

Strengthening America's Pastime



Forest Products
Laboratory
1910-2010

Scientists Work to Keep Baseball Players and Fans Safe

When Louisville Slugger™ turned 100, in 1984, nearly all baseball bats were made from white ash wood. Today, maple bats are all the rage. But home-run records are not the only things being broken. Since the early 1990s, changes in bat geometry, wood species used in manufacturing, and unregulated slope of grain production specifications culminated in a large number of broken bats during the 2008 Major League Baseball (MLB) season. Over 2,800 bats broke between July and September alone.

Bats were not only breaking, they were shattering. Players, coaches and fans have all sustained injuries due to “multiple-piece failure” bat breakage. In response, MLB’s Safety and Health Advisory Committee convened a panel of wood scientists and other technical experts to examine the bat manufacturing process. Between July and September of 2008; 2,232 broken bats were collected from Major League games. Of those broken bats, 756 were considered multiple-piece failures with maple bats three times more likely than ash bats to break into two or more pieces.

Dave Kretschmann, research engineer at the U.S. Forest Service’s Forest Products Laboratory in Madison, WI, was charged with the task of finding out why so many bats were breaking. Kretschmann teamed up with Dr. James A. Sherman, professor of mechanical engineering at the University of Massachusetts at Lowell—also director of the Baseball Research Center—and Dr. Carl N. Morris, professor of statistics at Harvard University.

The majority of multi-piece failures, says Kretschmann, were caused by slope of grain issues. Slope of grain is a term used to quantify straightness of grain (see diagram on back). As the straightness of the wood grain decreases, bat durability decreases. Although maple wood has been blamed as an inherently flawed species, Kretschmann points out that “the frequency of bats breaking into multiple pieces was primarily because of slope of grain issues, not necessarily the species of wood.”



Ash, a ring-porous species, has a very distinctive grain pattern, says Kretschmann. As such, it is much easier to assess the straightness of grain in ash. Maple, a diffuse porous wood, is much more uniform in structure, which makes it difficult to determine grain direction by sight alone.

TECO (Sun Prairie, WI), an independent certification and testing agency for wood products, has been helping to guide bat manufacturers through modified production and grading requirements. Scott Drake, vice president of operations at TECO, has visited most bat manufacturers and major league teams to ensure that everyone understands and follows the new regulations.

“There’s a lot of tradition in wood bats,” says Drake, “but it hasn’t always been based on sound science. We are trying to merge the realities of wood science research with the traditions of the game. It’s really about matching wood quality with appropriate bat design all while ensuring the best manufacturing practices.”

In 2009, the MLB Safety and Health Advisory Committee, in agreement with the MLB Players Association, implemented a list of nine recommendations intended to reduce the frequency of multiple-piece bat failures. Subsequently, there was a 30% reduction in shattered bats throughout the season.

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One simple change made to help reduce slope of grain malfunctions, Drake says, is retaining a clear finish 18 inches up the handle of bats made from hard maple or yellow birch. A small ink dot is also placed on the face-grain of the handle to help identify slope of grain characteristics. Ash bats can still be stained entirely black or brown.

Kretschmann says fans may continue to see bats breaking during Major League games but, because of revised manufacturing rules, bats aren't breaking into multiple pieces nearly as often. "Since those first changes, implemented in the 2009 season," says Kretschmann "we've also assessed the impact of other key variables causing bats to break into multiple pieces, such as bat geometry and drying."

The so-called "brick and a toothpick" style of bat has been a particular problem, says Kretschmann. This design, a thick barrel tapering quickly to a thin handle, tends to have multiple-piece failure more often. All MLB bats also need to weigh about the same. A bat using a larger volume of wood would then need to use lower density wood, which is also weaker. Over-drying of wood during the production process can also create weaknesses and affect a bat's strength integrity.

Changes for the 2010 season have addressed some of these issues. For example, bat dimension restrictions include a maximum barrel size for Major League bats of 2.61 inches across with a minimum handle size of 0.86 inches. Also, teams cannot purchase maple bats for Minor League players below a density of 0.024 lb/in³ at 8% moisture and the limit on minimum density for Major League maple bats is now 0.019 lb/in³.

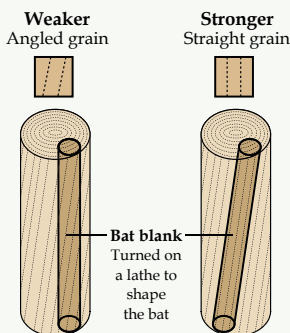
It takes an exceptional piece of wood to craft a Major League bat. In seeking to produce a traditional style bat, a manufacturer could go through a thousand raw dowels, or billets, and find maybe 250 of suitable weight, says Kretschmann. For the large wood volume "brick



Important recommendations in effect for 2009 season

Slope of grain requirements

A bat is stronger if the slope of grain is straight. A slope of grain that veers too far to the left or right increases the chance of bat breakage.



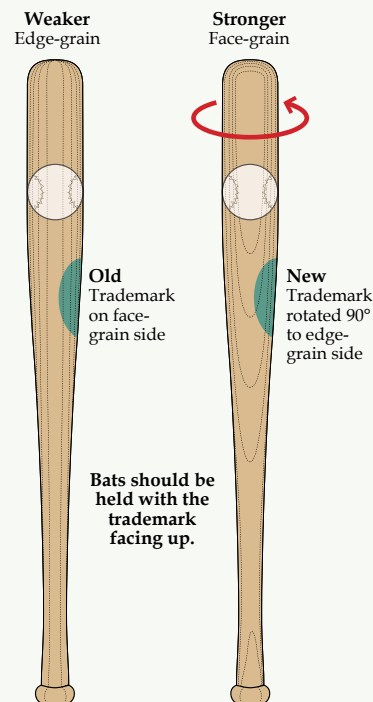
Ink dot on tangential face

An ink dot on the tangential face of sugar maple and yellow birch handles enables a player to easily view the slope of grain.



Rotate trademarks 90°

Hitting a ball on the face-grain side of a maple, yellow birch, or beech bat is less likely to result in bat breakage. Moving the bat's trademark to the edge-grain side increases the chance of striking the ball on the stronger face-grain side.



and a toothpick" style, he says, "it may be that you'd only find one or two billets out of a thousand."

The aim of continued research, say both Kretschmann and Drake, is to ensure a standardized process for bat manufacturing so that the danger of multiple-piece failure is reduced as much as possible. America's favorite pastime can then remain as safe and fun as always, for generations to come.