



October 28, 2010

Restoration Sciences Academy *Test Labs*
Hardwood Flooring Drying Test
Project No. 10010

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What kind of hardwood can be dried? How long do they take to dry? In this test, the goal was to determine what the effect of different attachment methods was on the drying time of hardwood flooring. Also, a visual inspection of the floor was completed to determine acceptability of the appearance of the various floors to the customer after drying. It was found that true hardwood and bamboo have a good appearance and dry well, and that engineered hardwood does not have a good appearance after drying and would be less likely to be saved.

Flooring Tested

The wood floors tested were:

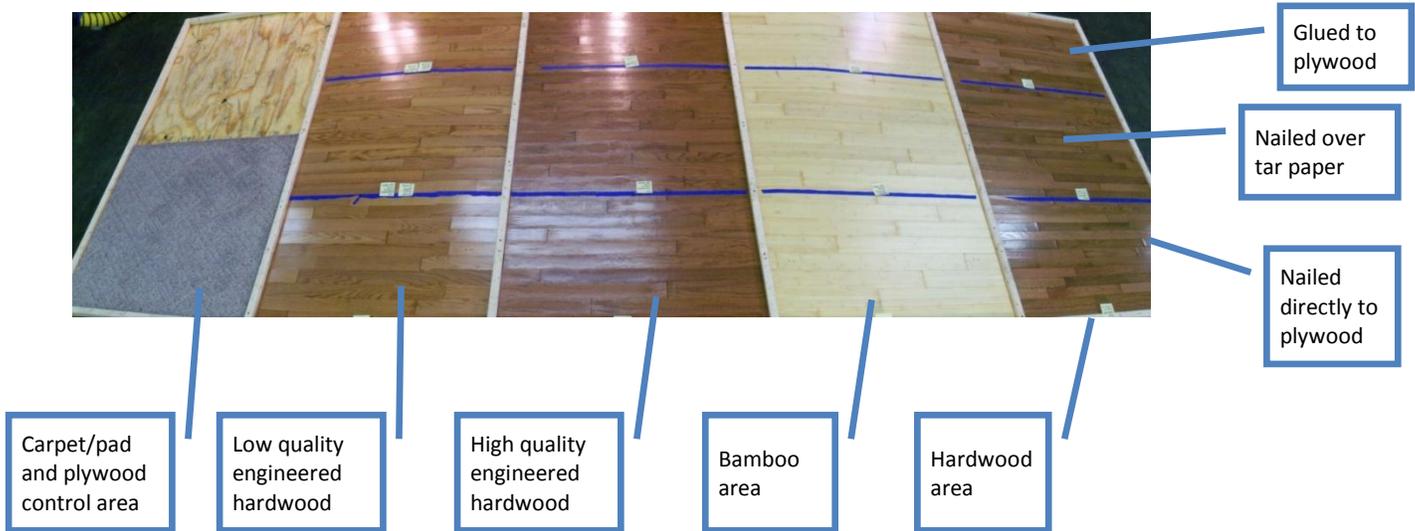
- Pre-finished hardwood
- Bamboo hardwood
- High quality engineered hardwood
- Low-quality engineered hardwood
- Control area with carpet/pad and bare subfloor

Each test cell was laid out over $\frac{3}{4}$ " plywood over standard joist construction. The wood is continuous on top, but underneath is different materials/attachment methods. The attachment methods were:

- Glued directly to plywood
- Nailed over 15# tar paper
- Nailed directly to plywood



Test Configuration



Establishing a dry standard

Our first step was to establish a dry standard in the material to be tested. We measured the moisture content of all the materials using the same meter, and marked the location of each measurement.

Flooding

The test cells all together made a 8' x 20' area. 2" x 2" lumber formed the boundaries of each cell. Each cell was filled with 10 gallons of water (50 gallons total for the floor) and covered with moving blankets to hold the water on the floor. After flooding the floor was covered with plastic to retain as much moisture as possible. After approximately 14 hours, the floor was re-flooded with 5 gallons on each cell (a total of 25 gallons). The blankets and plastic were re-set after this flooding. We allowed the water to sit for two more hours.



Extraction

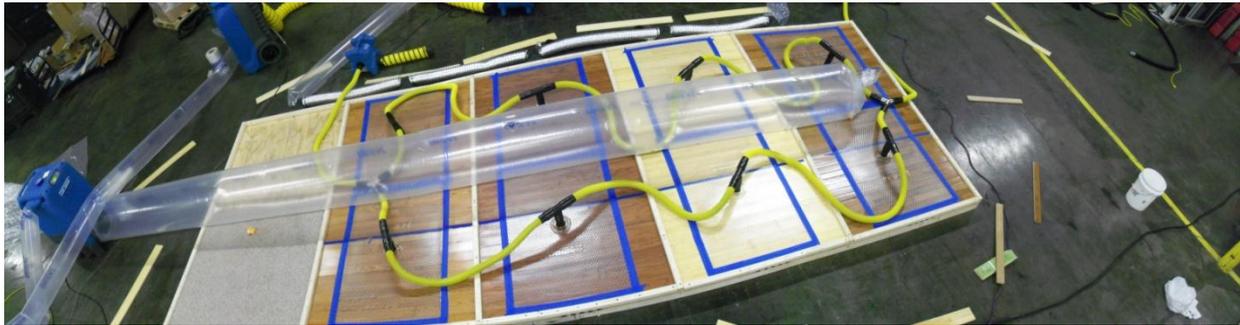
We then extracted the floor areas using vacuum panels connected to a flood extractor. The mats were connected in series to one vacuum hose and we ran the extractor for exactly one hour. We also performed a deep extraction on the carpet and pad. On the bare plywood, we used a squeegee wand.



Drying

After completing the extraction, we moved on to drying:

- The area under the floor was ventilated and dried using an high pressure ducted fan to force air under each test cell. One airmover with five vents. Ducted into the high pressure fan was an LGR dehumidifier.
- The surface of the floor was dried with vacuum panels and two inter air drying units. Two panels were set up per test cell. All mats and inter-air dryer units were hooked in series, so that all mats had the same amount of suction.
- The top side of the floor air conditions were controlled by tenting and ducting in a LGR dehumidifier



Monitoring

Air readings

- Remote sensors were used above and below each test cell to verify that conditions were equal for all areas of the floor.

Moisture readings

- Two locations were monitored in each area of each test cell. Therefore, a total of 28 locations on the floor were monitored daily.
- Each monitoring location consisted of two @ 2" long nails which were monitored with a penetrating moisture meter.
- Additionally, each area had one remote sensor screwed from the bottom through all layers of the floor to track moisture and air at that location.



Results

To prevent issues where parties in the industry might focus on a certain time to dry a wood floor, all readings are reported as a ratio compared to the plywood control cell. So for example, if the plywood control took a certain time to dry, and another material took 2.0 times the control, it could be said that it would take twice as long to dry vs. bare plywood. Expressed in drying time, if it took 24 hours to completely dry bare plywood using a certain drying system, a material that had a factor of 2.0 would take 48 hours to dry.

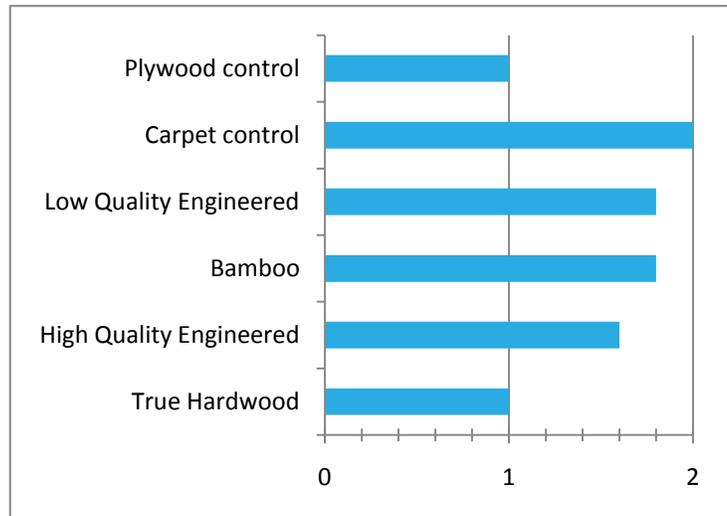
We considered an area to be dry when the readings in that area (including all layers) were within four percentage points of the dry standard for that floor assembly.

Time to dry based on type of wood

When analyzing the type of wood and how long it took to dry compared to the plywood control, results show that:

- True hardwood flooring systems dry at virtually the same rate as plywood
- Other wood flooring systems dry faster than carpet and pad over plywood
- Of the wood flooring systems tested, bamboo and low quality engineered wood were the slowest drying

Wood	Time Factor
Plywood control	1.0
True Hardwood	1.0
High Quality Engineered	1.6
Bamboo	1.8
Low Quality Engineered	1.8
Carpet control	2.0

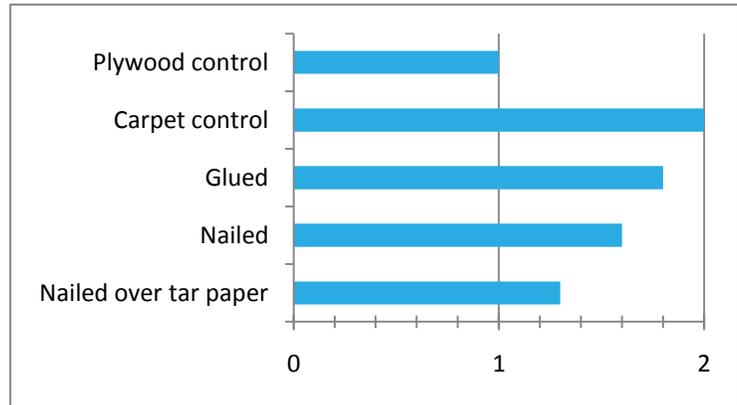


Averages by flooring attachment method

When analyzing the flooring attachment method comparing how long it took to dry compared to the plywood control, results show that:

- Wood nailed over tar paper dried faster than direct nailed or direct glued
- Even glued-down wood dried faster, on average, than carpet and pad over plywood

Attachment Method	Time Factor
Plywood control	1.0
Nailed over tar paper	1.3
Nailed	1.6
Glued	1.8
Carpet control	2.0



Time factors by wood and attachment method

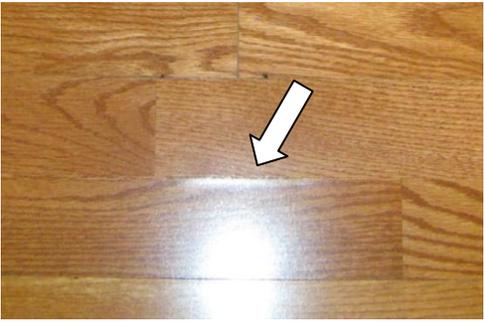
When analyzing the wood type and attachment method comparing how long it took to dry compared to the plywood control, results show that:

- Hardwood over tar paper dried faster than bare plywood
- Only the LQ glued and Bamboo glued took as long to dry as the carpet and pad over plywood

Wood / Attachment method	Time Factor
Plywood Control	1.0
Hardwood over tar paper	0.8
Hardwood nailed	1.1
Hardwood glued	1.1
HQ Engineered over tar paper	1.2
Bamboo over tar paper	1.6
LQ Engineered nailed	1.6
LQ Engineered over tar paper	1.6
HQ Engineered nailed	1.8
Bamboo nailed	1.9
HQ Engineered glued	1.9
Bamboo glued	2.0
Carpet	2.0
LQ Engineered glued	2.1

Wood appearance evaluation

One of the biggest questions of this study was the appearance of the wood after drying. Over 200 photos were taken of the wood floor at different stages. (Note that it is difficult to show even major imperfections clearly in a photo.) This table shows the different floors and their appearance after drying, as well as our evaluation of the acceptability of the appearance.

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Hardwood</p>		<p>The appearance of the true hardwood was satisfactory after drying. Minor retouching would easily return the floor to pre-loss condition.</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Bamboo</p>		<p>The appearance of the bamboo was satisfactory after drying. Minor retouching would easily return the floor to pre-loss condition.</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">HQ Engineered</p>		<p>The appearance of the HQ engineered was unsatisfactory. The floor had ripples in the upper layer that appeared “leathery.” To remove this wrinkled appearance would require major refinishing. Major refinishing is either not possible or not cost effective on most engineered hardwood. Therefore, it is our recommendation that engineered hardwood that has wrinkled in this way be removed as a part of the demolition process and replaced with new.</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">LQ Engineered</p>		<p>The appearance of the LQ engineered was slightly better than the HQ engineered; however, the edges were raised and therefore was unsatisfactory after drying. Major refinishing is not possible on this type of material. Therefore, it is our recommendation that low quality engineered hardwood that has raised edges in this way be replaced.</p>

Conclusions and Recommendations

This study confirmed that all standard methods of installation can be dried over plywood. The myth that hardwood over tar paper would be difficult or impossible to dry was totally dispelled. It is clear that hardwood, when dried properly, should dry with all the other structure and contents in a residential structure.

While all types of hardwood can be dried, it was also clear that engineered hardwood has a greater likelihood to suffer permanent aesthetic damage and would in many cases require replacement. Restorers should discuss this with their customers and make a proper judgment. Clear communication is a key, because some customers will want to save the wood even with if the damage is visible.

It is also important to note that the damage to the engineered hardwood is ONLY appearance related. There were no microbial damages or other safety hazards apparent from this appearance issue.

For more information, go to www.restorationsciencesacademy.com

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