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Frequently Asked Questions

"Wet" Lumber by Ryan J. Dexter

One of the most difficult things about designing metal plate connected wood trusses is the use of wood. Wood is a biological material; therefore, its structure is immensely varied. The species, grade, moisture content, temperature, load duration, chemicals and orientation of fibers with respect to the loads are some factors that ultimately affect the overall strength of the wood once it is cut into lumber.

At WTCA, we receive many calls regarding the effects of water on lumber. All other things being equal, the drier the wood, the stronger it will be.

Wood is composed of a series of polymer cells that contain water. These cells act similar to a sponge. Wood expands when wet and contracts when dry. This shrinking and swelling affects the dimensional stability of the lumber. Most uses for wood require that the moisture content be fairly low. The general rule is that wood should be dried to a moisture content that is as close as possible to that which it is expected to reach in service.

The Wood Engineering and Construction Handbook states, “Any piece of lumber will give off or take on moisture from the surrounding atmosphere until the moisture in the lumber has come to a balance with that in the atmosphere. The moisture in the lumber at the point of balance is called the equilibrium moisture content (EMC). The EMC is closely related to the relative humidity and the temperature of the surrounding atmosphere, although differences in temperature do not have a strong effect on the EMC” (Faherty and Williamson, 1997).

To minimize shrinkage, lumber used in truss design is kiln-dried or seasoned to a moisture content not exceeding 19 percent. The lumber design values used reflect this. When trusses are used in conditions where the moisture content will exceed 19 percent (e.g. above a swimming pool), the design values are adjusted using Wet Use Factors that are available in the NDS and various lumber association guides.

Moisture content of wood in equilibrium with stated dry-bulb temperature and relative humidity[1]

Temperature (dry-bulb)	Relative humidity																			
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	98
°F	Percent																			
30	1.4	2.6	3.7	4.6	5.5	6.3	7.1	7.9	8.7	9.5	10.4	11.3	12.4	13.5	14.9	16.5	18.5	21.0	24.3	26.9
40	1.4	2.6	3.7	4.6	5.5	6.3	7.1	7.9	8.7	9.5	10.4	11.3	12.3	13.5	14.9	16.5	18.5	21.0	24.3	26.9
50	1.4	2.6	3.6	4.6	5.5	6.3	7.1	7.9	8.7	9.5	10.3	11.2	12.3	13.4	14.8	16.4	18.4	20.9	24.3	26.9
60	1.3	2.5	3.6	4.6	5.4	6.2	7.0	7.8	8.6	9.4	10.2	11.1	12.1	13.3	14.6	16.2	18.2	20.7	24.1	26.8
70	1.3	2.5	3.5	4.5	5.4	6.2	6.9	7.7	8.5	9.2	10.1	11.0	12.0	13.1	14.4	16.0	17.9	20.5	23.9	26.6
80	1.3	2.4	3.5	4.4	5.3	6.1	6.8	7.6	8.3	9.1	9.9	10.8	11.7	12.9	14.2	15.7	17.7	20.2	23.6	26.3
90	1.2	2.3	3.4	4.3	5.1	5.9	6.7	7.4	8.1	8.9	9.7	10.5	11.5	12.6	13.9	15.4	17.3	19.8	23.3	26.0
100	1.2	2.3	3.3	4.2	5.0	5.8	6.5	7.2	7.9	8.7	9.5	10.3	11.2	12.3	13.6	15.1	17.0	19.5	22.9	25.6
110	1.1	2.2	3.2	4.0	4.9	5.6	6.3	7.0	7.7	8.4	9.2	10.0	11.0	12.0	13.2	14.7	16.6	19.1	22.4	25.2
120	1.1	2.1	3.0	3.9	4.7	5.4	6.1	6.8	7.5	8.2	8.9	9.7	10.6	11.7	12.9	14.4	16.2	18.6	22.0	24.7
130	1.0	2.0	2.9	3.7	4.5	5.2	5.9	6.6	7.2	7.9	8.7	9.4	10.3	11.3	12.5	14.0	15.8	18.2	21.5	24.2
140	0.9	1.9	2.8	3.6	4.3	5.0	5.7	6.3	7.0	7.7	8.4	9.1	10.0	11.0	12.1	13.6	15.3	17.7	21.0	23.7
150	0.9	1.8	2.6	3.4	4.1	4.8	5.5	6.1	6.7	7.4	8.1	8.8	9.7	10.6	11.8	13.1	14.9	17.2	20.4	23.1
160	0.8	1.6	2.4	3.2	3.9	4.6	5.2	5.8	6.4	7.1	7.8	8.5	9.3	10.3	11.4	12.7	14.4	16.7	19.9	22.5
170	0.7	1.5	2.3	3.0	3.7	4.3	4.9	5.6	6.2	6.8	7.4	8.2	9.0	9.9	11.0	12.3	14.0	16.2	19.3	21.9
180	0.7	1.4	2.1	2.8	3.5	4.1	4.7	5.3	5.9	6.5	7.1	7.8	8.6	9.5	10.5	11.8	13.5	15.7	18.7	21.3
190	0.6	1.3	1.9	2.6	3.2	3.8	4.4	5.0	5.5	6.1	6.8	7.5	8.2	9.1	10.1	11.4	13.0	15.1	18.1	20.7
200	0.5	1.1	1.7	2.4	3.0	3.5	4.1	4.6	5.2	5.8	6.4	7.1	7.8	8.7	9.7	10.9	12.5	14.6	17.5	20.0
210	0.5	1.0	1.6	2.1	2.7	3.2	3.8	4.3	4.9	5.4	6.0	6.7	7.4	8.3	9.2	10.4	12.0	14.0	16.9	19.3
220	0.4	0.9	1.4	1.9	2.4	2.9	3.4	3.9	4.5	5.0	5.6	6.3	7.0	7.8	8.8	9.9	*	*	*	*
230	0.3	0.8	1.2	1.6	2.1	2.6	3.1	3.6	4.2	4.7	5.3	6.0	6.7	*	*	*	*	*	*	*
240	0.3	0.6	0.9	1.3	1.7	2.1	2.6	3.1	3.5	4.1	4.6	*	*	*	*	*	*	*	*	*
250	0.2	0.4	0.7	1.0	1.3	1.7	2.1	2.5	2.9	*	*	*	*	*	*	*	*	*	*	*
260	0.2	0.3	0.5	0.7	0.9	1.1	1.4	*	*	*	*	*	*	*	*	*	*	*	*	*
270	0.1	0.1	0.2	0.3	0.4	0.4	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Asterisks indicate conditions not possible at atmospheric pressure.

Relationships such as those in the above table can be used to estimate the moisture content to be expected in service from the characteristics of the atmosphere in which the lumber will be exposed. (Keith F. Faherty and Thomas G. Williamson, Wood Engineering and Construction Handbook [New York: McGraw-Hill, Inc., 1997] 1.6.)

QUESTION:

I am looking for some information regarding black surface mold on lumber. Does it alter the integrity of the lumber stress values? I have a client who wants to use “all dry” lumber for his construction but I do not know if this is really necessary.

ANSWER:

Generally, mold or stain does not have an effect on the lumber values. However, it may be a warning sign of high moisture levels that definitely can cause problems. If the moisture content of the lumber is over 19 percent, two things will happen: lumber strength will decrease and decay can begin. If trusses were being designed and manufactured with green or wet lumber (over 19 percent moisture content), I would check with my plate/software vendor to see if the truss design should be modified. Do this even if you expect the moisture levels to drop to below 19 percent after they are in service.

QUESTION:

I would like to know if there is an age restriction on wood trusses? How long after production are they safe to use? The trusses in question are at least three to four months old. Are they still safe to use? They have not been covered the entire time and are showing signs of age.

ANSWER:

There are many factors that affect the strength, which in turn affects the life expectancy, of wood. One of the main factors regarding strength is the moisture content. The wood used in trusses is kiln dried (moisture content equal to or less than 19 percent). In the event of long-term storage, trusses need to be protected from the environment in a manner that provides for adequate ventilation. If tarpaulins or other materials are used, the ends need to be left open for ventilation. Plastic is not recommended, since it can trap moisture. When storing the trusses horizontally, blocking needs to be used on eight to ten foot centers, or as required, to minimize lateral bending and moisture gain.

Things you can look for to determine if the trusses are over-exposed to moisture: the teeth in the metal plates will

actually start to pull out of the lumber, fungus and mold will grow on the trusses, and the truss plates may begin to show signs of rusting starting with white rust that will eventually migrate to red rust. Anytime you see red rust, it is time to take a much closer look at the trusses.

To pose a question for this column, email us at faq@woodtruss.com. To view other questions visit the WTCA website.

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