

# **Effect of finishes on the moisture buffering capabilities of wood**

# It's Hygroscopic, Baby!

- Hygroscopic properties of wood are well known
- Recent interest in leveraging those properties for passive control of indoor comfort
- Just as thermal mass can regulate temperature, moisture buffering materials can regulate humidity

# The Wrinkle

- Wood is seldom left exposed once construction is complete
- Finishes for aesthetics
- Finishes for protection
- How do they affect the wood's ability to absorb and release water vapor?

# Protection From What?

- Mechanical damage — dents, scratches
- Chemical damage — food spills, skin oils
- Radiative damage — heat, light (especially ultraviolet)
- Biological damage — bacteria, fungi (i.e. rot)
- Moisture damage — vapor and direct liquid contact

# Hypothesis

- Different finishes provide different levels of protection against different types of damage
- Finishes designed to be most resistant to moisture will have the greatest impact on the moisture buffering capabilities of wood
- Shellac — Not known for its moisture resistance, probably won't have a huge impact on moisture buffering
- Spar varnish — Used for finishing boats, expected to completely block moisture buffering

# Which Finishes Do I Test?

- Only finishes that can be applied with a brush or rag
- Eliminates certain lacquers polyurethanes that require a spray gun
- No UV-cured finishes
- Design a procedure that can be replicated with other finishes later

# What Kind of Wood?

- Southern yellow pine
- Common construction material
- Visible applications likely to increase with adoption of mass timber products
- Dimensional lumber cut into standard lengths
- Sanded to minimize surface effects

# The Test Box

- Must be vapor-proof!
- Acrylic
- 8" × 8" × 8" nominal dimensions (6 sides from a single 16" × 24" sheet)
- Vapor-proof sealant applied to interior edges
- Gasket for lid?

# Equipment

- Humidifier outside the box adds water vapor to the interior
- Test samples sit on top of a small platform in the middle of the box
- Load cell under the platform measures changes in the weight of the sample
  - Tells us how much moisture the sample has absorbed
- Humidity sensor monitors changes in relative humidity
  - Tells us how quickly the moisture is being absorbed
- Microcontroller outside the box records data from load cell + humidity sensor

# Questions

- Is an 8" × 8" × 8" box large enough to allow the water vapor to diffuse evenly around the sample?
- How should I measure the amount of moisture added to the box?
  - By weight? — Place another load cell under the humidifier
  - By volume? — Measure the water level in the humidifier's reservoir before and after each test run
- Should the microcontroller be able to turn the humidifier on and off to maintain a constant relative humidity?