National Institute of Building Sciences Provider #G168

BEST4 Conference
April 13-15, 2015

Design Considerations for Climate Change

Paul Totten, Vice President, WSP
Alexandra Connor, Project Associate, WSP

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Learning Objectives

Participants will :

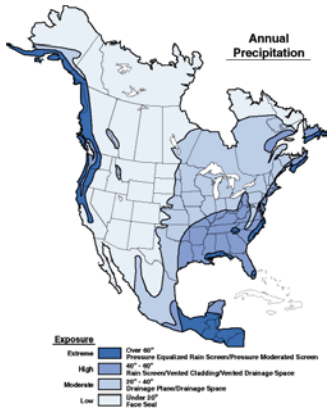
1. Be able to better assess short term and long term building enclosure performance objectives related to climate change.
2. Examine the impact on design decisions for fenestration, and roofing and waterproofing.
3. Better coordinate HVAC system layout and the enclosure design on new construction and impacts on existing infrastructure.
4. Understand various strategies to future proof buildings, and innovative design systems such as reactive exterior screens and solar chimneys.

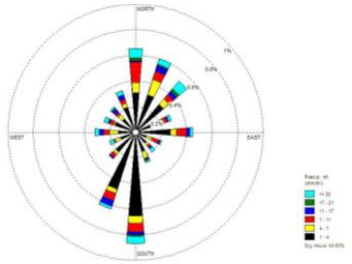
Presentation Outline

- Overview of design considerations
  - Climate change
  - Durability and redundancy
- HVAC and pressure interaction with enclosure
- Examples of enclosure considerations
- Questions

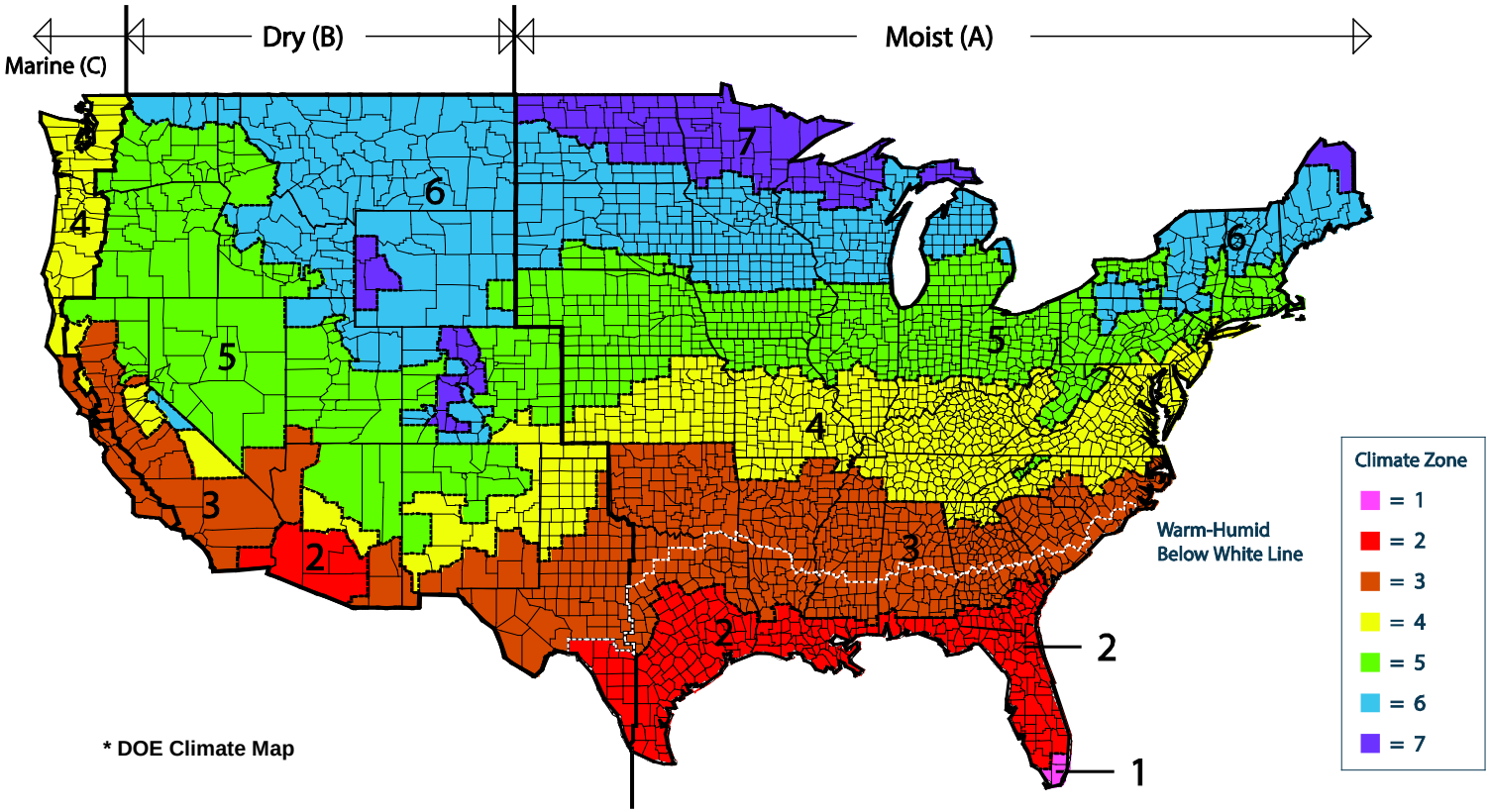
Importance of Climate Variation

- Review of macro and micro climate
  - Understand the climate zone
  - Rain fall volume considerations
- Micro climate specific to your site
  - Review of site topography
  - Development density
  - Neighboring existing buildings and planned future development
- Existing building versus new construction
- Orientation of building and considerations by elevation



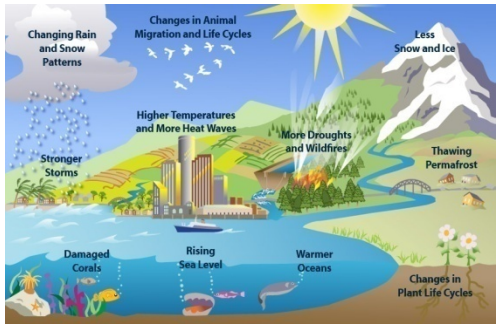


Climate Zones



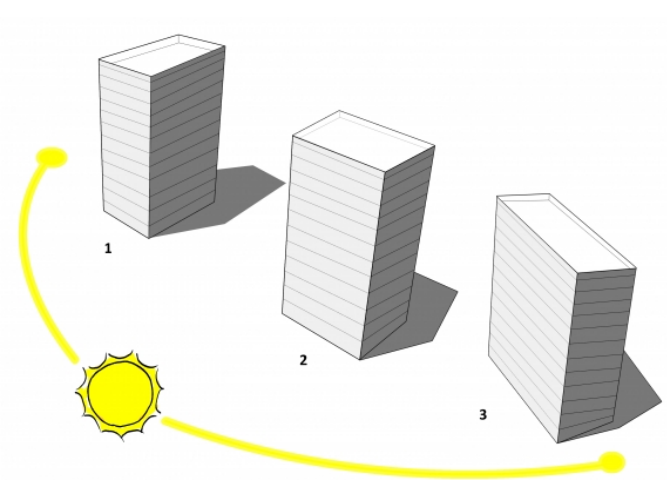
Impact of Climate Change

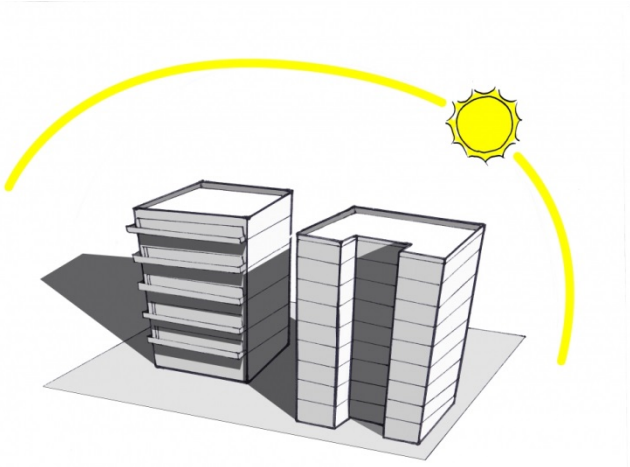
- Change in type of precipitation events
  - Increased volume/shorter duration
  - More severe storms/higher winds
  - Flooding
- Solar considerations
  - Increased radiation
  - Examine SHGC and window films
- Need for improved durability and redundancy



Building Design Considerations

- Orientation
- Floor plate – shape, depth
- Layout and type of mechanical systems
- Occupant comfort expectations – stretching the comfort zone





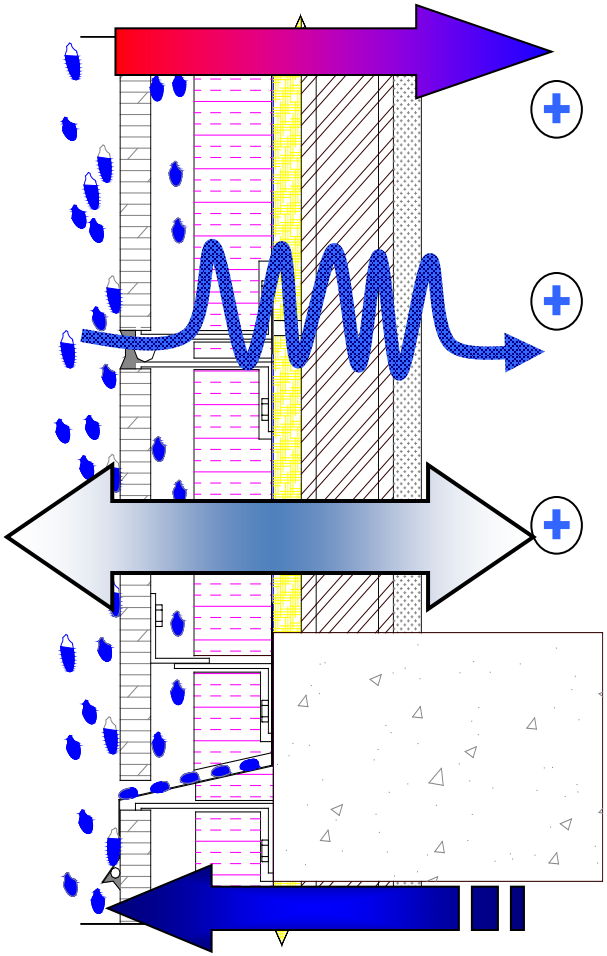
Heat, Air, & Moisture Transfer Principles

Warmer outdoor temperature

Higher vapor pressure (Higher RH)

Water drains along drainage planes and water redirected at flashings beyond exterior wall surface

Lower air pressure (ideal)



Cooler indoor temperature

Lower vapor pressure (Lower RH)

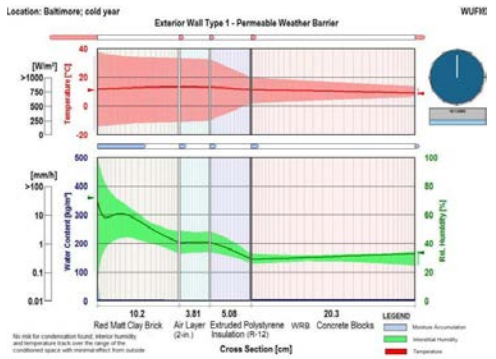
Cycling of air pressure due to wind, stack, or mechanical system variations

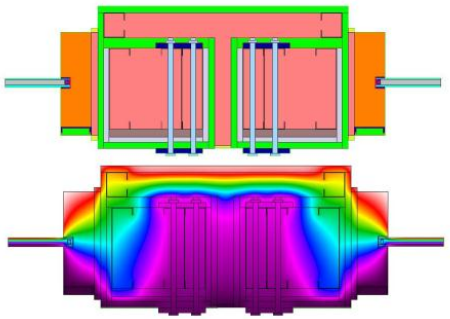
Positively pressurized building higher air pressure

Inverse direction for heating season for heat and vapor transfer

Initial Analysis

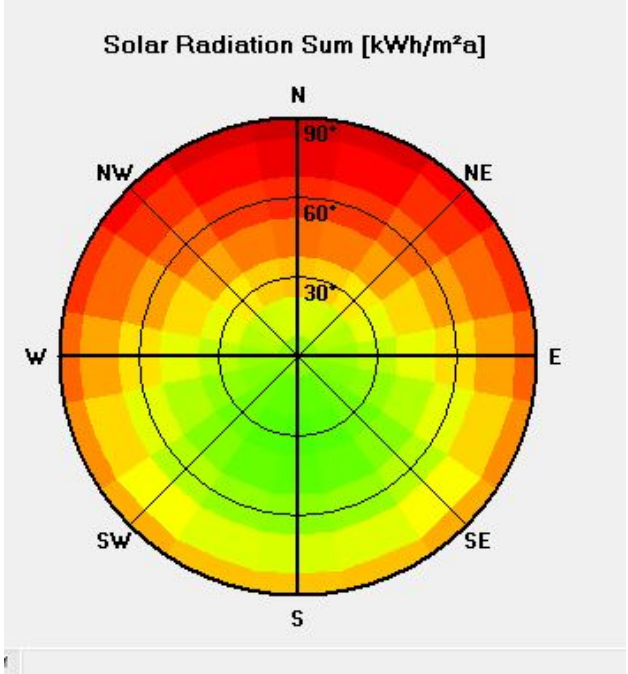
- Perform initial hygrothermal and thermal analysis during schematic design based on options for systems, orientation, etc.
- Initial energy modeling
- Not just present and historic climate data, but examine future prediction
- Design for adaptability
- System interaction
  - Mechanical with enclosure
  - Daylighting/lighting
  - Mechanical can drive the loads - ventilation





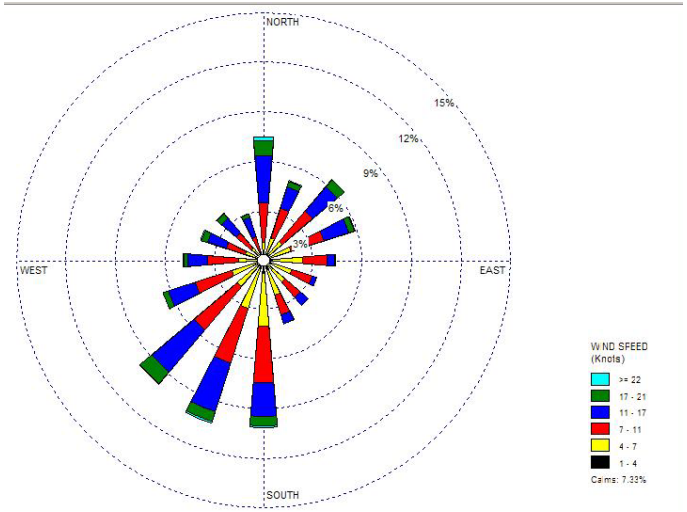
Temperature Considerations

- Solar angle
- Solar radiation
- Interior conditions

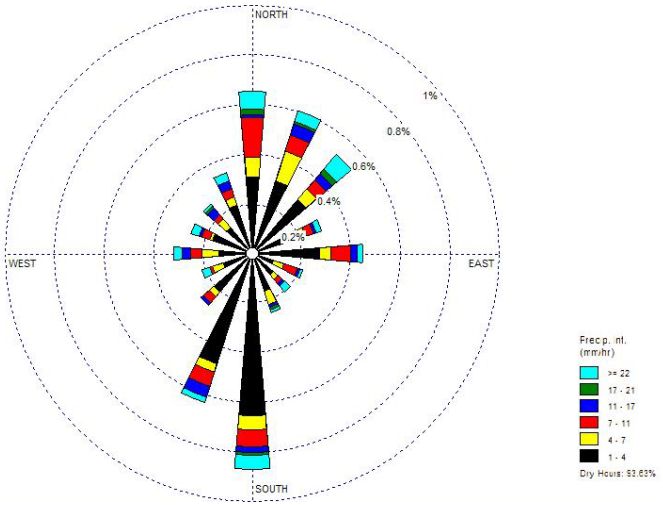


Wind and Rain Rose Diagrams

- Important to understand for natural ventilation
- Contaminant risk
- Needed to understand wind driven rain (wetting and drying potential)
- Need to understand for wind power



Wind Rose Diagram



Rain Rose Diagram

Wind

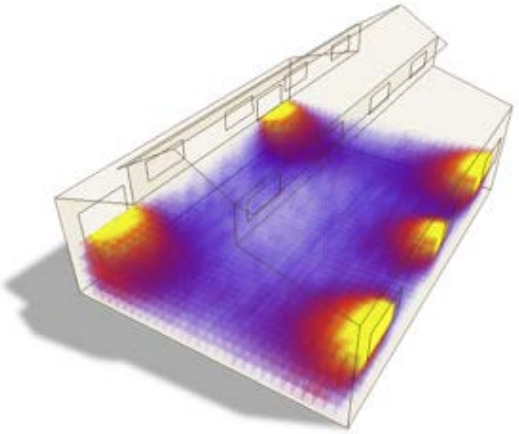
- Orientation
- Transport of Pollutants
- Orientation/location of fresh air intake

Climate Responsive Building Design

- Responsiveness of systems
- Controls
- How it reacts to the environment
- How to maintain

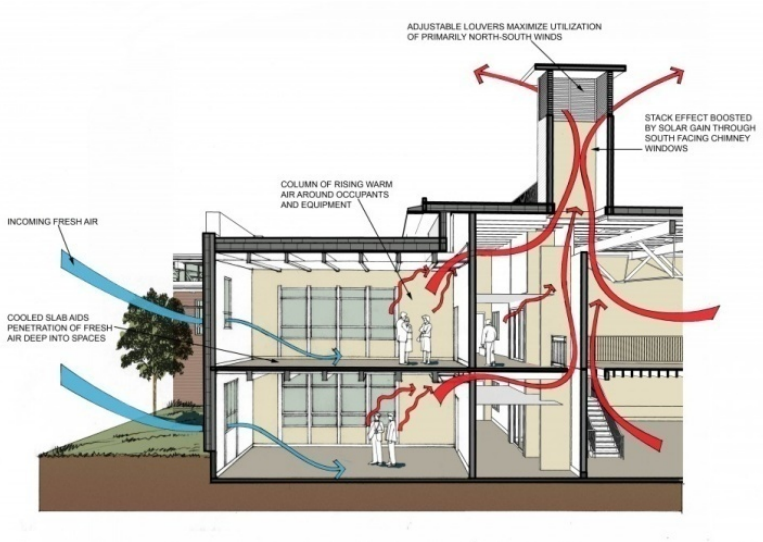
Daylighting

- Energy savings from heat transfer versus light transmission
- Fenestration positioning to optimize daylighting
- Daylighting savings
- Lighting system optimization
- Glare issues



Natural Ventilation

- Natural ventilation
  - Considerations for natural ventilation
  - Stagnation of air and fresh air considerations
  - Ventilation offset
  - Solar chimneys



Natural Ventilation

- Does not always translate into fresh air
- Don’t rely on the magic/smart arrows
- Understand prevailing winds and wind flow
- Orientation
- Manual operation versus automation
- Effect on overall pressures
- Stack effect
- Natural combined with mechanical

Natural Ventilation

- Ventilation loads are some of the most energy intensive and thus costly
- Need to understand wind speed and interior layout
- Stack effect
- Occupant comfort considerations
- Pollutant evaluation
- Stagnation of air evaluation
- Solar chimneys