White Pine Shrinkage - Practical Observations and Determination

Shrinkage Occurs During Kiln Drying; or does it?
The purpose of drying lumber is:

- Because we like to watch wood dry.
- To make money.

- To satisfy the needs and desires of our customers.
So, ..........

A situation developed ....

• 8-inch v-matched tongue & groove white pine boards
• Premium Grade
• Installed as vertical paneling in a home
• Subsequently, spaces were noticed between boards; homeowner unhappy
A situation developed....

• The homeowner found an expert who opined that MC at time of installation was as high as 17, 20.3 and 21.6%
• Opined that this supposedly high MC caused excessive shrinkage
• With legal counsel, filed a claim for damages of ~$200K
If the boards were wet when installed, why?...

• Were they wet from the kiln?
• Was there improper storage?
• Did they wet from the yard?
• Did they get wet during transport?
• Did they get wet at the lumber yard?
• Did they get wet at the home during construction?
• Were the boards not acclimated?

Or, ....

• Was the determination by the expert that the boards were wet when installed incorrect?
He ....

- Measured current MC with a meter.
- Measured the overall distance over sections of, for example,
  - 22, 39, 7 and 10 boards
- Assumed they were installed tight
- Assumed they were 6.875 in wide initially
- Measured spaces currently between boards

He ....

- then from these dimensions, calculated theoretical shrinkage.
- from this theoretical shrinkage, back calculated MC at time of installation.
- … Any problems with this?
\[ \Delta D = D_1 \left[ C_T (M_F - M_I) \right] \] (12–2)

where \( \Delta D \) is change in dimension, \( D_1 \) dimension in units of length at start of change, \( C_T \) dimensional change coefficient tangential direction (for radial direction, use \( C_R \)), \( M_F \) moisture content (%) at end of change, and \( M_I \) moisture content (%) at start of change.

Values for \( C_T \) and \( C_R \), derived from total shrinkage values, are given in Table 12–5. When \( M_F < M_I \), the quantity \( (M_F - M_I) \) will be negative, indicating a decrease in dimension; when greater, it will be positive, indicating an increase in dimension.

Wood shrinks more tangentially

- He assumed board shrinkage was 50% tangential and 50% radial
- Is this accurate?
• If the orientation is radial, it takes a higher change in MC% to cause a particular dimensional change
• Therefore, assuming a larger radial component results in a higher initial MC calculation.
Other important issues,

• He did not measure individual boards.
• However he presented a calculated initial %MC for individual boards, from assumed individual board shrinkage.
• But, individual board shrinkage was calculated from aggregate current total width of 7 to as many as 39 boards divided into the assumed initial width.
• The values calculated were specifically dependent upon the assumption that the boards were tightly installed, with no open space.

• However, there was no evidence that each board was in fact installed tightly. This was only an assumption.
• Interestingly, at many locations where there were spaces between boards, the boards were tight above and below.
• These boards were crooked!
• So, was a space due to crook or shrinkage?

NELMA grade rules

• Premium grade; 3/8 inch crook allowed in an 8 foot board!
And, ....

Panelization

• The finish which was applied to these boards caused adherence in a number of locations, so movement of boards was as a “panel”, creating one large space instead of several smaller spaces.
So, ……

• What really happened?

_A second expert_,

• Measured current %MC
• Measured current actual board dimension
• Assumed that boards were, conservatively, 80% tangential and 20% radial orientation (the USDA Wood Handbook suggests assuming tangential orientation)
• Observed panelization
• Observed crook
The sawmill’s expert calculated ....

- An average initial %MC of 13.7%;
- 12.1% if all tangential orientation

Interestingly, ...

- What is the NELMA %MC specification for kiln dried boards?
  - <19%,
  - <15%
  - <12%?
  - read the rule book, look at the contract
So, what happened and who won?...

- Nobody won!
- There was a much smaller settlement
- The lawyers and experts were paid.
- The lumber supplier unnecessarily spent time and money addressing the issue.
- The insurance company provided coverage with your money

White Pine –

is an Ideal Material:

- Attractive
- Economical
- Strong, stiff, lightweight
- Natural, renewable, sustainable
- Long lasting
- Low shrinkage
- Excellent insulator
- Readily available, locally
- Ready design, fabrication, modification
White Pine

Image Courtesy of
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White pine boards are good!