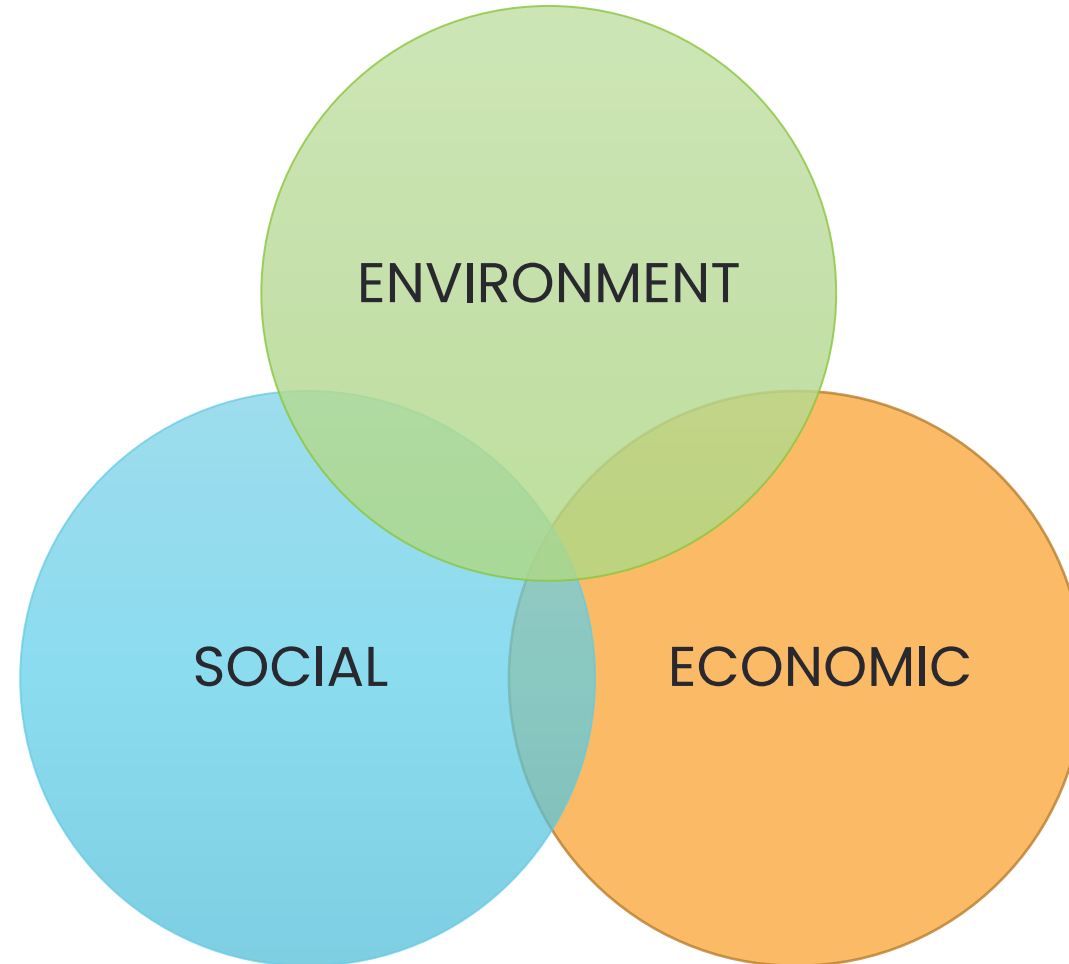
Session 9
September 8



Carbon/Electrification & A
Year In Review

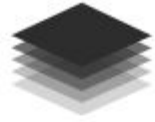
Session 10
October 13

Sustainability Interconnection & Complexity





Sustainable design and green building certifications offer a comprehensive framework to create healthier, more eco-friendly, and socially-conscious communities. By embracing these principles, organizations can enhance the quality of affordable housing projects, unlock funding opportunities, and foster greater community well-being. The journey towards a more sustainable future starts with taking the first steps to incorporate these practices and certifications into your development plans.



Passive Solar Design in Texas

April 14

Good design doesn't have to be expensive. In this session, we'll explore how architects use the natural conditions of a site—like sun angles, shade, breezes, and microclimates—to create energy-efficient and comfortable housing. Participants will learn how building orientation, window placement, shading devices, and overhangs can reduce cooling costs, improve comfort, and extend building life. These passive solar strategies are low-cost, practical, and especially well-suited to Texas' climate, offering long-term savings for owners and healthier living environments for residents.



Presenters



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Agenda

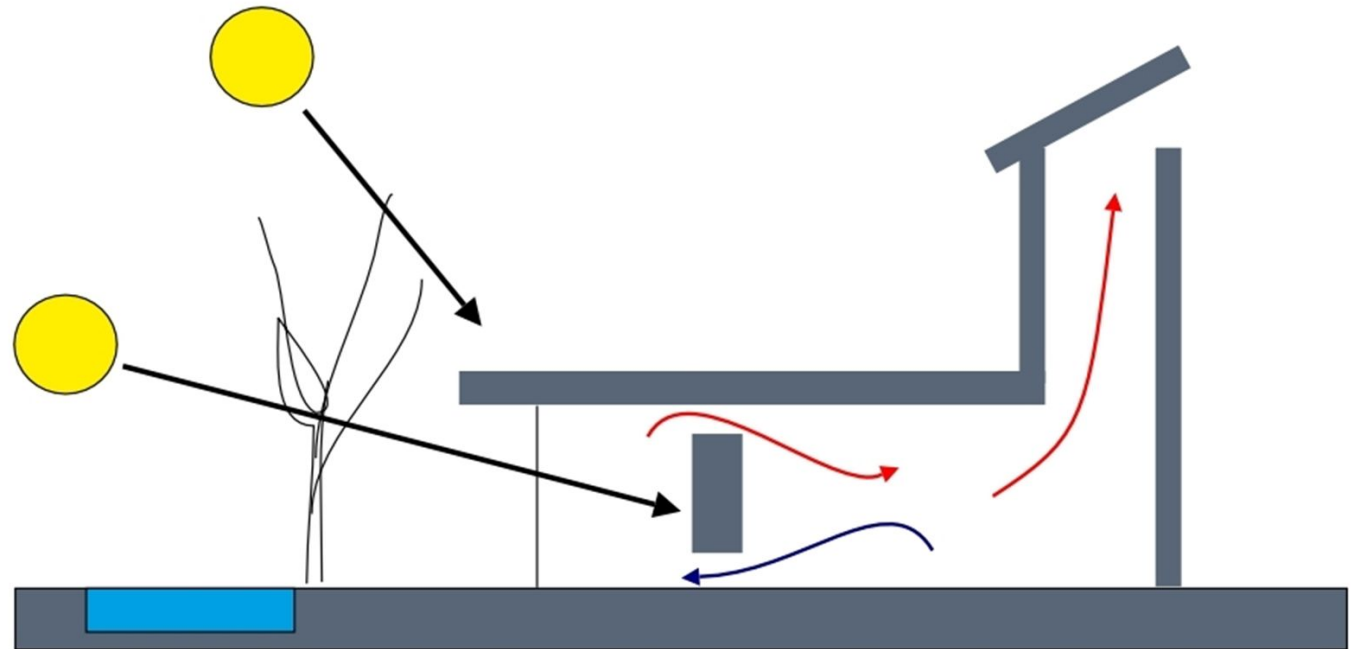
1. What is Passive Solar Design? and Why is it Important?
2. Orientation / Path of the Sun / Heat Gains
3. Building Envelope / Window Placement & Shading
4. Natural Ventilation and Micro-climates
5. Climates of Texas
6. Case Studies
7. Rules of Thumb
8. Q&A / Discussion

What is Passive Solar Design?

Architectural design approach that uses a building's site orientation, thermal envelope, shading and other strategies to capitalize on naturally cooling the building in the summer while harnessing sun's energy for heating in the winter.

Passive Design vs. Active Systems

- | | |
|---|---|
| <ul style="list-style-type: none">• shape / size• orientation• insulation• windows• shading• natural ventilation | <ul style="list-style-type: none">• HVAC• lighting• electrical power• renewables |
|---|---|



Why is it Important?



Energy Efficiency & Energy Cost Savings: Well built passive designs can significantly reduce energy consumption. And while the extra insulation or better windows may have a slight cost increase, the long-term operational savings and reduced maintenance on smaller HVAC equipment often lead to significant life cycle cost reductions.



Enhanced Occupant Comfort: provides more stable indoor temperatures year-round, eliminating cold drafts and hot spots. It also naturally improves indoor air quality through controlled ventilation.



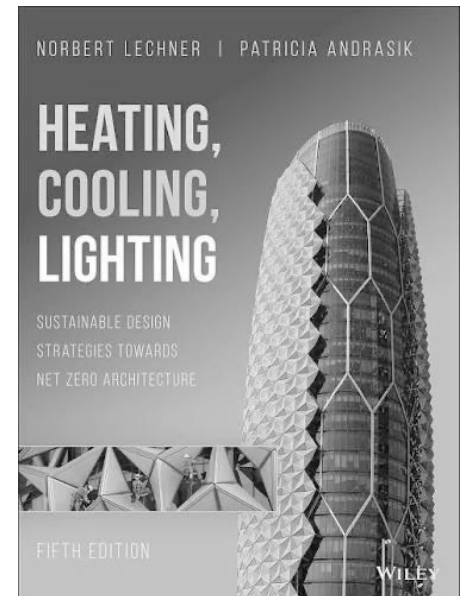
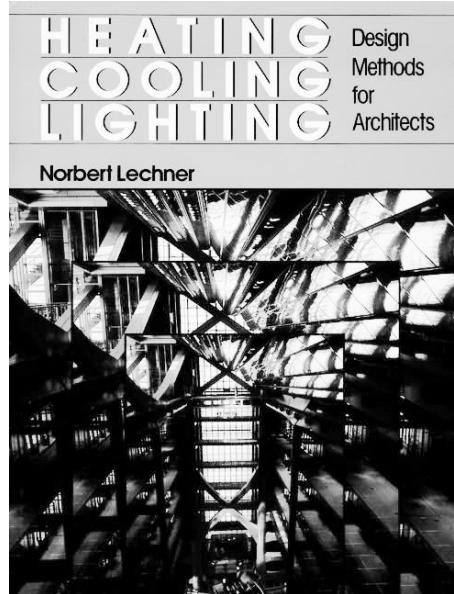
Environmental: As buildings account for over 30% of global energy consumption - Reducing a building's energy demand is a primary tool for lowering greenhouse gas emissions and help to meet climate action goals.



Resilience: When properly executed, passively designed buildings can maintain safe, habitable temperatures for several days during power outages or extreme weather events, a concept known as "passive survivability".



Increased Property Value: High-performance, energy-efficient buildings / homes often sell for a premium (estimated at 4–10% in some regions) and tend to sell faster than conventionally built ones.

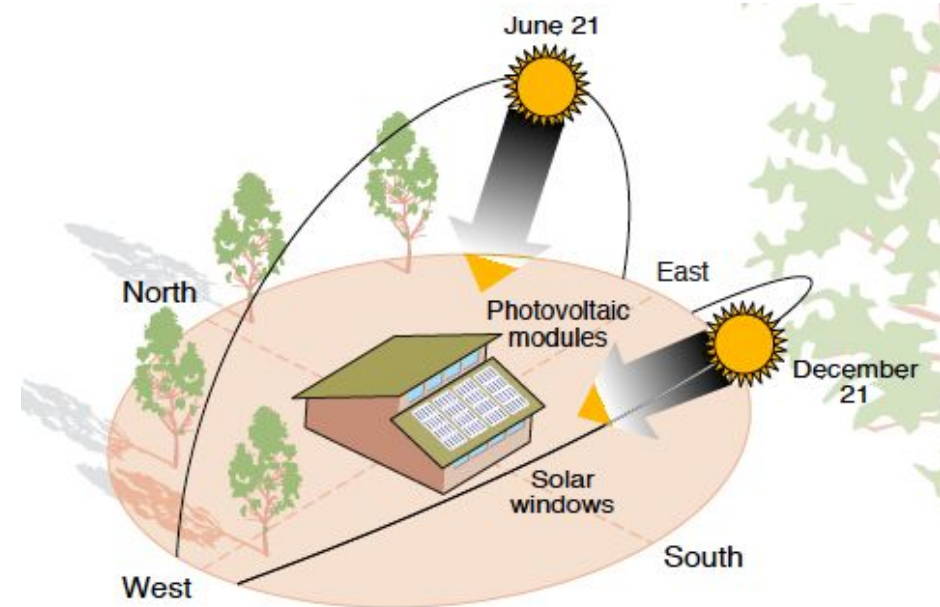
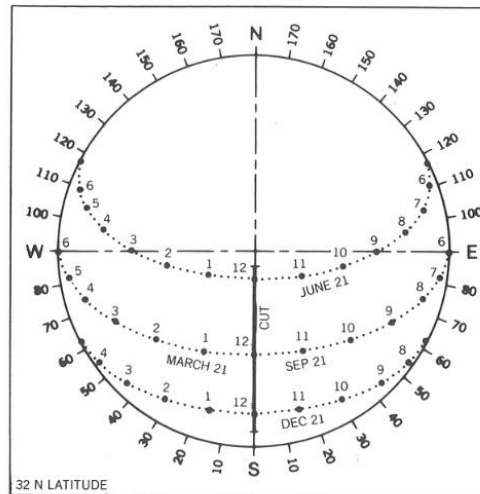
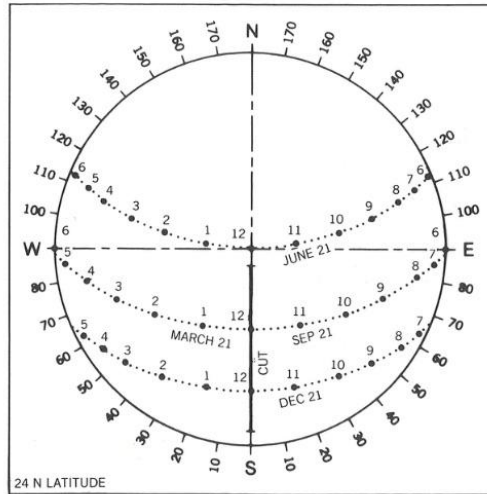
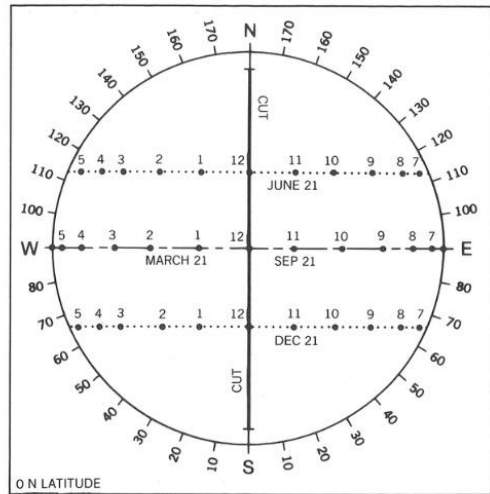
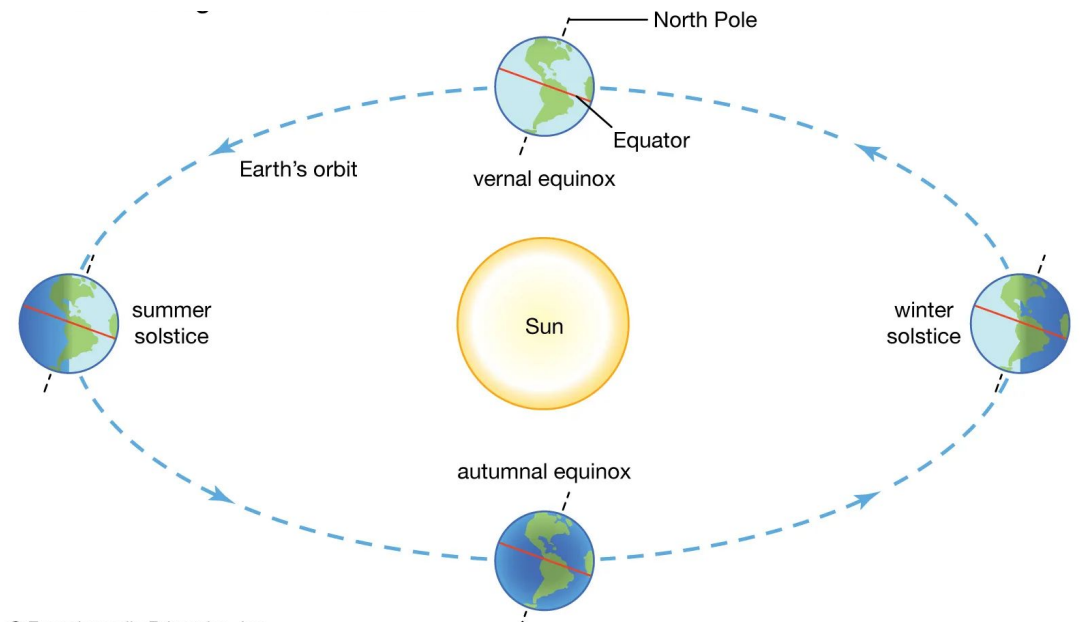


Path of the Sun

Winter Solstice - Dec 21

Spring / Fall Equinox - March 21 & Sept 21

Summer Equinox - June 21



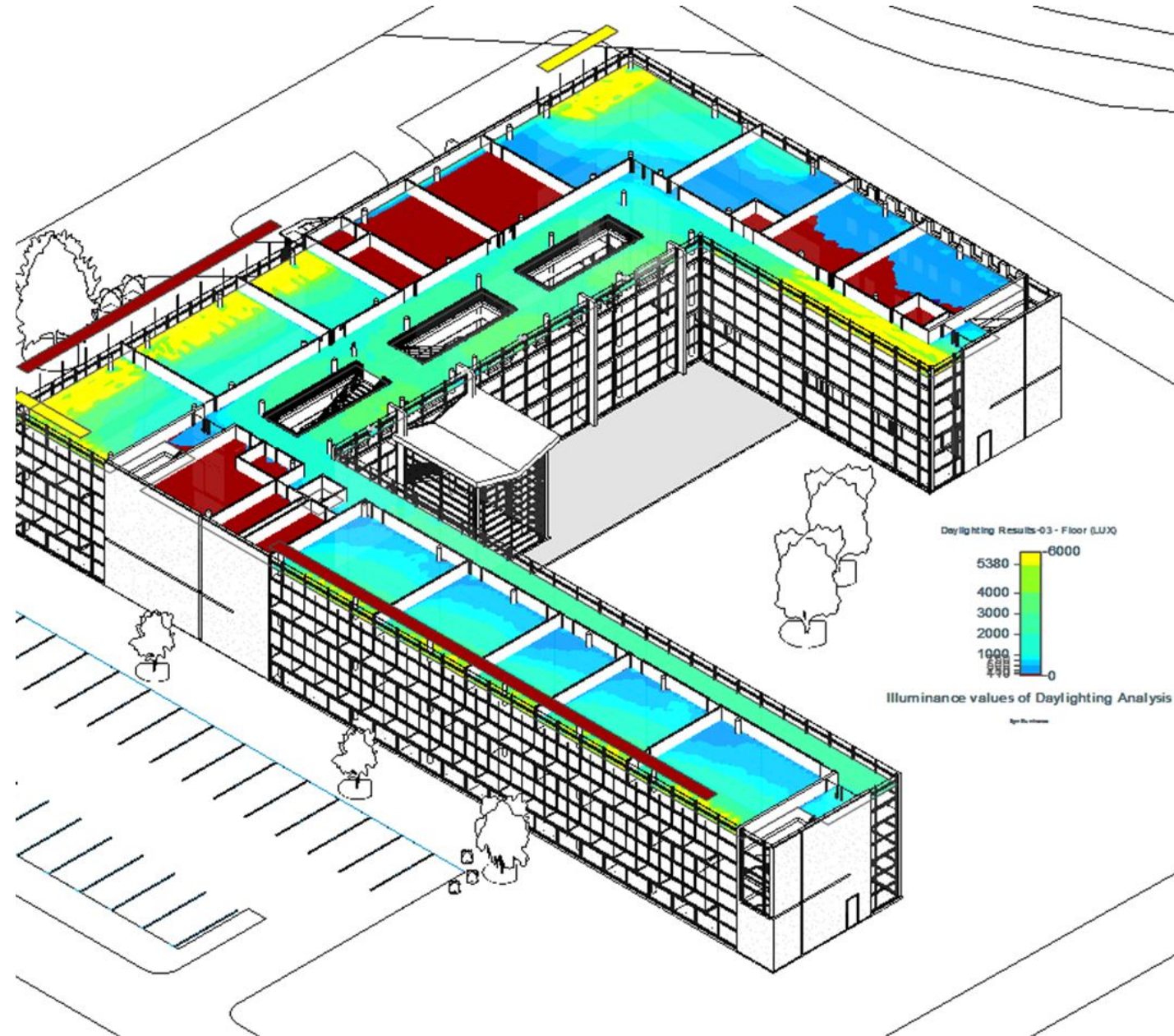
Orientation & Heat Gains

Warm Climates within the Northern Hemisphere:

East-West Axis: Buildings should be elongated along an east-west axis so the longest walls face North and South.

North-facing side is valuable as it can receive natural daylight while minimizing glare and heat gains.

South-facing side is also valuable - with proper shading and overhangs, we can provide some glazing but this needs to be studied to minimize heat gain in the summer while allowing for heat gains in the winter.



Building Envelope / Window Placement & Shading

Thermal Insulation & Windows

- **maximize envelope** while realizing the limitations or even more R-value..
- **R-20 min** to R-25 walls
(2x6 with cellulous + R-5 ext. continuous = R-25)
- **R-38 min** to R-45 roof
- **double or triple pane windows** with **low-e** coating and argon filled and **thermally broken**
- **skylight** windows should only **face north**

Shade

- place **evergreens** on east and west & **deciduous** trees on south
- neighboring buildings can help shade each other
- **large overhangs, porches, free standing** breeze block **walls** or wing walls can help with shading
- **use exterior shading devices such as canopys louvers on all windows except north**
- designer / **architects should study the effectiveness** of shading devices using solar sun path modeling software (i.e. Tally, Sefaira, Sketchup, etc.)



Micro-climates

Topographic / Natural: Hills and valleys often trap cold air or create rain shadows. South-facing are warmer and sunnier, while north-facing slopes are colder.

Urban / Structural: Cities create "urban heat islands" where concrete and asphalt absorb, store, and radiate heat.

Vegetation-Based: Forests and dense foliage create cool, shady, and humid microclimates compared to open land.

Water-Adjacent: Areas near bodies of water experience fewer extreme temperatures.

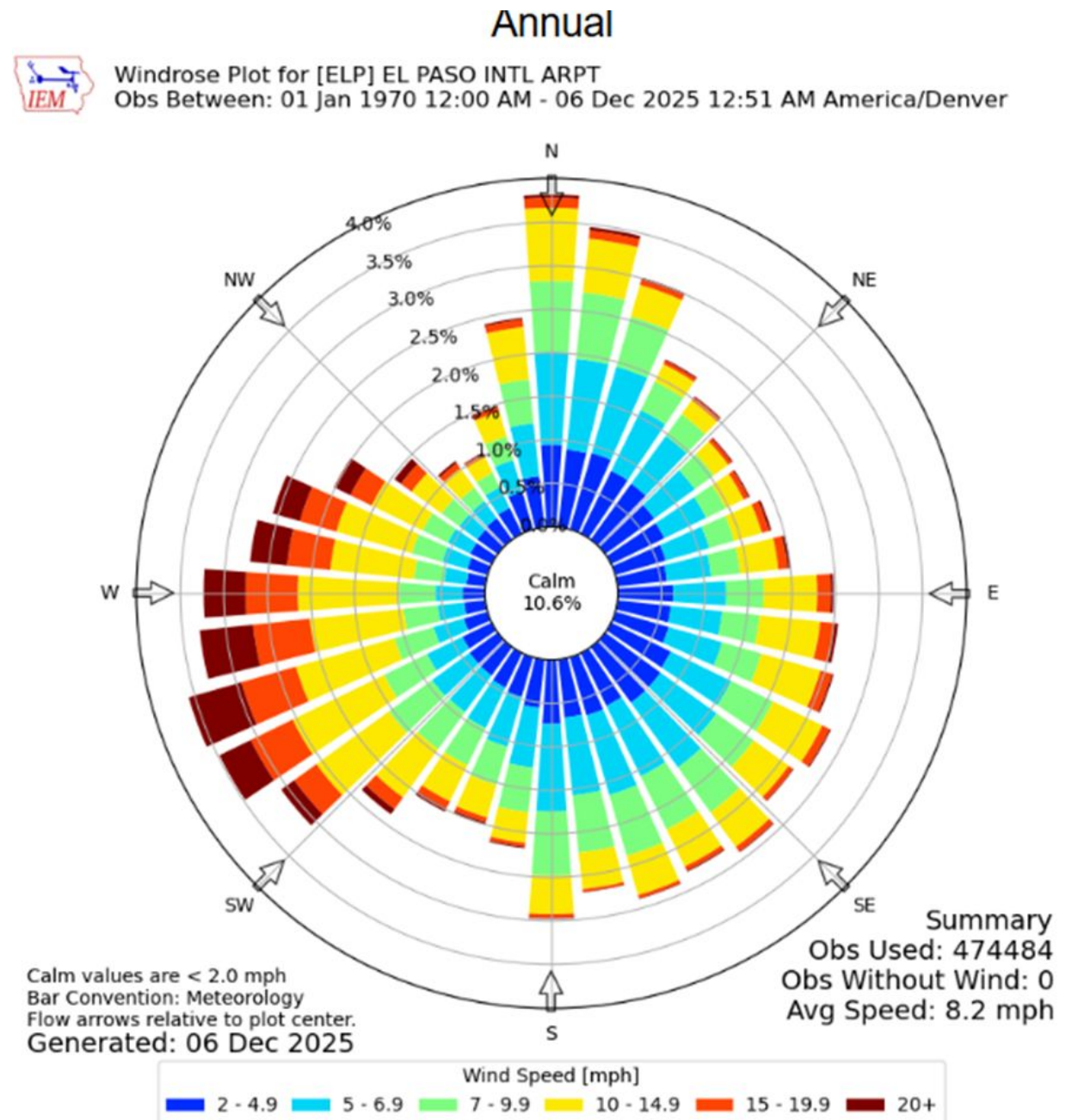


Wind Studies

Wind Rose: A wind rose is a graphical tool used by meteorologists to show the speed and direction of winds at a specific location over a set period of time.

Texas: Wind patterns vary significantly by region, such as the persistent southerly winds in the Gulf Coast or the high-speed gusts common in the Panhandle.

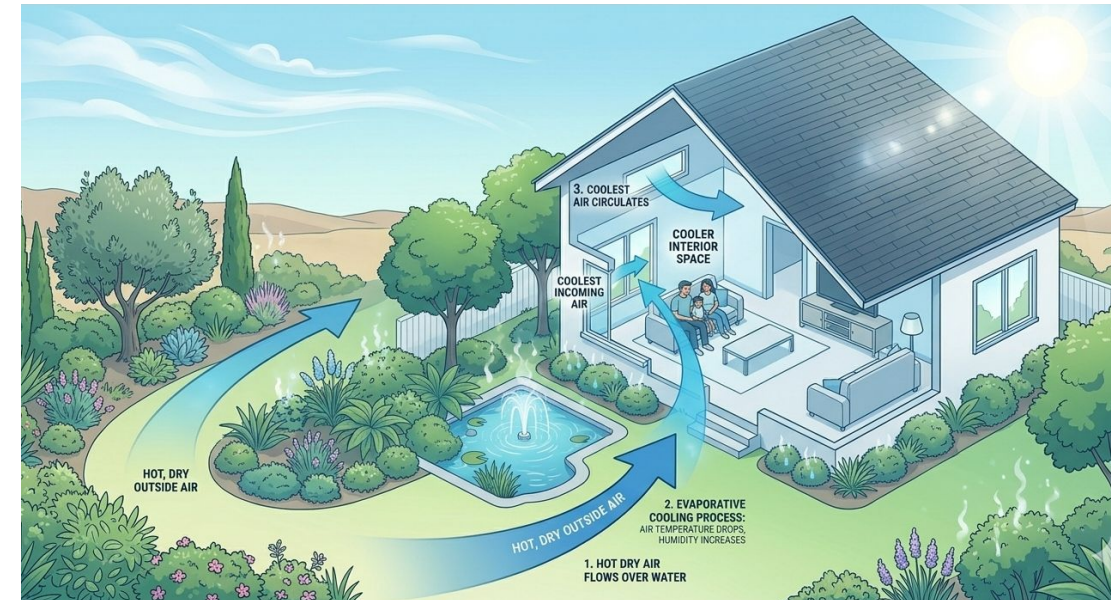
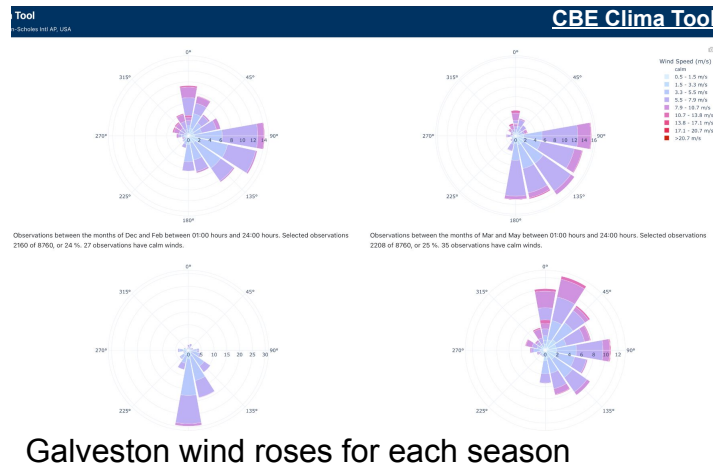
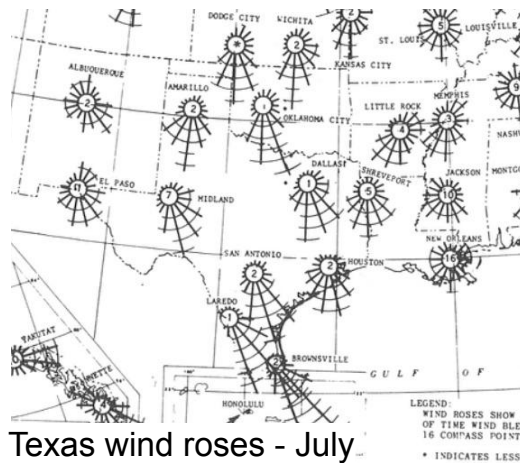
Natural Ventilation: Supplying and removing air without the using of mechanical equipment. Certain locations of the windows can optimize air flow.



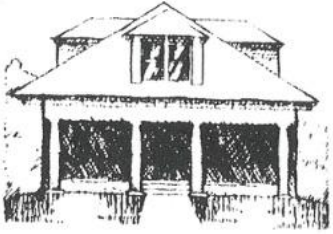
Natural Ventilation

- **Cross-Ventilation:** Positioning window and door openings on opposite sides of a space creates a pressure differential that pulls fresh air through the building.
- **Stack Effect (Buoyancy):** Hot air naturally rises; placing vents or windows at high points (like skylights or chimneys) allows warm air to escape, drawing cooler air in from lower-level openings.
- **Night Purging:** In climates with cooler nights, opening windows after sunset allows the building's **thermal mass** (like concrete or stone) to release stored daytime heat and pre-cool the structure for the next day.
- **Floor Plans:** Designing buildings with narrower forms (ideally under 45 feet wide) ensures that natural breezes can reach every room rather than getting trapped in deep interior spaces.

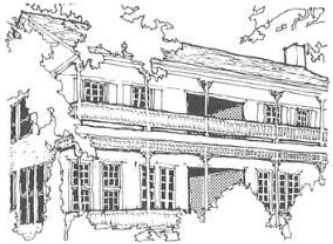
- **Evaporative Cooling:** Strategic use of **water features**—such as ponds, fountains, or misting systems—near windows can cool incoming air as moisture evaporates.
- **Vegetative Shading & Airflow:** Deciduous trees provide summer shade while allowing winter sun to pass through. Landscaping can also be designed to "funnel" prevailing breezes toward openings or act as a buffer against harsh winter winds.
- **Surface Reflectance:** Replacing hard, dark surfaces like asphalt with permeable paving, light-colored materials, or grass reduces heat absorption (the "mini-urban heat island" effect) immediately around the home.



Climates of Texas



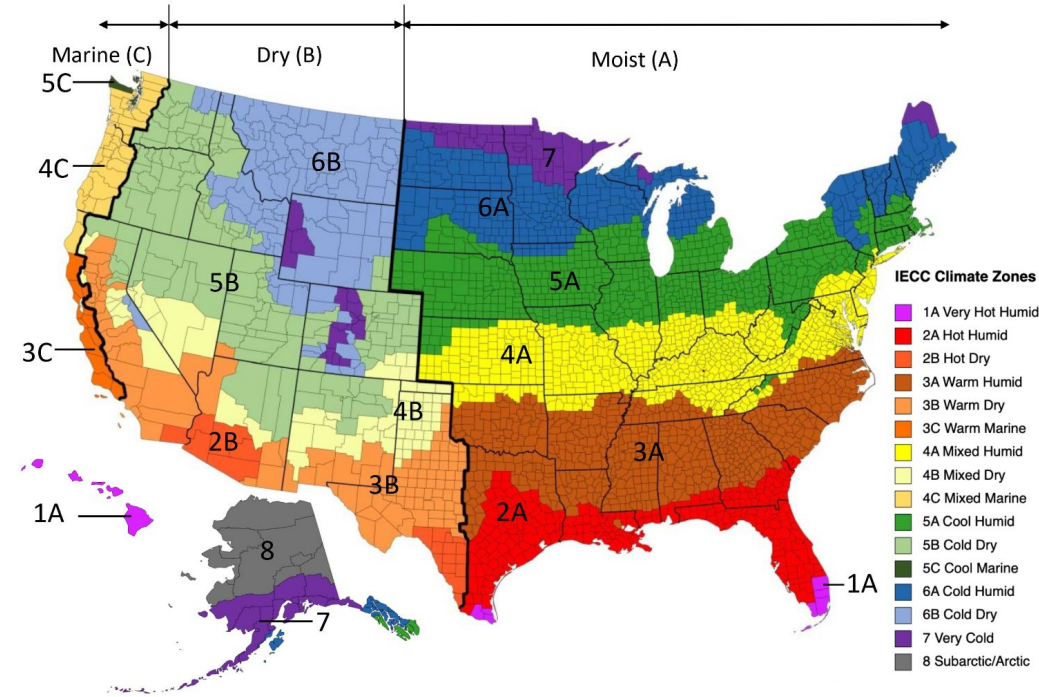
3A - "North Texas has cold winters and hot summers. Cold winds come from the north and northeast. There is significant sunshine available for winter solar heating. During part of the summer the high temperatures and fairly high humidities combine to create uncomfortable conditions. During other times in the summer the humidity drops sufficiently to allow for evaporative cooling to work. There are also ample summer winds for natural ventilation."



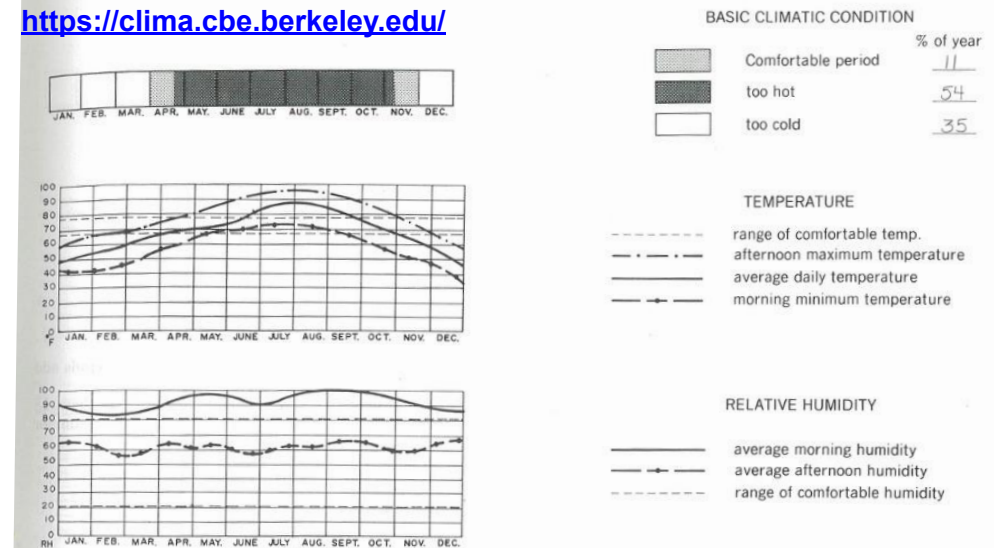
3B - "West Texas is an arid climate of hot summers and cool winters. Plentiful sunshine, more than 60% in the winter can supply ample solar heating. Low Humidity in the summer allows the effectiveness of evaporative cooling. Thus, in this region climatic design can have a very beneficial impact on thermal comfort."



2A - "This part of the Gulf Coast is similar, except the summers are more severe. Very high temperatures and humidity make this a very uncomfortable summer climate. The high humidity and clouds prevent the temperature from dropping much at night. Thus the diurnal temperature range is quite small. Fortunately, there are coastal breezes in the summer. Winters are short and mild."



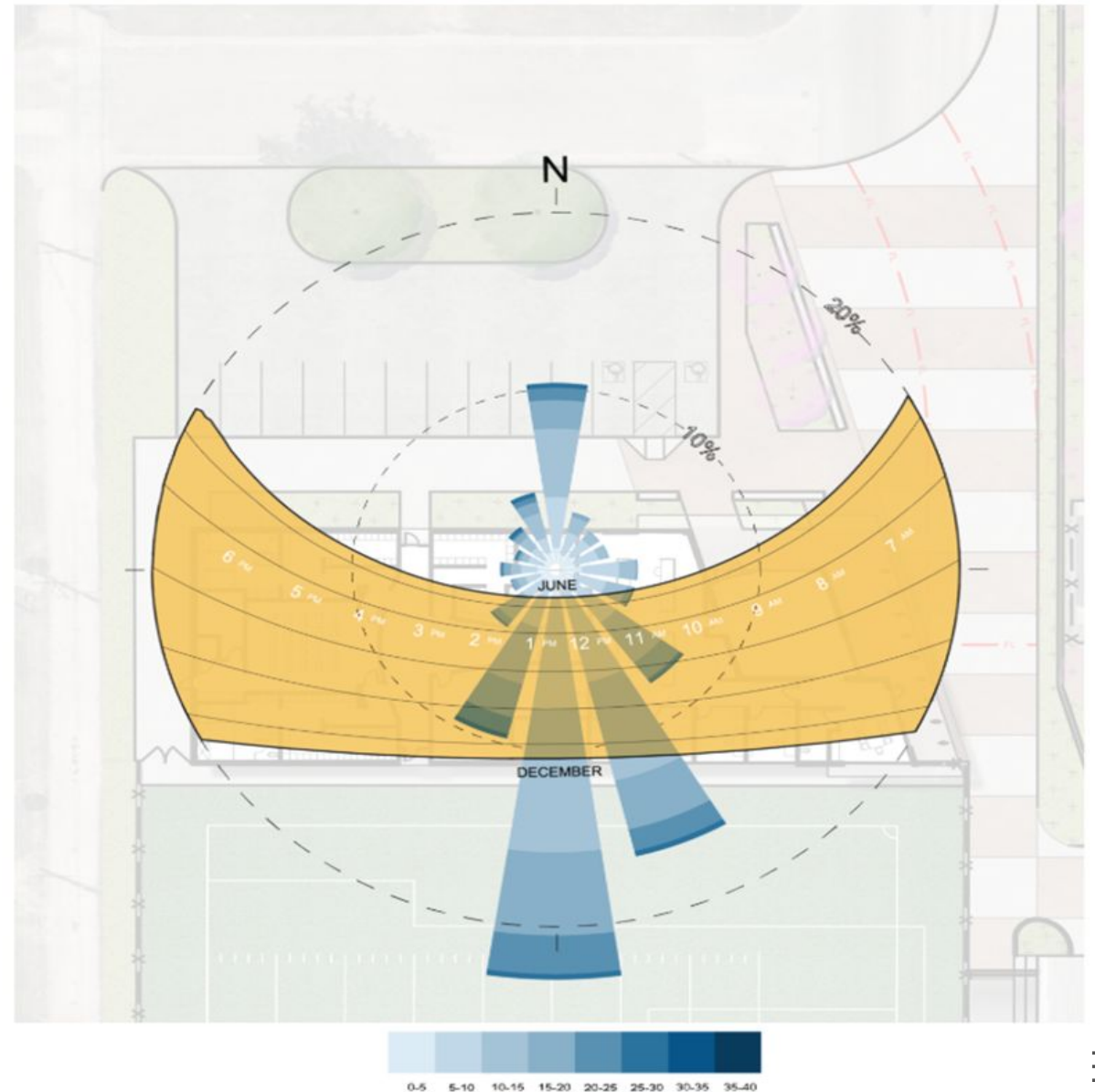
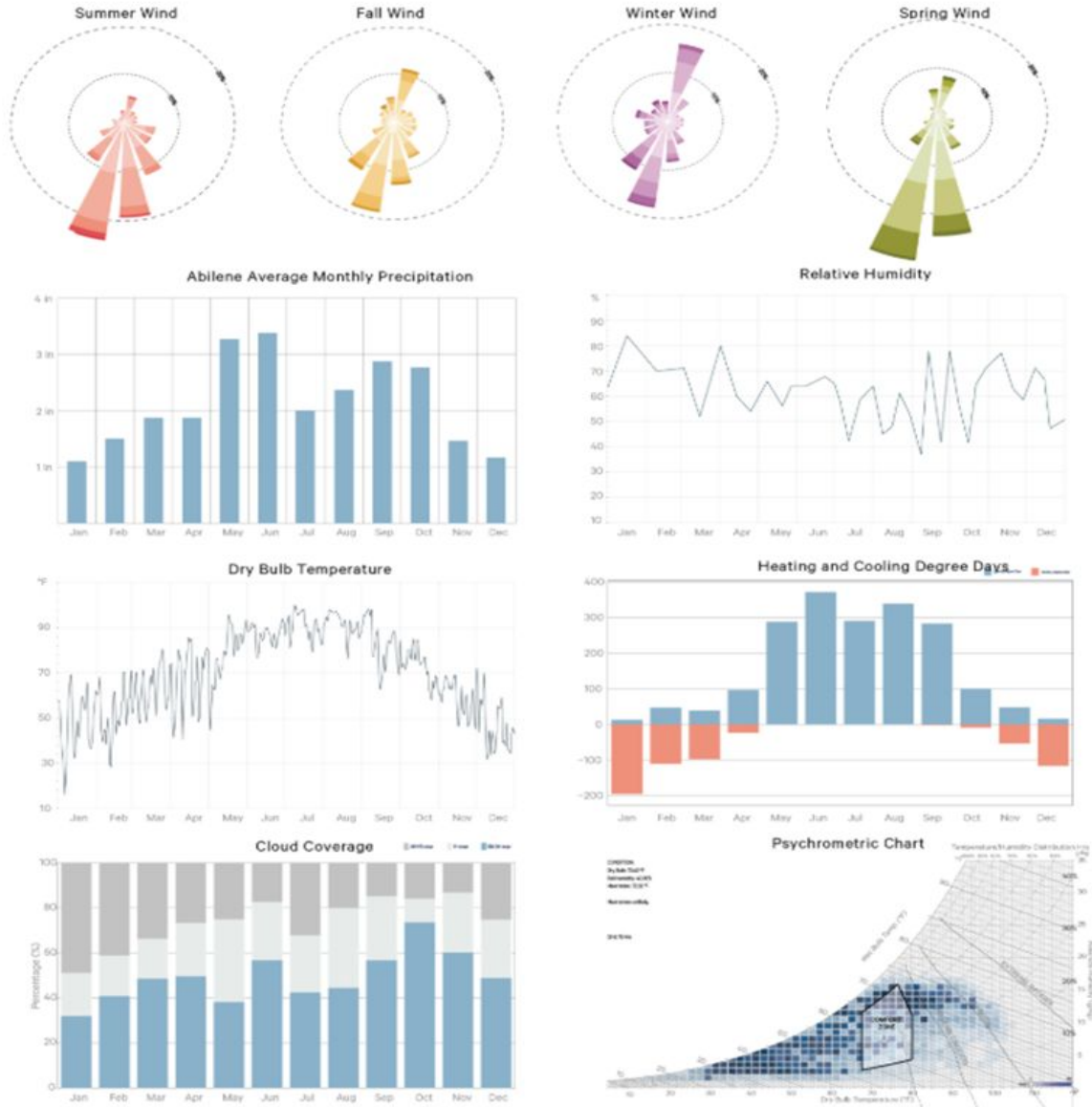
<https://clima.cbe.berkeley.edu/>



Case Study #1 - McMurry University Athletics



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Case Study #1 - McMurry University Athletics

North Elevation - Key entrance with canopy. High clestory windows over the locker rooms.



South Elevation - Recessed windows at coach's offices.



East Elevation - Sun shades over large conference room.



West Elevation - No Windows!



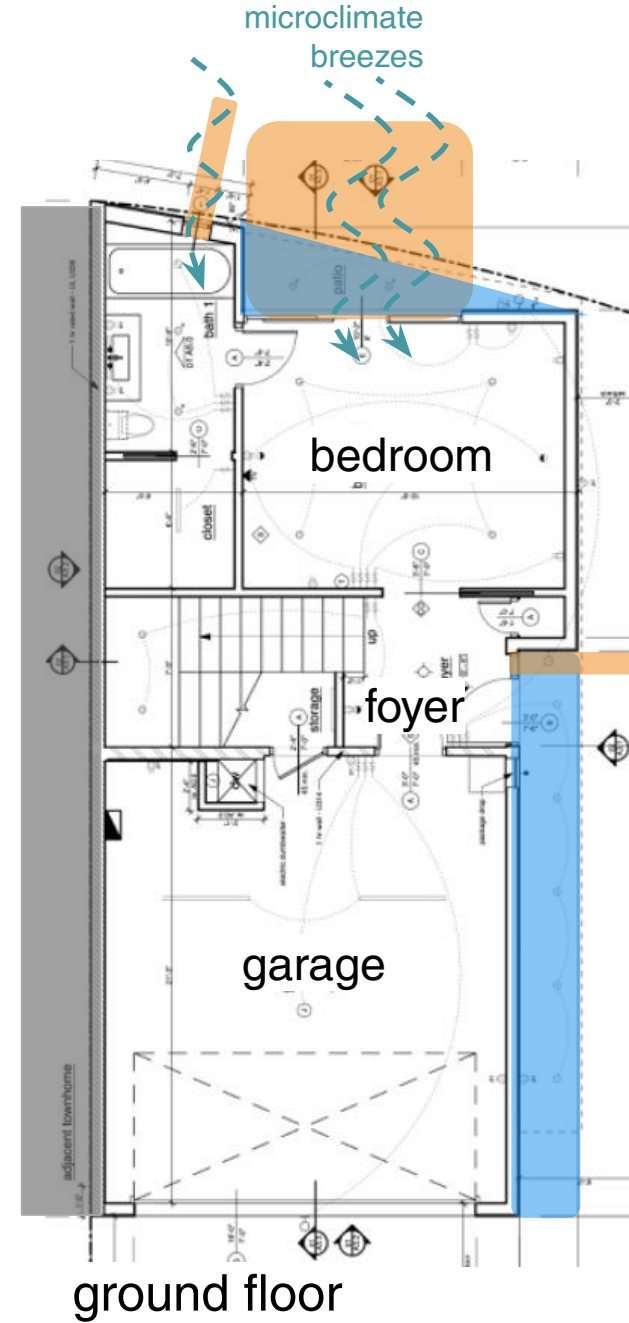
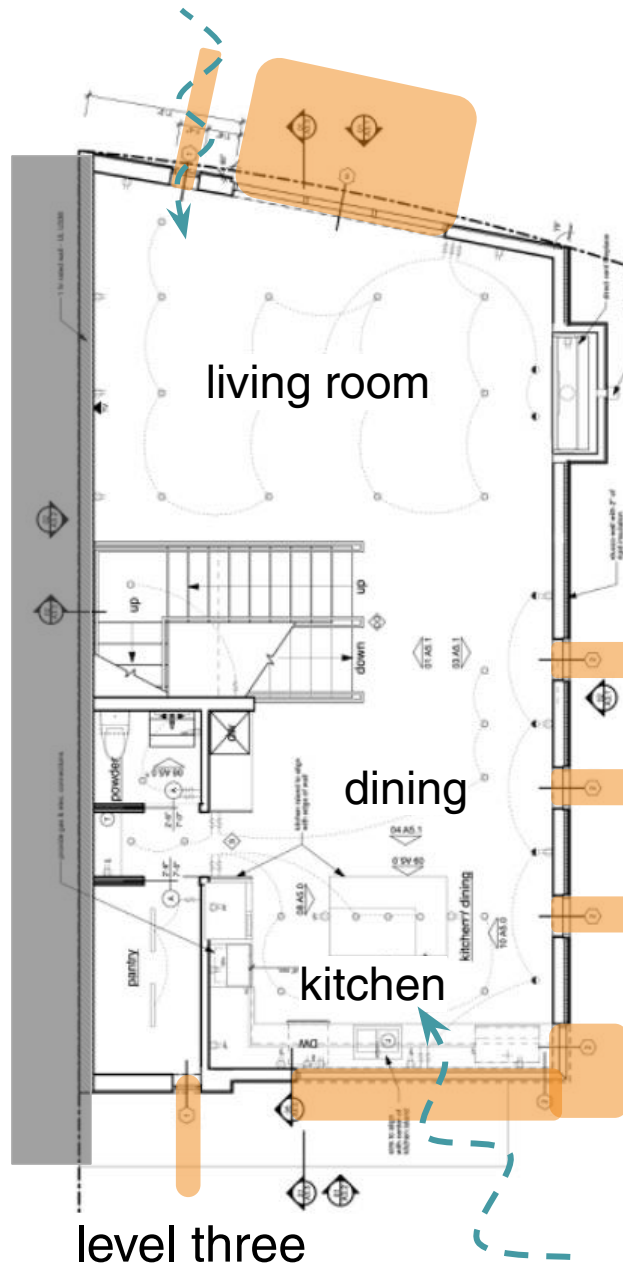
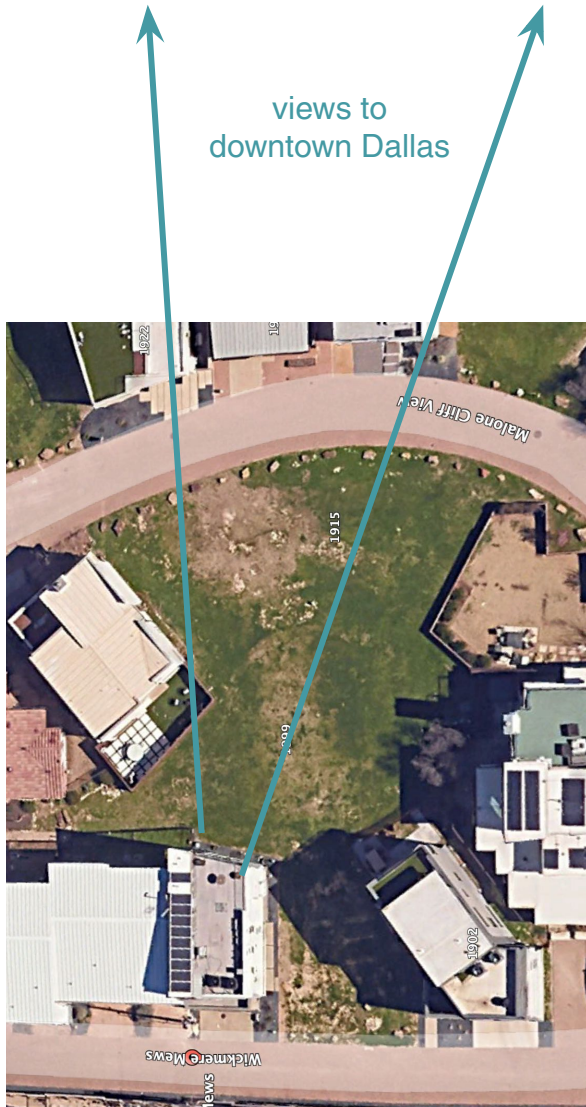
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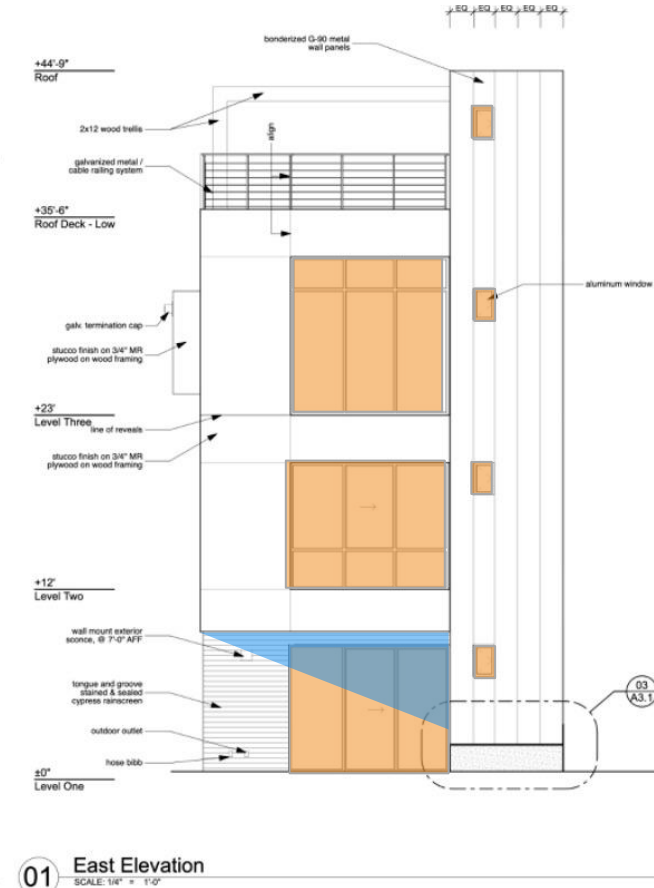
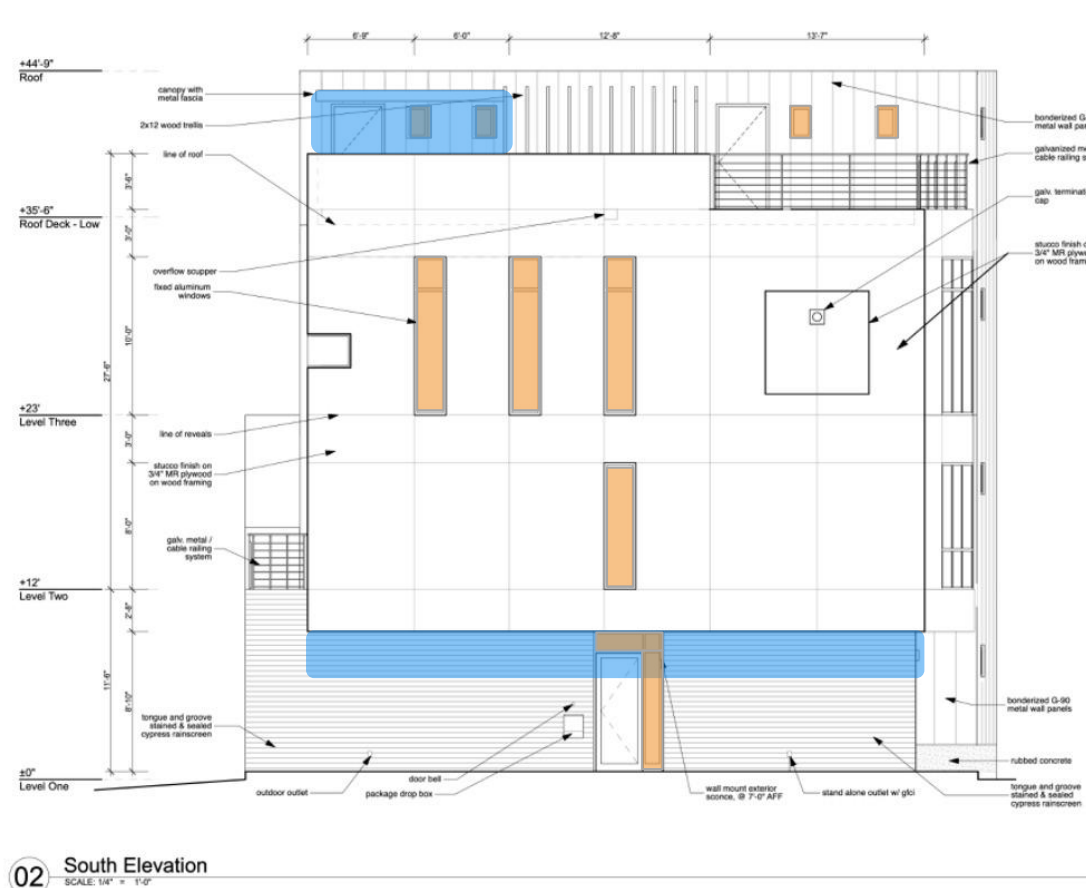
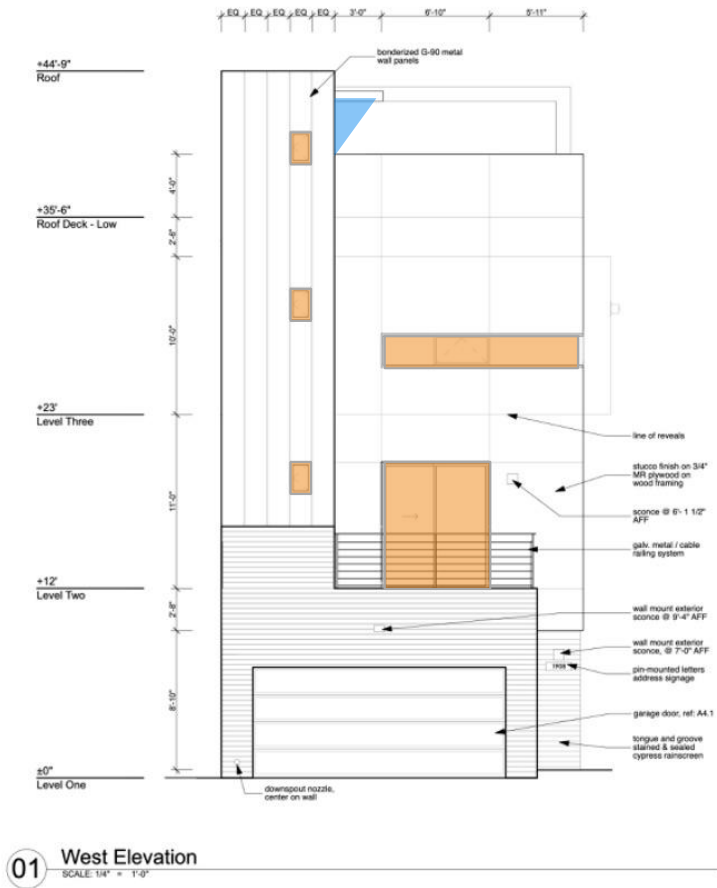
Case Study #2 – Private Residence on Wickmere Mews



Case Study #2 – Residence on Wickmere Mews



Case Study #2 – Residence on Wickmere Mews





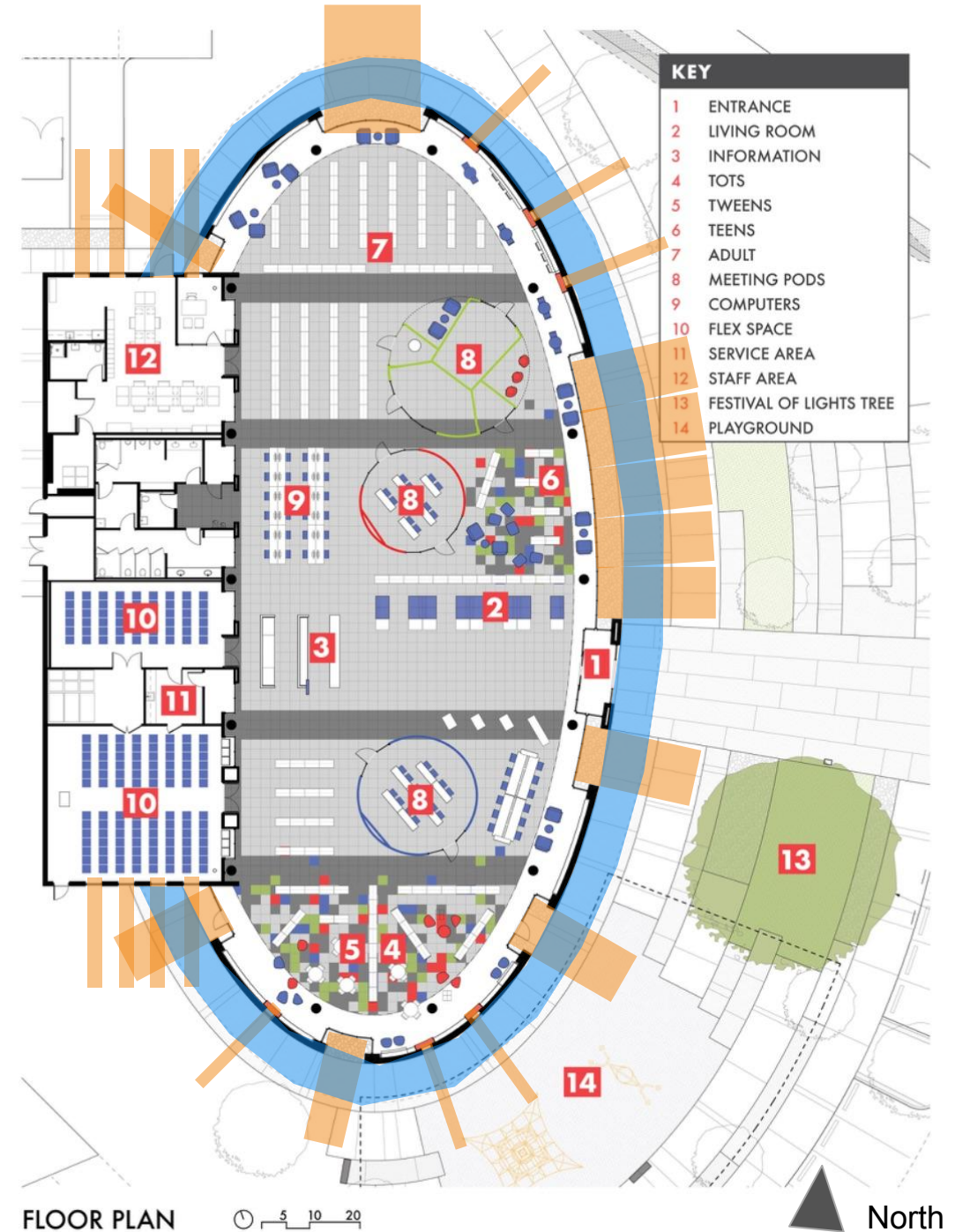
Case Study #3 - Vickery Park Branch Library



Vickery Park Branch Library



Vickery Park Branch Library



Vickery Park Branch Library

SUMMER SOLSTICE
JUNE 21



1
FLEX SPACES

2
PHOTOVOLTAIC
PANELS

3
COLUMN FREE
GREAT ROOM

4
CLERESTORY &
LIGHT SHELF

WINTER SOLSTICE
DECEMBER 22



5

RAISED FLOOR & PLENUM
FOR FUTURE FLEXIBILITY

6

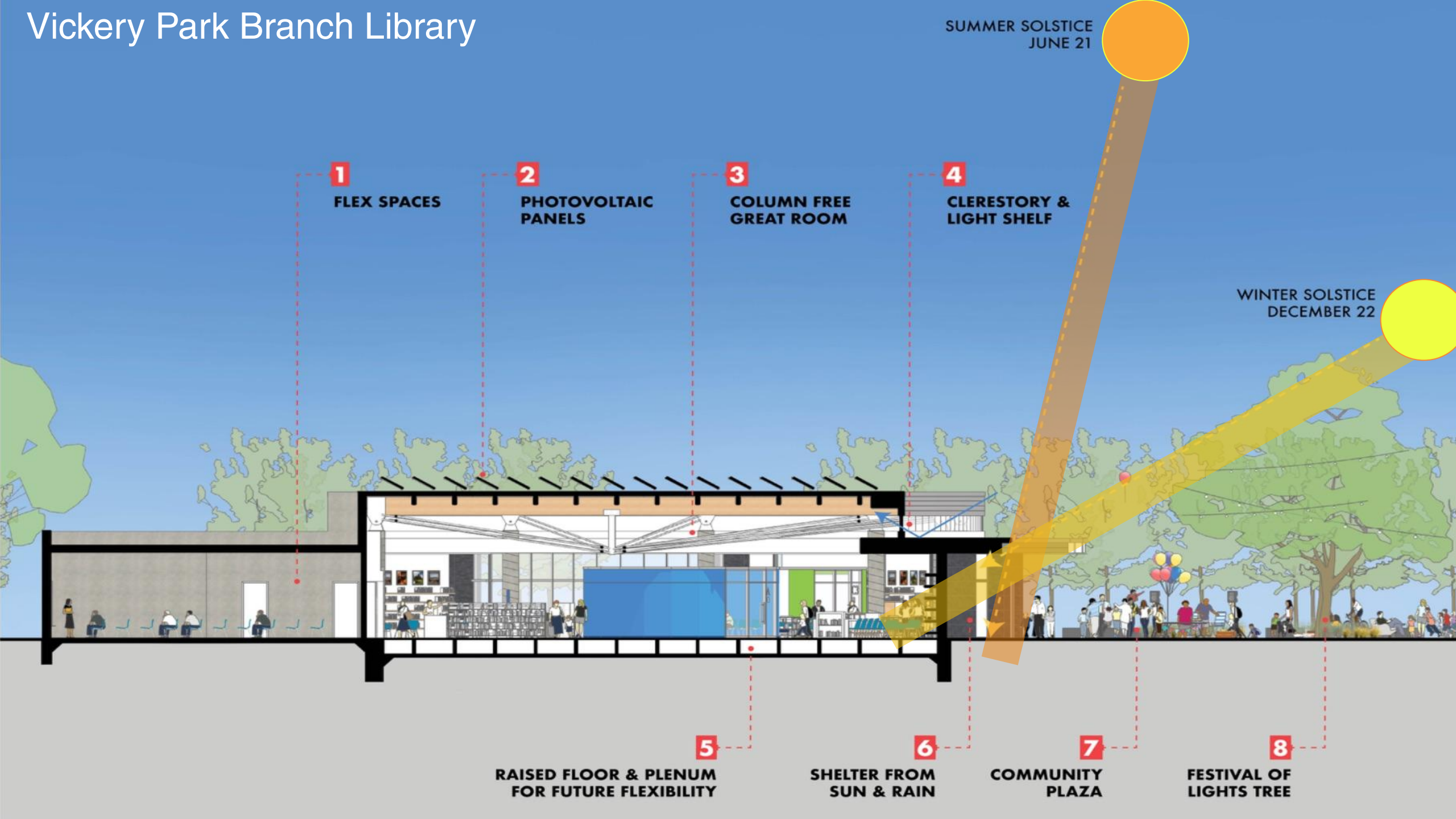
SHELTER FROM
SUN & RAIN

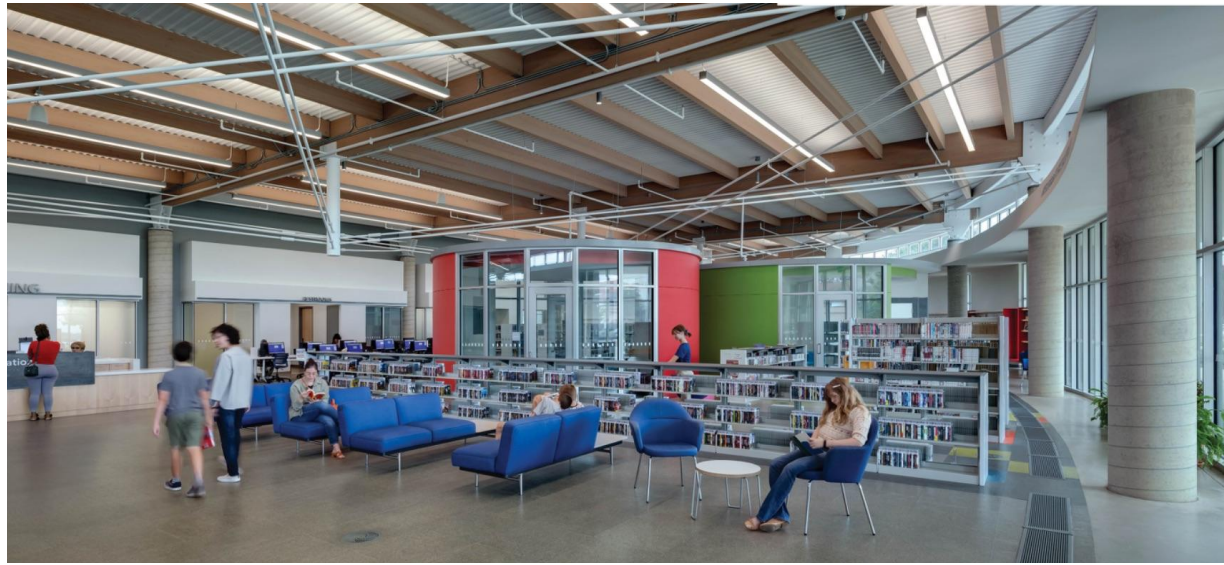
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COMMUNITY
PLAZA

8

FESTIVAL OF
LIGHTS TREE





Vickery Park Branch Library



Rules of Thumb

1. **Ideal orientation** - long sides face north and south / short ends face east to west
2. **Locate windows on north & east** first, then strategic **small south windows & minimal windows to west**
3. To **maximize thermal insulation - start with the roof!** then install best windows possible, lastly max r-value on the exterior walls
4. **Operable windows** to catch prevailing breezes with a way to pass through (up & out)
5. **Shading** devices that **block summer sun** and **allow for winter sun**
6. **Incorporate porches, deep overhangs, evergreens, etc**
7. **Look for opportunities** for **naturally ventilated** areas (rooms, hallways, etc)
8. In less humid climates, look for opportunities to **incorporate evaporative cooling**
9. Have architects / **designers study** winds and shading **using climate software**



Basic Energy Modeling & Why We Do It

Session 5
May 12th

LINK HERE AND IN THE CHAT!
<https://tinyurl.com/2fjtv5cp>



Renovation & Reuse: The Hidden Power of Existing Buildings

Session 6
April 14



Questions and Discussion