BUILDING UP SHOW HORSES: Mathematics Vs. Rules of Thumb

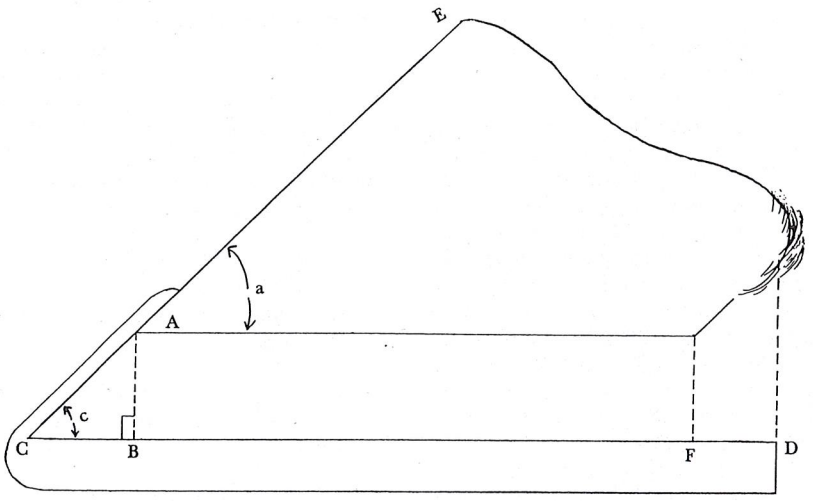

Figure 1

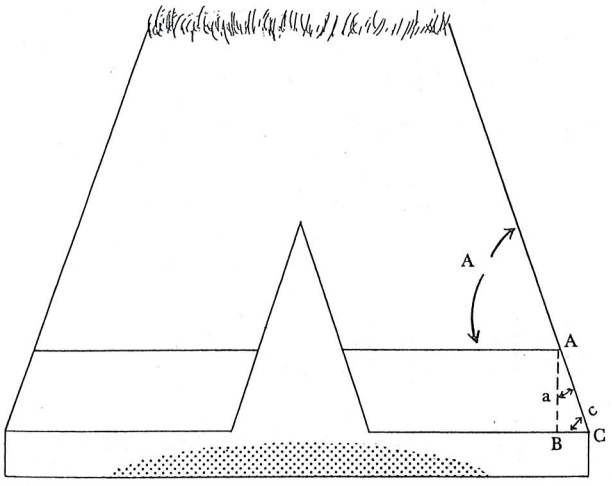

Figure 2

by Randy Luikart

Periodically we all attend a clinic or seminar on the fine art (or science) of shoeing show horses—i.e., saddlebreds, Tennessee Walkers, or other horses that require a build-up. Probably the most asked questions at these clinics are, "How do you figure out steel?" and "How do you fit shoes for a particular build-up on a particular horse?" The rule-of-thumb answer normally given is that for every inch of build-up, you stick out an inch of shoe. This misconception is being taught by many, and it makes the farrier profession a "that's-enough-to-get-by-on" occupation instead of an art based on accurate science.

My purpose in this article is twofold: (1) to try to stimulate interest in the art and science of shoeing fine show horses, and (2) to cast doubt on the accuracy of rules of thumb that are currently being used throughout the country. By using some elementary mathematics you can replace guesswork with scientific accuracy, and you can carry out the build-up of a show horse with skilled craftsmanship.

There are two fundamental principles to be used in calculating the build-up:

1. The package (build-up) to be made for the horse should be a continuation of the slope of the hoof from the toe around to the heels. As the slope changes, so does the package, so that a symmetrical shape is the end result, as in Figures 1 and 2.

2. Angle *c* in Figure 1 is the angle upon which all the figuring is based. Angle *a* equals angle *c* if *a* flat build-up is being done, but if wedges are to be employed, then angle *c* is the determining angle upon which the calculations rely.

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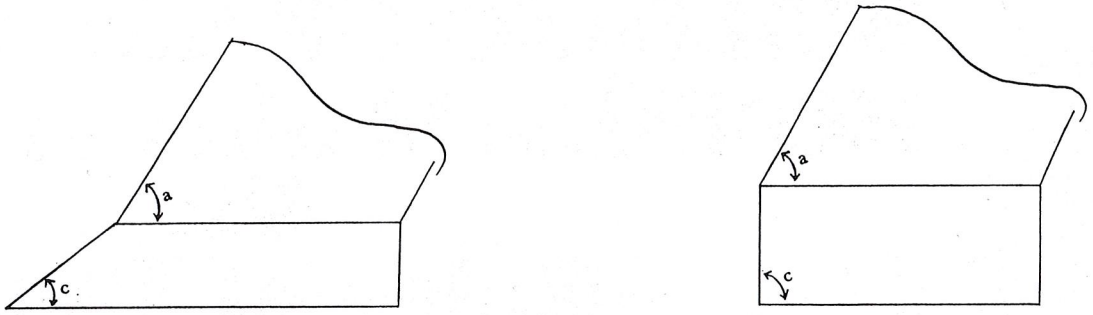

Figure 3

When we do a build-up, there are some things that we already know. Length AE in Figure 1 is known, and length AC is desired (either by the owner or the trainer, or because that is the amount of a broken foot we have to replace). Angle *a* is known, and if the build-up is flat, so is angle *c* (it equals angle *a*). If wedges are used, then the calculation of angle *c* should be done. Length BF is known, and lengths CB and FD are desired.

For the sake of simplicity, we can use a few exact measurements and quickly assume the rest. Let's assume that angle *a* is 45° and the build-up is flat, so that angle *c* is also 45°. The desired length of AC is 1". ABC is a right isosceles triangle, so that length AB equals length CB. A geometry theorem states that, *in a right triangle* (ABC) *the square of the hypotenuse* (AC) *is equal to the sum of the squares of the other two sides* (CB and AB).

Thus $(CB)^2 + (AB)^2 = (AC)^2$.

But AC = 1", and CB = AB, so (substituting x for AB and CB):

$$2x^2 = 1"$$
$$x^2 = 0.5"$$
$$x = 0.707",$$
slightly less than 3/4".

Thus we have already solved the distance to be fit full at the toe to allow for the 1-inch build-up. We have also solved the approximate thickness of the build-up (AB, or 3/4").

We may now quickly add the 3/4" to the exact measurement of BF, and add distance FD to obtain the total length from the toe to the bulb of the heel.

To achieve symmetry in the build-up we must also figure the amount to be fit for the quarters. With the use of a hoof gauge we find that angle *a* in Figure 2 is 60°. Angle *c* is also 60° in this case. A wedge will not normally alter angle *c* in the quarters as drastically as it might in the toe, unless the wedge is put in sideways. We now know that length AB is approximately 3/4", and that ABC is a right triangle. Another geometry theorem states that *in a right triangle, if one of the angles is 60° the side adjacent to it* (BC) *is one-half the length of the hypotenuse* (AC). By substituting x for BC, $2x$ for AC, and 3/4" for AB, we get the following equation:

$$x^2 + (3/4")^2 = (2x)^2$$
$$x^2 + 9/16" = 4x^2$$
$$3x^2 = 9/16"$$
$$x = 0.433",$$
about 7/16".

Add this to both sides of the width of the hoof.

By now you can readily see that as the angle increases, the distance to be fit full decreases. This is necessary to obtain the results shown in Figures 1 and 2. Of course, the results in Figure 3 are from improper figuring or guesswork.

If you have access to a math book or a pocket calculator with sine and cosine functions on it, figuring can be made much easier. For example, if length AC needs to be 1.5" and angle *c* is 53°, then length BC will equal the cosine of 53° times the length AC (1.5"):

$0.602 \times 1.5" = 0.90"$,
slightly less than 1".

Here are the cosines of some regularly used angles:

cos50° = 0.643	cos52° = 0.616
cos55° = 0.574	cos57° = 0.545
cos60° = 0.5	cos65° = 0.423

A few moments taken to think about the package and measure will result in a build-up that fits the horse. Rules of thumb are not adequate for today's science. As I have shown, the amount to be fit full does vary, depending on the toe angle and quarter angle. With some practice and understanding of the principles I've discussed, fixing broken feet or making a complete build-up for a horse can be made easier, as well as more comfortable for the horse. And the result can even look nice when you're done.▲

"Rules of thumb are not adequate for today's science."