Design Challenges in Southern Climates

Weighing the risk of different approaches to common conditions
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hot, sunny, and wet

Arrhenius equation
for every 10 degree Celsius rise the reaction rate doubles

annual rainfall
atlanta: 50 inches
houston: 50 inches
dallas: 40 inches
new orleans: 60 inches
miami: 60 inches
orlando: 50 inches
enclosure problems in hot-humid climates

compromised durability due to damage by heat, UV, and moisture (rain water, ground water, water in air, water in materials)
for water infiltration to be problematic, the wetting a wall assembly experiences must exceed its capacity to store and redistribute water for long enough to damage the materials that comprise it.
evaluating risk

1. potential pathways
2. the conditions under which water might infiltrate those pathways
   • climate
   • exposure
3. wall assembly’s tolerance for wetting
   • drying capacity of the wall
   • moisture sensitivity of the materials that comprise it
typical areas of compromise

1. stucco assemblies
2. balcony waterproofing systems & details
3. commercial window installation
4. roofing system design
the perfect wall
stucco assemblies

The cavity behind stucco:
(1) provides drainage for liquid water that bypasses stucco through larger cracks & penetrations (relieves hydrostatic pressure)
(2) acts as capillary break and receptor for capillary water, interrupting flow
(3) provides an air gap that facilitates hygric redistribution and moisture removal by air exchange
install a drainage mat with stucco and adhered stone claddings on framed walls...

1. in climates that receive more than 20 inches of rain per year
2. for buildings that exceed 2 stories
3. for buildings that are architecturally complex
balcony
waterproofing
drained/protected vs. barrier systems
window detailing

• reduce the load (head flashings, overhangs, drips, kerfs)
• integrate control layers
• isolate the window from the wall cavity
• assume imperfection:
  • provide redundancy
  • provide drainage
INTERIOR BACKER ROD & SEALANT JOINT (THIS SEAL SHOULD BE INDEPENDENT OF ANY "BEAUTY BEADS" USED AS TERMINATIONS FOR INTERIOR FINISHES)

SELF-ADHERED WATER CONTROL MEMBRANE OVER BLOCKING PRIMARY WATERPROOFING SEAL

WATER-SHEDDING SEAL

METAL PANEL
roof system design
The temperature gradient across a roof comprised of two materials, each with a different thermal resistance:

- Exterior temperature = 40°F

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0 F          40 F        80 F          120 F
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- R-8 material (21% of total assembly R-value)
- R-30 material (79% of total assembly R-value)

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0 F          40 F        80 F          120 F
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Interior temperature = 70°F

Since 79% of the total 30°F temperature drop occurs across the pink material, the temperature at the exterior surface of the pink material is 46°F.

(79% of 30°F = 24°F; 70°F interior temperature minus 24°F = 46°F)
temperature gradient across a roof comprised of two materials, each with a different thermal resistance

- exterior temperature = 40 F

- interior temperature = 70 F

Since 89% of the total 30F temperature drop occurs across the pink material, the temperature at the exterior surface of the pink material is 34F. (89% of 30F = 27F; 70F interior temperature minus 27F = 43F)
These ratios are based on tables from the residential code. The commercial code requires different (typically lower) total R-values for roof assemblies. Use the ratios shown here for your calculation, even for commercial applications. Or calculate what's required based on the 45 degree rule in Section 1203.3.5.1.4. You may wish to increase the ratio to account for higher interior humidity on your project.

Read: Building Science Insight 100: Hybrid Assemblies
36-inch truss, completely filled with insulation (per fire code)
36 inches fiberglass batt insulation @ R-3.5/inch = R-126

For condensation control ~10 -15% comprised of air impermeable insulation OR located on top of roof deck:

Option A: replace 5 inches of fiberglass batt insulation with open cell SPF
Option B: Add 5 inches rigid insulation on top of the deck… for total of ~R-150
So what does an R-150 roof look like?