

Determining Healthy Hoof Proportions

by Sabine Kells

How to get as close as possible on almost any hoof, using the plexiglass guide as a tool.

Anyone who's been trimming for any length of time knows that not all hooves look the same, not even when they're perfectly healthy. Their shape varies according to species, obviously: a mini's hoof looks nothing like a draft's, which is very different from a donkey's. They also vary slightly by individual horse, just as no two people's hands are exactly alike. The same horse's foot will even look different depending on what type of terrain the horse is adapted to, whether hard, rocky ground, or softer grasslands. Dr. Strasser described how, in response to concussive forces, the coronary corium changes its angulation slightly, resulting in a slightly more vertical hoof wall for hard terrain – producing a hoof which is better able to withstand the expansion forces of such ground – and a slightly less vertical hoof wall for softer terrain, producing a foot able to expand even with less impact.

But every hoof, no matter the terrain or breed, shares a certain fairly narrow range of angles and parameters and proportions which are determined by anatomy and physiological function. When these parameters are correct, the hoof is beautiful and functional and harmonious and healthy. When one or more of these proportions is off, the hoof is none of those things – and most importantly, it is neither healthy nor functional, and damage and “disease” of the hoof will occur in time, if they haven't already. Such a hoof, to a trimmer who has developed an eye for healthy proportions, will just look “wrong”; in the case of an observant horse owner who isn't trained in hoof anatomy, they may still get this feeling, but without ever being able to put into words what it is that doesn't look right about their horse's feet.

This article is intended to briefly touch on some of the basics behind hoof form, and give the parameters common to every healthy hoof: certain values which are determined by the anatomy every equine shares and are non-negotiable if hoof health is to be maintained. These common parameters were noticed by Dr. Strasser in the course of nearly 40 years of research studying live horses and cadaver hooves of various breeds all around the world. This article also offers a tool which may be used to help guide the trimmer's eye in how to best shape a misshapen hoof into the proper proportions, or as close as the amount of horn available will allow.

When it comes to hooves, the shape of the coffin bone serves as the template for the formation of the hoof capsule. Coffin bone shape provides the basis for everything from the hoof's vertical heel height to its coronet angle, toe angle, the toe-coronet angle, and the position of the deepest part of the solar concavity, which coincides with the position of the frog tip. These basic angles and proportions are found in all healthy equine hooves, whether mini or donkey or warmblood or draft horse; and whenever a hoof deviates markedly from the fairly narrow range of these values, internal hoof damage is the inevitable result.

When I first began teaching Strasser hoofcare some 20 or so years ago, I found that the easiest way to get students to develop an “eye” for healthy hoof proportions was to come up with some sort of visual guide for them to use, which contained all of the basic parameters and which could be overlaid onto whatever foot they were about to trim. This was far more effective than measuring heel height and the various hoof angles individually with various tools. I came up with the idea of placing these parameters onto a clear plexiglass square, creating a trimming aid and tool which is still in use by Strasser students and horse owners around the world today (that template was published in THH Issue 2).

Thanks to an amazing horse I was recently asked to trim, and a resulting conversation with Dr. Strasser about this mare's feet, I've realized that it was high time to update my plexi guide with a piece of information which it had not previously contained: frog tip position. Dr. Strasser realized almost a decade ago, as a result of countless cross-sections of cadaver hooves during seminars and practicums, that the deepest part of a healthy solar concavity – and thus the position of the frog tip – is always vertically below the toe coronet. Aside from constituting a basic trim parameter, this is especially important to accurately locate on a highly deformed hoof or one with long-term founder,



Coffin bones from a variety of equine sizes, as viewed from the front and from above. Note that despite a range of “footprint” sizes between the breeds, the height of the coffin bones remains remarkably constant. Note from the destruction of the tips, that these are not healthy coffin bones.

Photos courtesy Sabine Kells

Toe angles are likewise quite uniform among regular horses, with 45 degrees being the norm for the front hooves, and a range of 55-60 for the hinds.

as it will prevent accidentally thinning the sole too much underneath the often greatly “displaced” coffin bone.

But before I get to this “new” bit of info, I want to quickly review the existing parameters on my plexiglass guide, for those who may not be familiar with it. The information on the first version of the guide represented the average values for coronet angle, front and hind toe angles, and heel height.

The Coronet

The 30 degree coronet angle is something that Dr. Strasser noticed and already taught several decades ago, as she came to realize it from studying and researching the hoof. I remember very clearly driving with her through Yellowstone National Park on the way to yet another hoof seminar, and her insisting on getting out of the car near a grazing buffalo to get a peek at its hooves – and promptly to exclaim with great delight, “Look! 30 degree coronet!” Me, I was hanging back behind the safety of the car, trying to figure out how I would explain the lack of Dr. Strasser’s presence to the upcoming seminar’s attendants due to her being gored or trampled by a buffalo while studying its hooves...

As it turned out, no ill befell her that day, and the seminar tour went on as planned, and a couple of decades later, the 30 degree coronet angle was being published as a “new discovery” in mainstream equine circles; it has by now become virtually “common” knowledge. (Which just proves Scopenhauer’s words, that “*All truth passes through three stages. First, it is ridiculed. Second, it*

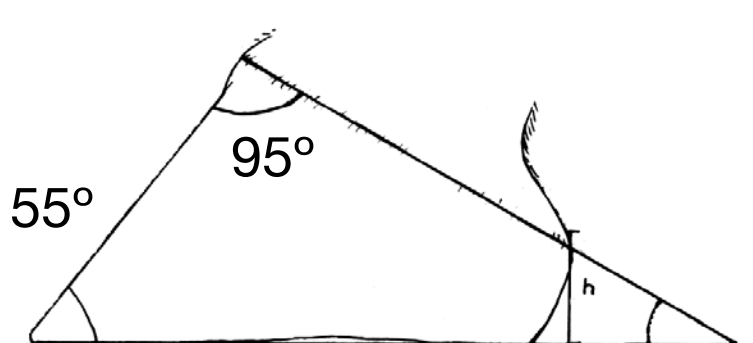
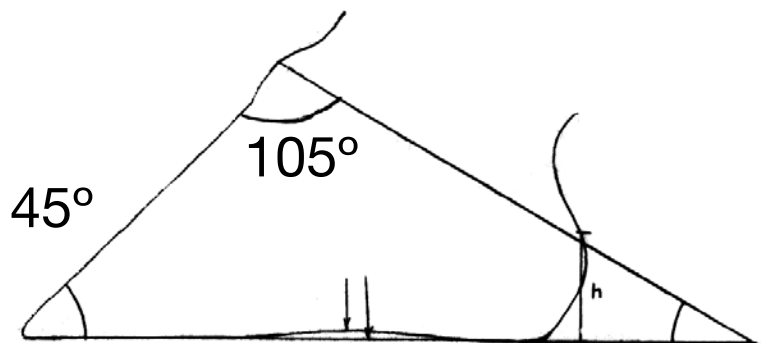
is violently opposed. Third, it is accepted as being self-evident.”)

The coronet angle derives from the anatomical proportions of the coffin bone, and is a virtually constant 30 degrees in all healthy hooves (from horse to buffalo!). Since the height of the coffin bone is pretty much the same across the board (whether donkey or draft horse), but its “footprint” size does vary quite a bit with the size of the animal, the coronet angle does have some variation at those extremes: the tiny-boned hooves have a slightly steeper angle by maybe a degree or so, and the giant-boned ones a slightly shallower one. But all of the “regular”-sized riding horses fall smack dab into the 30 degree category.

Toe Angles

Toe angles are likewise quite uniform among regular horses, with 45 degrees being the norm for the front hooves, and a range of 55-60 for the hinds. Again, these angles are predicated on the respective shapes of the coffin bones of hind and front feet: front coffin bones are rounder and a bit shallower, while hind ones are more oval in shape, and steeper.

Note that these toe angles are for healthy hooves with fully suspended and whole coffin bones. The toe angle of a hoof which has neither, or which is in the process of healing from either problem, may have a far steeper angle to the effective breakover point during the orthopedic trim stage. Also, anytime the coronet angle is less than 30 degrees – such as during rehabilitation when there is still a lack of vertical toe



A front coffin bone has a 45 degree toe angle. A hind coffin bone has a 55-60 degree toe angle. The resultant, important toe/coronet angle is 105 degrees for a front foot, and 95 degrees for a hind. When this angle is greater than normal, it indicates that the toe wall is no longer parallel to the frontal surface of the coffin bone (“separation”).

Photos & Drawings courtesy Dr. Hiltrud Strasser

height, or because the coffin bone is missing a large amount of material in the toe due to long-term excessive steepness – the toe angle must be steeper, usually by the same amount. Toe and coronet angle, where they intersect at the coronet, form another angle also vital to hoof health: the 95 & 105 degree toe-coronet angle (on hind and front feet, respectively). If this toe-coronet angle is too great in a hoof, it indicates that the toe wall is no longer parallel to the coffin bone.

Heel Height

This is also determined by the shape of the coffin bone and the anatomical necessity of its ground-parallel placement. (More recent mainstream literature talks about the importance of uniform sole thickness, which basically leads to the same end result: a ground-parallel coffin bone.) For the purposes of this article, heel height is measured from the hairline where the lateral cartilages dip into the hoof capsule in the heel region. Vertical distance from the hairline at this point to the ground is, for regular sized horses, 3 cm; for minis, it may be as low as 2.5 cm, and for big draft horses, as high as 3.5 cm. It's important to make sure heel height is measured *vertically*, meaning the “plumb-line” distance from the hairline to the ground; not measured along the angle at which the heels grow, which is slightly slanted rather than vertical. Also – and this may sound obvious, but you all know how often it's not the case – heel height must be the same for both heels; all too often, one heel is higher than the other, leading to shear and an unlevel hoof.



Heel height is measured from the heel hairline (red line), vertically straight down to the ground.

The 2016 Plexi Guide

The coronet and toe angles and the vertical heel height measurements were on my plexiglass hoof guide for the last couple of decades. Now, thanks to Fancy, I'm adding the frog tip position, because it really is something that was missing before. As mentioned previously, the correct position for the frog tip, coinciding with the area of greatest solar concavity, is always vertically below the toe coronet of a hoof with a 30 degree coronet angle, and that is a very useful thing to be able to check at a glance. It's also one of those things that many trimmers get slightly wrong, the tendency being to leave the frog tip a little farther forward than it should be. Since the frog grows forward/downward from its corium, the same as the sole does, the frog tip ends up growing closer and closer to the toe wall as the hoof grows longer and longer. A common mistake among trimmers is to carve the concavity around the

frog tip without first bringing it back far enough to where it should be in the hoof. The main problem with this error is that the solar concavity then ends up too far forward – and too close to the coffin bone tip. In a mostly healthy hoof, this may “just” mean that you can't regain toe height, or end up losing toe height (and thus compromising the coronet angle) over time; in a hoof with severe coffin bone rotation and separation, trimming solar concavity too far forward in the foot could land your knife smack dab in the solar corium or the coffin bone.



Photo courtesy Dr. Sabine Kells

A hoof with coffin bone rotation and separation, insufficient vertical toe height, and some coffin bone tip destruction.

This photo above shows the front foot of a horse with coffin bone rotation and separation, insufficient vertical toe height, and some coffin bone tip destruction. In this trim, the heels were overshortened a little in order to get the coffin bone ground-parallel, to stop further bone destruction at the tip. The toe was backed up significantly to remove any chance of lever forces, and to place the breakover just back from where a healthy toe wall, growing parallel to the frontal coffin bone surface, would end. The red arrow shows where the overgrown frog tip is on the sole of the foot, having grown far forward along with the previously slipped toe and sole; trimming concavity in front of this frog tip would be disastrous to the foot, as every bit of horn in that area is needed to cover the coffin bone tip. The green arrow shows the location of the trimmed frog tip, vertically below the toe coronet on this hoof with a proper 30 degree hairline. The necessary solar concavity to allow the hoof to function has been trimmed around the correctly placed frog tip, and all remaining horn in front of it is left to help maintain and grow vertical toe height. Note that the forward part of the foot is still “floating,” i.e. too short to touch the ground; however, despite all of this, the proportions needed for the hoof to heal are in place.

For those of you who have been trimming for a long time, correct hoof proportions will have become so ingrained that if they're not quite right, the hoof just looks “wrong,” so you won't need a visual guide when you trim; you have that built in already. For me, the only time I use the plexi now is when I'm trimming a horse that's lying down, because I don't do that often enough to have developed a reliable eye for hoof proportions when everything is turned on its side or upside down, or when half the hoof is hidden by the horse's body or another leg, and there's not a right angle or

For measuring, it's important to hold the plexi in very precise ways, and to look through it from very specific angles; otherwise visual distortion will give you wrong impressions.

level anything in sight. At times like that, it's wonderful to be able to just lay the plexi over the foot and help my eye "see" clearly, and to double-check all the angles and proportions.

Using the Gauge

First, a caution disclaimer: this plexi guide is intended only for use by someone who already knows how to trim a hoof properly, or someone who is getting proper instruction in trimming. It is not meant to take the place of trimming instruction, nor to be used by anyone unfamiliar with the shape and proportions of a healthy hoof and how to establish them.

Second, a crass commercial disclaimer: please realize that while the angles and measurements of the hoof were designed by Mother Nature, the template displaying them in this manner is an invention of yours, truly (and thus my copyright). That basically means you can't display it as your own, or use it to make money. For all those barefoot trimmers and horse owners who are loyal THH readers and trying to give their horses a lifetime of barefoot soundness, you are all welcome to make your own plexi viewer from the template published here, and to use it freely for yourselves and your friends and clients. If you should want to use it commercially, or incorporate it into your teachings, or produce and sell a viewer featuring this template, please respect copyright and contact me first. Thank you!

To make a plexi guide, print out the template, and lay it under a piece of plexiglass. For the greatest hoof-size versatility, I've found that an 8x8" piece works best; but if you trim mostly minis, or mostly huge draft horses, you can get different sizes of plexiglass, and shrink or enlarge the template as you print it out (just measure to make sure you got it right).

You can draw or etch the lines onto the plexiglass. I find a permanent marker, such as used to label CDs or DVDs, works great, and at worst you have to re-draw the lines once in a while. Do make sure the lines for toe & coronet angle start at the corners of the plexi; if the sizing is slightly different between the printed template and the plexi piece, you can move the template so that each line starts at the opposing corner. Before using it, do double-check all angles and measurements after you've completed your plexi guide, to make sure they're correct and that some mishap didn't occur during the transposing of lines from template to plexi.

Once you have your viewer, find a quietly standing horse; you're about to get nose to hoof with it, so please don't do this if you expect the horse to be dancing about or doing anything but playing statue. The hoof you're about to measure should be clean and standing on a flat, level surface – a piece of wood works well for this, in case the horse isn't standing on a concrete pad or the like. Stand the plexi on edge next to the hoof to check each of the parameters.

For measuring, it's important to hold the plexi in very precise ways, and to look through it from very specific angles; otherwise visual distortion will give you wrong impressions. If the horse is standing, the plexi must be vertical, and placed parallel to the front-to-back centerline of the hoof. And you need to be looking at the plexi from dead center of whatever line or angle you're measuring, so your eye needs



Photo from THH Files

Hind foot with a perfect toe and coronet angle, with the plexi gauge in proper position next to the foot.

to be at hoof height – thus my warning about not using this guide with horses apt to shuffle about. If you move the plexi "around" the hoof, or look at it from too high or off to the side, the readings will be misleading.

Also, in order for you to properly use the angles and proportions on the plexi, you must trim the hoof *in a certain order*: first heel height, then coronet angle, then toe angle and frog tip. **Important:** *you can only measure each parameter **after** the previous one is established (i.e., after the hoof is trimmed correctly to that measurement).*

This gauge is a very simple and helpful tool, but if used incorrectly, it can lead to wrong readings and a very bad trim. So I highly suggest that if you want to make a plexi viewer and use it to help fine-tune your trim, that before you actually trim with it, you get together with a Strasser-trained hoofcare practitioner (SHP) or horse owner who has been taught how to properly use this gauge. Please, get a little hands-on instruction to insure that you don't inadvertently cause more harm than good by following the lines of an improperly held or used plexi gauge.

For an average horse, check the heel height by comparing the 3cm line against the hairline at the back of the lateral cartilages. If any heel protrudes below the bottom of the plexi, it's excessive, and can be trimmed off. If the horse is much bigger or much smaller, adjust heel height accordingly.

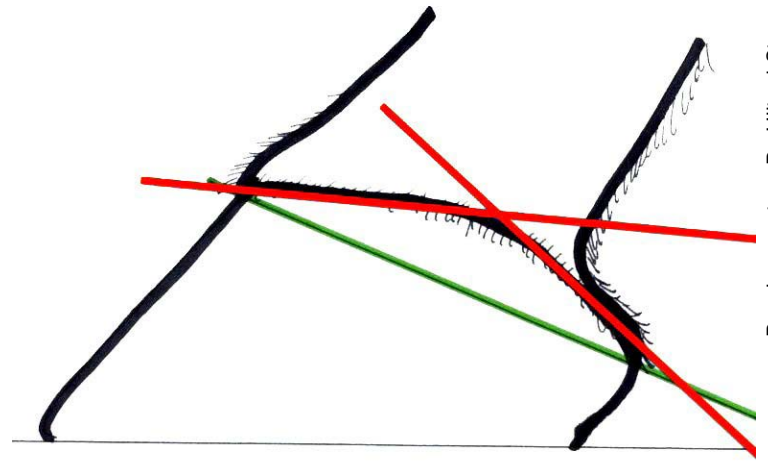
Once the heel height is correct, next check the coronet angle: match the toe and heel coronet points of the hoof onto the 30 degree line on the plexi, keeping in mind the heel height match.

If any heel/wall still protrudes beyond the bottom of the plexi, trimming it off will get the hoof to a 30 degree coronet angle – but you can

only do this IF the heel height is also still greater than the 3 cm mark. If it isn't, and you don't have a 30 degree coronet angle on the hoof, it's not so much a matter of the heel being too tall, but rather of the toe already being vertically too short. This is often the case in horses which had some degree of heel pain, or which were conventionally trimmed (high heels still being in fashion in much of the world). In this case, all you can do is shorten the heels to the correct height and wait for enough vertical toe height to grow back to give you the correct coronet angle and a ground-parallel coffin bone. In some cases, it's vital to get the coffin bone ground parallel as soon as possible, and if the horse is in a hoof clinic or similar environment where a too-short heel will not cause it heel pain, overshortening the heel may be an option.

Once you have a 30 degree hairline on the hoof, you can check the toe angle. Find the "crosshairs" of the toe/coronet angles intersecting on the plexi, and superimpose that onto the toe coronet of the hoof. The place where the toe angle line on the plexi meets the ground is where the toe of the hoof should end (i.e. where the breakover should be). Be sure to use the hind angle for the hind hoof, and the front angle for the front hoof. These are average angles for healthy hooves with a complete coffin bone and one that is properly suspended; if a hoof is in the initial stages of rehab from rotation with separation, for example, the toe may have a much steeper effective angle (i.e. the angle from coronet to breakover), such as seen in the previous photo of the horse with coffin bone rotation and separation.

If a hoof doesn't have a correct 30 degree coronet angle yet, you need to superimpose that 30 degree line onto the existing coronet, match the toe/coronet "crosshairs" to the actual toe coronet, and from there judge where the toe angle would end. Do NOT just use the toe angle mea-



Checking coronet angle: the green line shows the correct way – ignore the pushed up hairline in the quarters.

surement if the coronet angle on the plexi is not matched perfectly to the actual coronet; it will lead to an incorrect toe angle and length.

For the frog tip guide, match the 30 degree line on the plexi to the hairline on the hoof, slide it until you have the toe/coronet angle crosshairs precisely over the toe coronet spot of the hoof, and follow the dashed line down to see where the frog tip should be. If the horse is standing up, you can mark that spot with a felt pen or score it with your knife, so that you can see it when you pick up the foot and know where the frog tip should end. (This is one time where it's easier to see something on a horse that's lying down.) If you don't have a 30 degree hairline yet, superimpose the 30 degree line of the plexi over the existing coronet, slide the plexi until the toe/coronet crosshairs match the toe coronet, and measure the frog tip location from there.

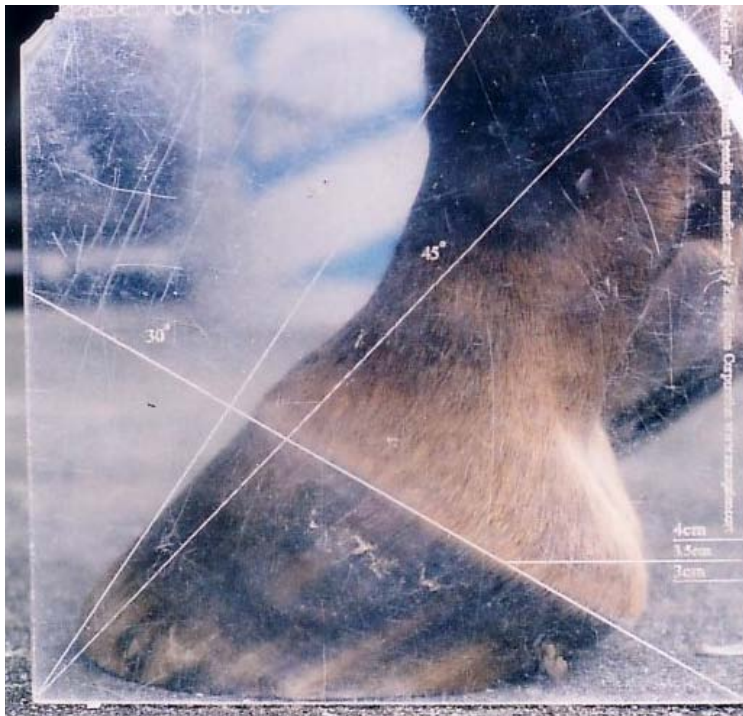
In addition to giving you correct angles and heel height, you can also use the plexi guide to "mimic" the ground, and check the profile of the bottom of a trimmed foot. Pick up the foot, place the plexi onto it, and voila: you can see at a glance where the weightbearing points are, if the scoop is in the correct place, whether anything such as a fat frog is sticking out farther than it should, etc.

It is my hope that this template and the plexi guide that you can create from it will be of use to you in fine-tuning the hooves you trim, and to help you establish perfect hoof shape and proportions, no matter whether you're trimming a horse that's standing up or lying down. May it help provide quick rehabs and sound hooves to all the horses in your care!

Dedicated to Fancy, Nancy & John, & Trisha. 🐾

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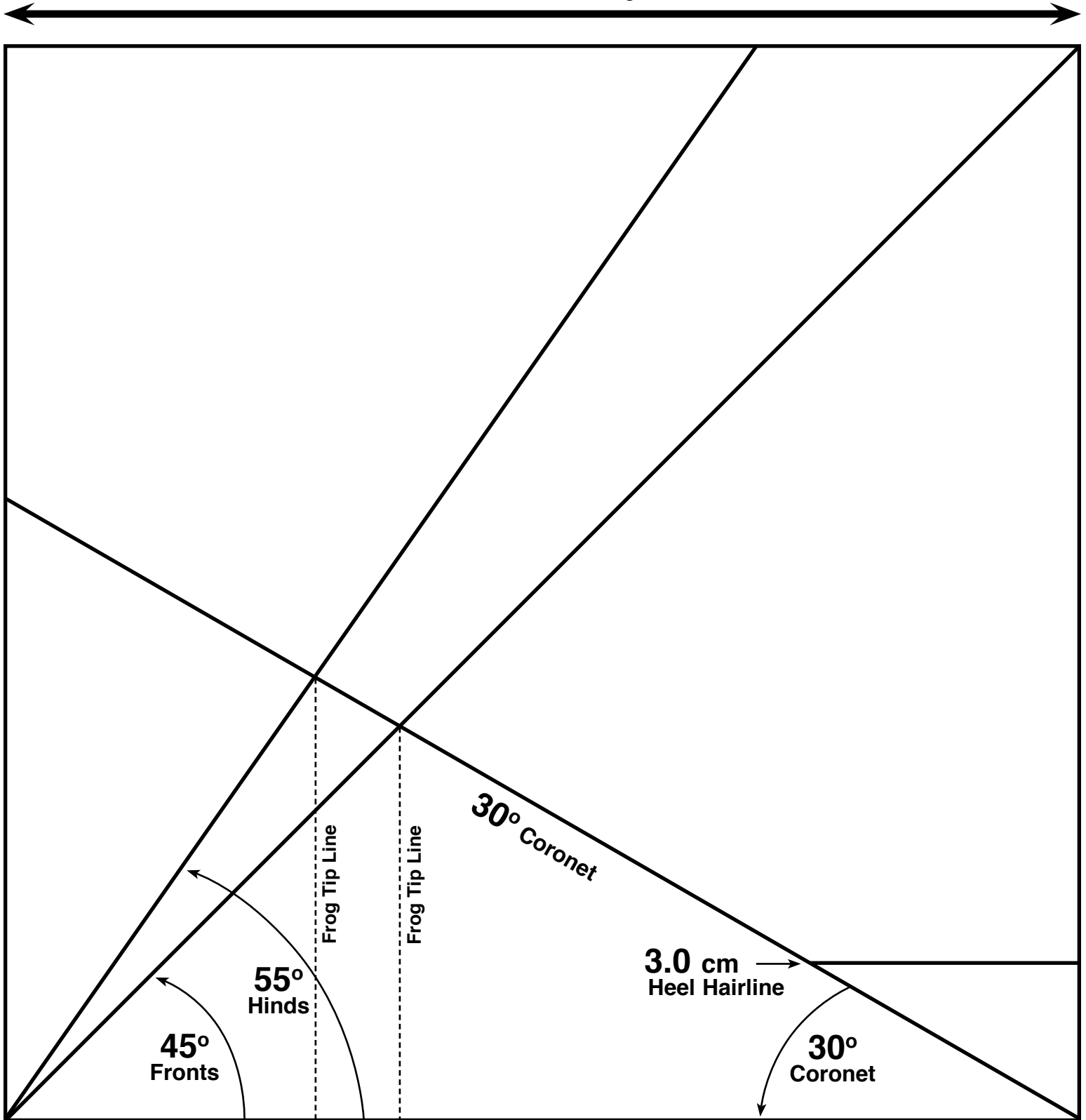
About the author: Sabine Kells lives with her two horses on beautiful Vancouver Island in British Columbia. She is a Strasser Seminar and Certification Course Instructor, and head of the Education Committee of the Equine Soundness Association.



Front hoof with perfect angles; 30 degree hairline achieved by slightly overshortening (which, due to the camera being held a bit too high for this shot, looks even shorter than it actually is). The eye of the observer must, when checking parameters through a plexi, always be directly in line with (ie, at the same height) as the line being checked, and perpendicular to the plane of the plexi/midline of the hoof.

Hoofcare Professional Angle Guide Template

8 in. wide x 8 in. high



Directions: Purchase an 8" x 8" piece of 1/4 inch thick Plexiglass (available from glass/crafts/plastic stores.) Place this plexiglass square on top of this template, and using a waterproof fine-tip felt pen, or glass etcher, trace these angles. It's a good idea to bevel or sand the outer edges of the plexiglass until smooth to prevent cutting yourself. *Disclaimer: Use this information at your own risk. Neither the author nor the publisher accept any responsibility for the use of, or misuse of, the Angle Guide Template and its application to equine hoof trimming. Always obtain professional guidance before trimming your horse's hooves.*