Image courtesy of Persinger Architects.

MSR Madness

By Dwaine Charbonneau, P.E. at RedBuilt

A key element of the legendary RedBuilt™ open-web truss is the chord. These wooden wonders—found top and bottom, and joined to steel webs between—account for many of the best traits of these trusses. The chords are lightweight and strong, resisting thousands of pounds of force, and sheathing is easily nailed to them. Together with RedBuilt's precision woodworking processes, the chords enable the building of trusses in myriad profiles, including radius-pitched, scissor, bowstring, and barrel.

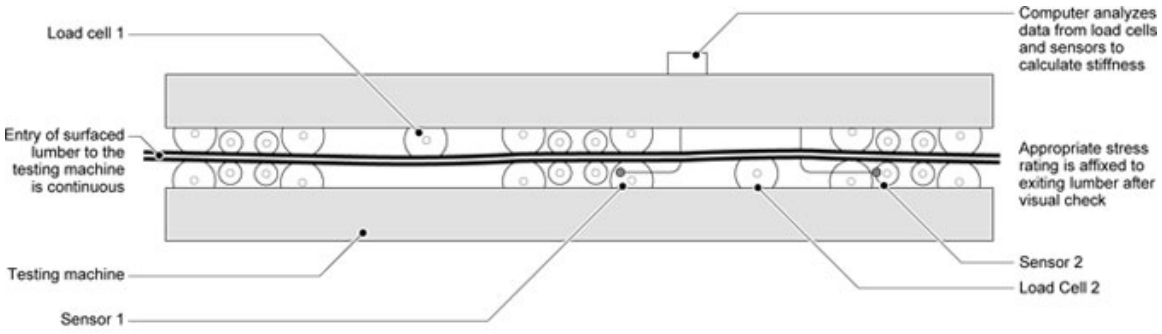
An important characteristic of the chords is that the lumber is Machine Stress Rated (MSR) rather than visually graded. If you don't already know the technical differences between these types of grading systems, you at least understand the concept if you've ever had to choose sides for a pickup game of basketball. The players line up, and your job as team captain is to snag the best player of the bunch. Say you've never seen any of them play before: you are now engaged in visual grading.

The limitations of this method become clear the first time you pick the six-foot-five prospect who, it turns out, can't jump and couldn't throw the ball in the ocean from a rowboat. It would work so much better if you could just see the players run before you choose. Running isn't everything, but it takes strength and coordination to run well, and those qualities may translate to basketball skills.

So it is with MSR lumber. The particular truss-chord "skills" we're looking for are stiffness and strength. Stiffness is indicated by how much the lumber curves or stretches as you apply a force. If you apply enough force to break it, now you know the strength. With visual grading of growth characteristics such as knots, checks, and slope of grain, we can get a good idea of the strength and stiffness of a piece of wood. But it would be even better to pull, push, and bend the piece to really dial it in.

We can't very well test the strength of a piece of lumber because, well, the piece would not be of much use once it's broken. Thankfully the stiffness of the lumber also tells us a lot about how strong it is, and we can test stiffness without breaking anything.

An MSR grading machine guides each stick of lumber through a series of rollers. The rollers are not directly aligned, and so the piece is forced into a curving path. By knowing the force required to bend it and how much it is being bent, the stiffness can be calculated. From this we infer the strength. For good measure, the lumber is then also visually graded for growth characteristics that may affect strength and appearance.



Schematic of Mechanical Evaluating Equipment for MSR Lumber

Image courtesy of Canadian Wood Council.

The benefits of this process are crucial to the success of a RedBuilt™ open-web truss. Consider the following:

- PERFORMANCE: The machine stress grader culls the best of the best. With MSR we can get more than twice the tension stress of the highest visual grade, which permits a longer truss span, shallower depth, or greater load capacity.
- SIMPLICITY: We can draw from five different species combinations, but need stock and design only three grades. It doesn't matter if the lumber is Southern Pine from Georgia or Hem-Fir from Oregon—the same MSR grade of either species does the job. Designing and building trusses is simplified because it doesn't depend on the region and the number of grades is minimized.
- QUALITY: Experience proves that MSR lumber reliably meets our quality assurance targets.
- CONSISTENCY: Since stiffness is tested by machine, it's no surprise that variation in MSR stiffness is greatly reduced compared to visual grades. This translates to more-predictable deflection characteristics and better load sharing.
- STABILITY: The strength and stiffness of a given MSR grade are the same today as they were yesterday. Though occasions are rare, the properties of a visual grade are more susceptible to adjustment over time.
- USAGE: The narrower identification of strength means only the lumber best suited for our needs makes it to our yards, so the forest resource is allocated more efficiently.

RedBuilt obtains MSR dimension lumber from qualified mills throughout the country. The lumber we receive has been rated and stamped at the mill. The grade stamp tells us the product is "machine rated," and includes the

Fb (bending stress) and E (modulus of elasticity) properties. E is the tested property and Fb is inferred.
Image courtesy of MSRlumber.org.

With two primary grades to choose from, 2100f-1.8E and 2400f-2.0E, we can employ the most economical lumber for a particular truss design as required. A third and higher grade, 2700f-2.2E, takes it to another level for the Red-L™ series of truss. Yet a fourth option, RedLam™ LVL, is not MSR lumber at all. This is RedBuilt's own engineered chord stock. Its properties are evaluated in a different manner. (Tell me that's not another white paper just waiting to happen!)

For RedBuilt™ open-web trusses, MSR grading is merely the first step in quality assurance, with continual RedBuilt evaluation of the properties critical to truss chord performance. Consider, for example, tension strength. Nothing is more crucial to truss performance. A tip of the hat to Machine Stress Rating for providing the best material for the job, but here it is necessary to continually sample and test the MSR chord material in tension. And yes, in this case, we do break pieces to determine their strength—a decidedly messier process than Machine Stress Rating.

It may be inappropriate to ask basketball players at the Y to hop on the treadmill for a minute before picking teams, but at the professional level, potential draft picks do this and more in the evaluation process. In the same way, Machine Stress Rating is a vital assessment for RedBuilt truss chord material, and has played an essential role in making the RedBuilt open-web truss a proven performer for more than fifty years.

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About the Author:
Dwaine Charbonneau, P.E., has worked in the Engineered Wood Products industry for 16 years, lives north of Portland, Oregon near the Columbia River, and is scandalously handsome. As a RedBuilt corporate engineer, he is an expert on truss design, floor performance, and alpacas.