Tension compensated fretboard

Cedar Mountain Mandolin

Perfect intonation is the sign of a high-quality stringed instrument. Intonation is the accuracy of tune of a stringed instrument. Musicians strive to play instruments with perfect intonation. I use a tension compensated fretboard on **all** my instruments to attain perfect intonation over the entire fretboard. The only way to achieve perfect intonation is to have a tension compensated fretboard. A tension compensated fretboard

is a complex topic to discuss. Let's get down to some basics before we get into the nuts and bolts of the subject. A fretboard, also called a fingerboard, is a thin piece of wood glued to the neck of a mandolin. A fret is a metal strip inserted into the fretboard. To fret an instrument is to press down on the string behind the fret. When you fret an instrument, you are trying to play a note that is in tune. The ideal instrument will be in tune up and down the fretboard while you are playing.

A traditionally tuned instrument is intonated at the 12th fret because this is the halfway point between the nut and the bridge. Typically, a luthier will adjust the bridge location or height to correct the intonation. Bridge compensation will only correct the intonation at the 12th fret. It is not possible to precisely intonate a fretted instrument over the entire fretboard using traditional fret placement and bridge compensation.

A tension compensated fretboard is based on a complex mathematical formula developed by Gary Magliari of the Guild of American Luthiers outlined in his paper *Method for Positioning Musical Instrument Frets that Compensate for Fretting-Induced String Tension.* Two fundamental components determine the amount of compensation that is necessary. These components are string stiffness and string height. Based on this calculation, we can determine the pinpoint location of each fret on the fretboard to achieve perfect intonation. The variations in fret location are so subtle that most professional players will not notice the difference in fret position. They will notice the intonation instead.

String stiffness is overwhelmingly determined by string gauge and the core metal of the string. Stiffer strings have greater tension than strings with lower stiffness given the same amount of stretch. Higher stiffness strings and higher fretted tension require more compensation. When you fret an instrument, this causes the strings to stretch which increases the tension, which, in turn, increases the pitch. Less stiff strings will stretch more than strings with a higher stiffness. Strings with

greater stiffness have a greater increase in tension. The stiffness of strings markedly affects the amount of compensation required.

String height is another factor in the string tension equation. String height is determined by the height of the strings at the 12th fret and is adjusted by changing the bridge height, also known as the saddle.. The height of the strings contributes to how much a string will stretch. String height is lower at the first fret and gets higher as it moves down the fretboard. The higher the string, the greater the stretch. The greater the stretch, the greater the tension. String tension will change depending on which string you are depressing and where you are on the fretboard.

I utilized the method developed by Gary Magliari to determine the proper placement of frets on my compensated fretboard. When I setup an instrument, I use the string gauges and action height that I used in my computation. I have done this to improve the playability of the instrument and to achieve that perfect intonation that every musician is looking for while playing an instrument. Simply put, depressing the string on the fretboard creates tension on the string and produces a note. Where the frets are placed on the fretboard affects the quality of the note being played. I have done the math for you and placed the frets in the optimal location on the fretboard, so you can have the best tuned instrument possible.

I would like to thank Gary Magliari of the Guild of American Luthiers for developing this methodology. His paper, *Method for Positioning Musical Instrument Frets that Compensate for Fretting-Induced String Tension,* was heavily relied upon for the creation of this newsletter.

Feel free to e-mail me with any questions you have, and they will be answered in our upcoming Q&A newsletter edition.

If you would like to sign up for our newsletter, it does come out six times a year, please visit our Web site at www.cedarmtm.com to join. While you are there, check out our blog posts in the Behind the Bench section of the site.

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