ARROW SPINE
(part 1)

How to find static spine of an arrow.

This requires the use of a tester known as a ram static spine tester
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Ram testers help us look at several things. Run out is one of them. So, what is run out. Run out is listed as .001, .003, .006 as a standard for arrows. This number is a half rating not total indicator runout (T.I.R.). T.I.R. on shafts will be there straightness rating doubled. So, a .001 arrow can have as much as .002. A .003 as much as .006 and a .006 can be as much as .012. This test is done on the ram tester with no weight. Arrow straightness also can be at full length of arrow or at 28 inches. The arrow manufacture dictates at what length there rating is listed for.

The next thing we look at with a ram tester is static spine. Static spine is how much an arrow reacts when a 1.94 lb. weight is hung from the center of the arrow. To calculate this, arrows must be around 29" long or longer and supported at two points 28" apart. The number of inches the arrow bends multiplied by 1,000 is the arrow's spine. So, an arrow numbered 350, bends .350" when the weight is applied. This directly relates to arrow "bend."

This static spine is how the manufactures have set it up so that we can look at what they recommend for the arrow needed for your set up.

So why do we need to know what the static spine is. When shooting arrows, we need to find an arrow with the best reaction when shot. We find this by programs and charts. Then we verify with the ram tester.

This static spine comes from the arrow manufactures. Some manufactures say +/- .010 between the dozen. So, if you buy a dozen .300 spine shafts. This means you could be anywhere between .290 to .310 on a dozen .300 spine shafts. Some manufactures are +/-.020. This would mean a dozen .300 spine arrows could be .280 to .320.

Then we use a ram tester for looking at spine variance on each shaft. We do this by hanging the 1.94 lb. weight and see what the static spine of the shaft is. Then you rotate the shaft and watch the indicator. When looking at this you want an arrow with very little to no spine variance. An arrow like this shows that the arrow was built with good material with no voids between the carbon and epoxy. Arrows with a wide variance shows that there is a flaw in the build. Arrows that are concentric or elliptical in shape will show this variance. Personally, if an arrow should have a max variance of .005 or less. Any more then this we need to look at what arrow this is and the possibility of replacing.

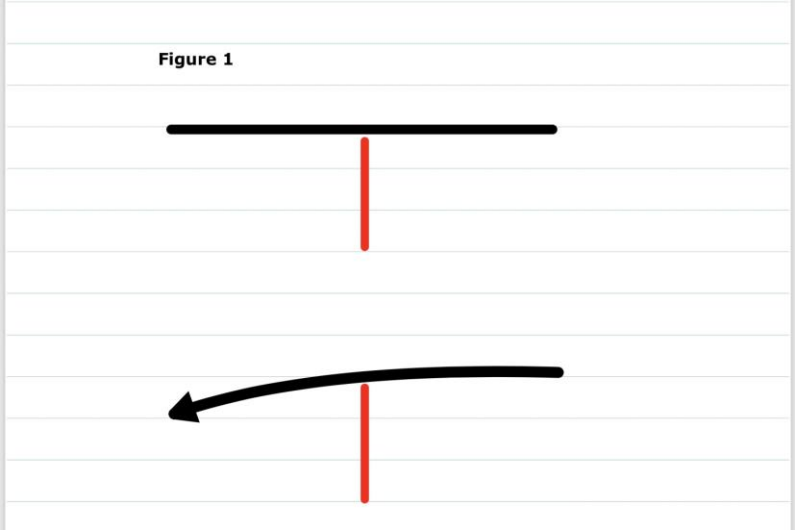
So, people look at this spine variance and see it as a stiff point in the spine. They mark this point and set this point to whatever position they feel is best for their set up. By

doing this they are trying to cut down on nock tuning their arrows and getting the arrows to a point that they have the same reaction when shot.

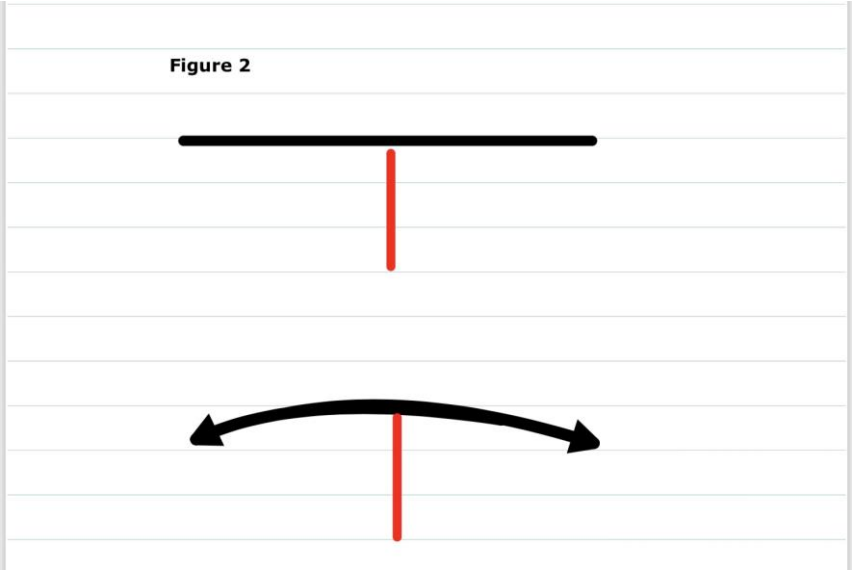
Arrows are built and designed with a specific static spine. The static spine for arrows will never change unless something happens to the arrow itself.

We are taught in the archery world that as you add tip weight we are making the arrow weak and if we add nock weight we are making the arrow stiff. This is not completely correct. We must remember that static spine never changes.

Look at figure 1. Let's say this shaft is a 300 static spine. Let's mount it ridged in the center. Now let's add tip weight. What happens? The shaft starts to bend. Did the static spine of the shaft change no, It's still 300 spine. when adding this weight to the shaft you are just causing it to bend. Now depending on static spine of the shaft and the amount of weight you add will dictate how much it will bend.



So, what happens if we add weight to the nock end of shaft at the same time. Let's look at figure 2. Using the same set up as we add nock weight you will see that the shaft will also bend. Does this mean we are making the shaft weak as we add this nock weight? Absolutely not. We are just causing the shaft to bend, but static spine is still 300.



So why in the archery world are we taught that adding tip weight weakens the shaft and adding nock weight stiffens the shaft. My opinion for simplicity. But we need to learn to look at arrows dynamically. This is where it matters. What is the arrow doing when shot not when just lying on the table?

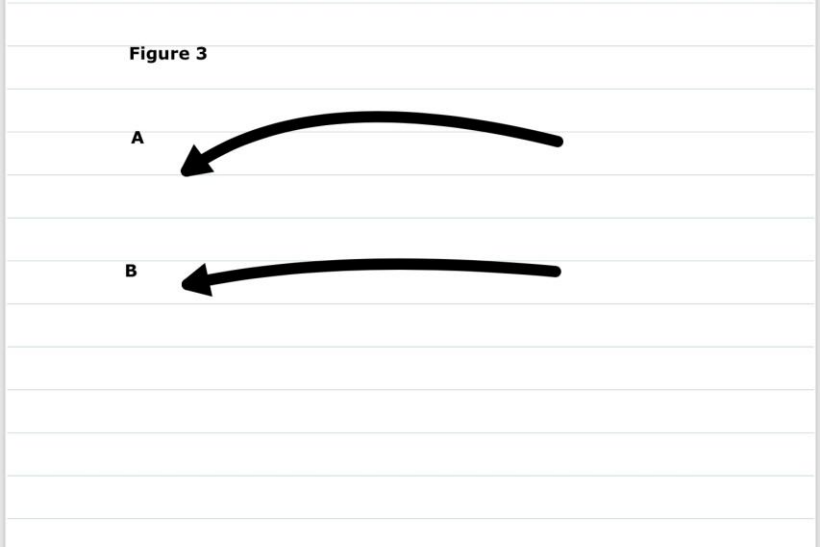
Let's look at what really happens. First you need to understand an arrow just setting there is a static position, but when an arrow is shot we now have a dynamic reaction.

When the string is released and is pushing forward on the arrow for that split second the nock travels first. Depending on the static spine of the shaft and tip weight and draw weight determines the amount of bend the shaft will have before the complete arrow starts moving forward.

So, why are we taught as we add tip weight we are weakening the spine, when in reality all we are doing by adding tip weight is causing the arrow to bend more when shot.

When doing this we can add enough tip weight to an shaft that when shot it has too much bend for the static spine of that shaft. This causes bad flight and tuning issues. Easy fix, go to the next stiffest static spine shaft.

Look at figure 3. Here we have an arrow with too much tip weight figure 3A so we get an undesirable amount of bend. By changing the static spine, we can now get the arrow to a more desirable amount of bend figure 3B when shot.



Now let's look at the nock end of the arrow. We know in the static position adding weight to either end will cause the arrow to bend if the shaft is supported in the center. But what happens in the dynamic side of things.

When shot we know that the nock moves first. This nock will move forward till there is no more flex in the shaft then the tip starts moving forward. When we add nock weight we are closing the gap between the nock end and tip end in the weight ratio. By closing this ratio, and as the arrow is shot there will be less bend on the shot. Therefore, we are taught by adding nock weight it is stated we are stiffening the shaft. But what we are really doing is just causing less bend.

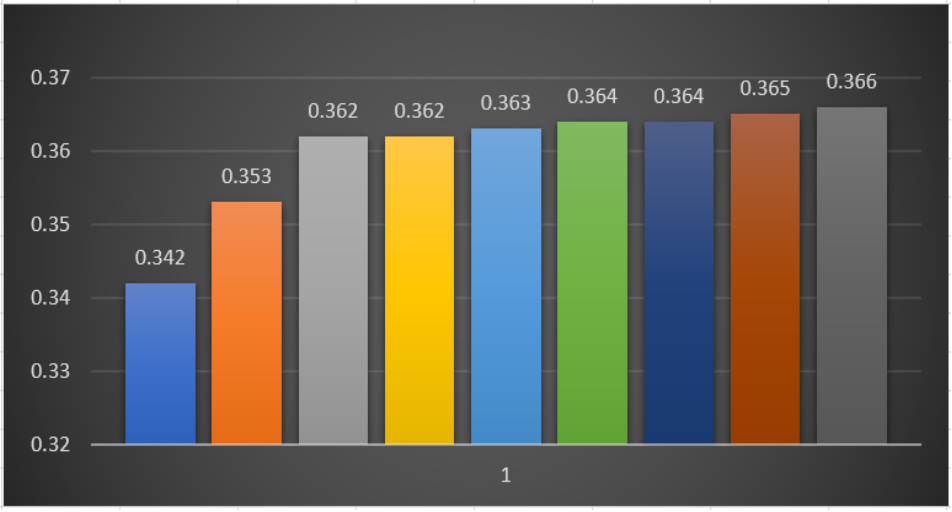
Why do we need to know what the static spine of an arrow is? Knowing what the static spine is helps us build and design arrows to have the correct dynamic reaction needed for good tuned arrows.

When choosing what spine, we need we go to charts or programs. When doing this we are looking for an arrow that when built will not have too much bend on shot. Therefore, we test the shafts on the static spine tester. The importance of this is due to the variance we see when shafts are made.

Here in figure 4 are nine shafts sent to me to look at. The shafts are advertised as .350 spine. As you can see if your set up requires a .350 spine seven of the nine arrows would be underpinned for your set up, this may be critical when building your hunting arrow. You can see looking at this group there is a .024 from the stiffest to the weakest. This still may not be as critical, but the seven being underpinned are .012 to .016 on the underpinned side. This may or may not be acceptable to some people. What I look at is consistency of the group. Since I was only able to test 9 arrows we still have 78% good. Any time you have 80% good then you have a good set.

Figure 4

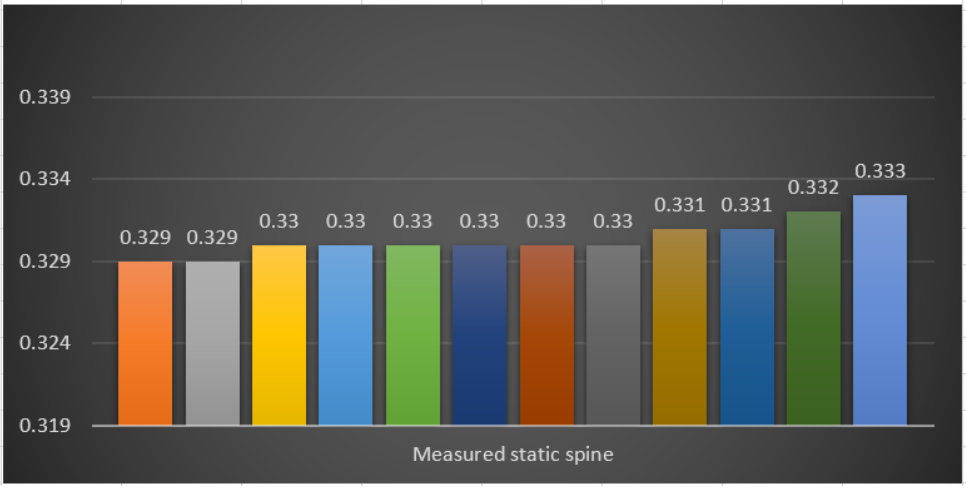
elemnet fire&ice 350	measured spine
C	0.342
F	0.353
D	0.362
I	0.362
G	0.363
B	0.364
E	0.364
A	0.365
H	0.366



In figure 5 you can see that this set of twelve .330 spine shafts are well within the range of good arrows should be.

Figure 5

Easton injection 330	Measured static spine
D	0.329
F	0.329
L	0.33
J	0.33
A	0.33
I	0.33
C	0.33
B	0.33
K	0.331
H	0.331
E	0.332
G	0.333



Therefore, when building great hunting arrows knowing the actual static spine of the shaft can be critical.

For some people this is more involved then they care to look at. They know they can get an arrow, tune the bow and go hunting, and enjoy the outdoors. For others we like to get deep it to the physics of how things work and react.

Note: the two set of arrows tested, and what it shows doesn't mean every set tested will have the same results as the ones I tested. Therefore, it's important to test every set of arrows before you build

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Physics never lies, but bowhunters do.