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Helping the Horse to Help You

By Jeff Cota, Editor

Protecting the hoof has been a challenge since humans in the Volga-Don region of southern Russia domesticated the horse and put it to work more than 4,000 years ago.

Ancient Asians "applied booties made from hides and woven from plants," wrote Rachel Cohen in "The History of Horseshoes" for *Dressage Today* in 1996. Romans initially developed the *soleae Sparteae*, a plaited straw appliance that was strapped to the hoof. As you might imagine, they didn't last long. They improved the design with the *soleae ferreae*, a thick leather sole featuring bronze cleats to slow wear.

First shoes. Catullus suggests Romans invented the "mule shoes" after 100 B.C., according to Robert E. Krebs. Yet, Rodney Carlisle writes in *Scientific American Inventions and Discoveries* that he could be referencing the Roman hipposandal, a strap-on application that was the forebearer of the modern hoof boot.

The earliest written account of "crescent figured irons and their nails" was made in A.D. 910, writes Bracy Clark in 1829. However, he references a horseshoe and nails from the fifth century.

"… [The] only one recorded as more ancient is the shoe said to have been found in the coffin of Childeric I, king of the French, who was buried at Tournay in Flanders," Bracy writes, noting it "fell to pieces on being handled."

Hoof care has come a long way since the Roman Empire and the first nailed-on horseshoes. While leather still protects the foot, it's no longer the only thing between the ground and the hoof. In fact, leather pads play a greater role, as we see in "Improving Road Horse Efficiency by Increasing Stride Length" on Page 4.

Pads for performance. Middlebury, Ind., farrier LaVerne Mast explains how his use of pads, Drill Tek and shoe placement optimizes performance and increases longevity of the horses that pull his buggy.

"Look at what God gave the horse," he says. "And we run them down the road at 18 mph pulling a 1,500-pound buggy and expect them to hold up. We need to help them as much as we can."

Although Mast uses video cameras to determine the speed for optimal efficiency, geometry enhances horses' performance. International Horseshoeing Hall of Fame member Steve Kraus of Trumansburg, N.Y., explains on Page 13 how geometry improves balance and the effects it has on the hind end.

Yet, performance doesn't always originate with the feet. Reuben Miller of Leesburg, Ind., writes on Page 9 that harnesses restricting the natural movements of the hindquarters and the breeching not only negatively affect performance, but also leads to significant health problems.

The *American Farriers Journal* Shoeing the Road Horse report shares insights from hoof-care professionals, so you can help the horse help you.

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CONTENTS

ON THE COVER

An Amish road horse pulls a buggy along a road in Lancaster County, Pa., at sunrise in this image captured by Charles via Adobe Stock.

Improve Road Horse Efficiency by Increasing Stride Length

Pads, Drill Tek & shoe placement can optimize performance & increase longevity

By Maclaren Krueger, Assistant Editor

In a farrier's everyday practice, efficiency is subtle, but it adds up. If grabbing a wire brush at the anvil requires turning around or stepping away, those are wasted seconds. When an assistant doesn't know the routine, that's frustrating. It may be a minute here or there, but over the course of a day, that's an extra hour or two under a horse. Efficiency is dependent on consistency. One domino out of place and the result looks different.

The same applies to road horses. As a financial — and personal or emotional — investment, the goal is longevity. How long can you safely keep a road horse sound and in work? Middlebury, Ind., farrier LaVerne Mast operates a haul-in practice, shoeing around 35 buggy horses per week. For him, the key to maximizing a horse's working life is efficiency. This means keeping a horse going at the same speed for the same distance using fewer steps.

"If I'm traveling 5 miles, I want to take as few steps as possible," he says at the 2024 International Hoof-Care Summit. "That does not always mean that if he takes 3,000 steps at 12 miles per hour and I can do 15 mph that I should drive 15 mph. Faster is not always more efficient. It takes more energy. Balancing speed with efficiency is a fine line."

Measuring Stride Length

To reduce the steps taken over a distance, a baseline must first be established. Mast does this by measuring stride length. In an experiment, he drove 14 horses at 12 mph each with varying shoeing packages.

"I painted the road with a neon stripe every foot for about 50 feet, so at least 3 stride lengths," he says. "Then we put a camera under the buggy, 6 inches above the ground. When we loaded the footage onto the computer, we could see if what we do to horses affects them."

Figure 1a

Figure 1b

LAVERNE MAST

When the shoe follows the shape of the coffin bone, the foot can function most efficiently.

Once the footage was analyzed, the average stride length was 84 inches at 12 mph. At a faster or slower gait, the stride length changes. This equates to 754 steps per mile. Mast's average customer travels 24 miles per week, meaning horses are accumulating 18,096 steps per week, 168 miles every 7-week cycle and 940,992 steps per year.

"If I can increase the stride length from 84 to 88 inches for a 7-week cycle, with the same distance and speed, the horse will take 898,550 steps per year," Mast says. "That's about 42,000 fewer steps per year. If you can establish that stride length in a 3-year-old and shoe it until it's 10 years old, that 10-year-old horse has taken almost 300,000 fewer steps but traveled the same distance."

Balancing speed with efficiency is a fine line ...

Fewer steps also minimizes joint stress, which can shorten a horse's working lifespan.

"Let's keep them efficient for the first 7 years, and they might go 15 years before having joint problems instead of having joint problems at 8 years," he says.

Shoeing to the Phases of Movement

In his observations, Drill Tek placement, the addition of pads and shaping the shoe to the inside of the white line can improve stride length by 4-8 inches. The success of these adjustments is dependent on supporting the foot in its key areas. For Mast, the hind end of the horse is the most important, specifically the toes of the hind feet.

"If I chop a horse in two, right between the front and the back legs, and I take my hand away from the back half, it's going to fall forward," Mast says. "The support system in the horse's hind end is in the toes. It pushes off that. For a horse that has sand or dirt underneath it, it digs in and has a foot full of dirt to balance itself on. A road horse does not dig up the road. The toe is the only thing that propels the horse forward.

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"If you take your hand away from the front half of the horse, it's going to fall backward. So the support system of the front feet is in the heels. When I picked the foot up and my thumb palpated the heels, four of the 14 horses reacted. That's why I use leather pads on all my horses."

Mast considers the five phases of movement — landing, loading, midstance, breakover and flight — when determining the horse's shoeing needs. Phases two and three (loading and midstance) are where the most concussion happens. In phase two, the horse's center of gravity passes over the hoof, and its structures respond accordingly. The horn tubules compress, the sole drops, the heels expand and the digital cushion compresses.

"Look at what God gave the horse," he says. "And we run them down the road at 18 mph pulling a 1,500-pound buggy and expect them to hold up. We need to help them as much as we can."

To absorb some of the shock upon landing, Mast uses leather pads on his horses. He also finds this gives him an extra 1-2 inches of stride length. In his experience, adding pads has never resulted in a reduction in stride length.

Figure 2a

Figure 2b

LAVERNE MAST

To fit the shoes to the inside of the white line, Mast narrows the toe and quarters.

"If I walk a horse in and it has pads on, people ask me, 'Why does it have leather pads on the fronts?' I think that's the wrong mindset. If a horse walks in and has no pads on, then you should ask why not," he says.

Pads also aid in foot engagement during this phase of movement, especially with the addition of Drill Tek.

"By putting Drill Tek on a shoe, we're raising the foot higher above the ground," he says. "So the frog has to sink more to engage. This can decrease blood flow. So, I find that riveting a pad in is a great improvement to the hemodynamics of the foot. It's an extra cost, but what's that cost against 300,000 fewer steps?"

In Mast's view, breakover does not exist in the hind end in the traditional sense. In the front feet, breakover starts when the knee pops and the heels lift, ending in the toe. However, as the hock engages and the foot "breaks over" there is still downward pressure on the toe. Because the toe is used as a propulsive force in the hind end, it causes the hind toes to "spin over" instead of break over.

"There's no other discipline in which horses pull buggies over long distances. So, we have to view these hind feet differently. That's what 20 years of experience tells me," he says.

On hard surfaces, the toe cannot dig in and push off the way it does in dirt or other soft substrates. So, when the heel lifts, the toe is still pushing, which causes it to twist. Without that twist, the foot would slip. To accommodate that twisting, he does not dress the toe from nail to nail with Drill Tek,

which would be prohibitive. Instead, he dresses only the front of the toe.

"With a 1,100-pound buggy and a family of five, the pulling weight is about 300 pounds," Mast says. "The horse is digging in and pushing off that back end. It has to be able to spin across that toe. If you have a straight-toe dress, it wants to spin over, but it can't. It already broke over, so its hock and stifle are going to make up for that. That's why some horses get sore-stifled."

Shaping the Shoe for Efficiency

Adjusting the shoe to match the shape of the coffin bone has gotten Mast 4-8 inches of additional stride length. **Figures 1a-b** illustrate how the shoe follows the path of the coffin bone.

"This is nail-able," he says of the shoes. "The front toe should be reworked a little, but these are great shoes. We just need to fit them to the white line."

Each horse is an individual, meaning no two feet are the same. Mast hot fits most of his shoes, so taking the time to shape them to the foot is a matter of a few hammer blows. He avoids using pre-dressed shoes for this reason.

"There are a lot of shoes that are dressed and then sold, and that's OK if you're starting out, but I shape the shoe to the foot, then dress because once you dress them, you cannot shape the toe anymore," he says.

The St. Croix Crossover is a popular shoe for Standardbreds because the shoe falls on the foot. However, it doesn't align exactly with the shape of the coffin bone. When comparing the shape of the Crossovers out of the box **(Figure 2a)** with after they're shaped to the foot **(Figure 2b)**, the toe is narrowed and the quarters brought in to match the inside of the white line.

Drill Tek Placement

In Mast's practice, "basic" shoeing has done him the most good. This includes the placement of Drill Tek, which optimizes stride when it's placed on the toe and heels.

A 2-year-old was brought to Mast's haul-in practice on a 6-week cycle with Drill Tek on the outside edge of both hind feet and the shoe not centered over the coffin bone **(Figure 3a-b)**.

"Both hind feet were dressed on the outside edge because he was hitting his ankle," Mast says. "The thought was that if you take more off the inside toe, it'll push the foot out, but horses need that push-off directly in the center of the limb."

So, when Mast shod the colt, he took down the flare on the outside of the hoof wall and set the shoe over the coffin bone. This had the effect of fitting the shoe full on the inside. After a couple shoeings, the foot grew to the coffin bone and the shoe, which eliminated the fullness on the inside and prevented the horse from knocking its ankles.

"I have to envision these horses as they're going down the road and where the legs are going to be midstride, not just when all 4 feet are standing on the pavement," he says.

He kept the Drill Tek limited to the front of the toe and shaped the shoe to fit the white line. The shape of the new shoes and positioning of Drill Tek are

LAVERNE MAST

Figure 3a

Figure 3b

This 2-year-old colt was shod with Drill Tek on the outside edge of the toe in an attempt to prevent it from hitting its ankles.

LAVERNE MAST

Figure 4

Mast re-centered the shoe and limited the Drill Tek to the toe to aid in breakover. Seven weeks later, the 2-year-old had not hit its ankles.

significantly different **(Figures 3b & 4)**. The shape of the toe and quarters is narrower, and the Drill Tek does not go past the toe nail. At the start of the next shoeing cycle, the shoe wasn't worn and lasted another five resets.

"Seven weeks later, he never hit his ankle because he could push off the toe and flip over it easier," he says.

A more efficient shoeing means extended performance from buggy horses. Mast prefers shoeing tailored to the horse and the biomechanics of movement. In this case, the Drill Tek hindered breakover, and since the shoe was not fit to the inside of the white line, it prevented the internal structures of the foot from performing the way they're designed.

The reason Mast does not add Drill Tek to the branches of the shoe is because it's simply not needed for traction. In addition, if a shoe is experiencing excessive wear, adding Drill Tek to the branches just delays future problems because it does not address the root of the loading issues. On a handful of the horses on his books, Mast adds borium on the inside edge of the branch because it provides stability without adding too much grab and affecting spin-off. Where Mast lives in Indiana, the terrain is flat, so there also isn't a need for extreme traction. In somewhere that has more hills, more grab may be needed. Mast would rather add too little Drill Tek than too much and reassess at the next shoeing. If there is too much traction, he can see it in the leg.

That horse has taken almost 300,000 fewer steps while traveling the same distance ...

"The horse's fetlocks will be hot because in every stride it takes, it plants its foot without any slide," he says. "The fetlock joint is going to experience most of that excess trauma. Once I take the shoe off, the sole will also be red and flaky inside the white line because the circumflex artery takes the brunt of the landing. If I see those signs, I'm going to look at my Drill Tek."

Its correct application for the needs of the horse is imperative to prevent slipping and allow the horse to work at its most efficient. Efficiency extends the working life of the horse and is done by extending stride length without adjusting speed. Mast does this through pads — which he says adds 1-2 inches of stride length by protecting the foot from concussion — proper Drill Tek application and well-fitting shoes. In his observations, fitting the shoe to the shape of the coffin bone increases stride length by up to 8 inches.

"If there's a horse ready to be shod, I need to think about what this horse needs and how the shoeing package is going to look before I do anything," he says. "If I'm using a bicycle that's too small for me, I can go forward, but I'm tired. That's how a horse performs without a properly placed toe. It can't perform at his full potential." Ω

How Harness Fit Influences the Performance of Working Horses

Restricting natural movements of the hindquarters & breeching strap leads to troubling path

By Reuben Miller, CJF, APF-I

"What did you change on my horse's feet the last time you were here? I've got two new horses!"

How often do we hear about the importance of equine hoof care? How great an effect does it have on the performance of this noble beast that serves humankind?

Many of us have found this to be true. Real-life results have proved this time and again in many scenarios. Real-life results have also shown that it isn't always the feet that are causing a problem. Changes in harness fit inspired the comment at the beginning of this article.

Multiple things can influence a horse's performance. This article is being written to bring one of these to light, that is, in most cases, easy to change, and best of all, totally free. All it requires is the realization that a change is needed and might be beneficial. We're talking about harness fit.

Using Body Weight

Most of us are probably aware that horses use their body weight when starting a heavy load. What I mean is, they'll press downward into the breast strap/collar as they push with their back feet.

Sometimes, if we take things to an extreme, it becomes easier to visualize. Looking at **Figure 1**, it becomes obvious that the hind legs are doing a lot of the work. Look at all four front legs. The knees are all open, which means there is very little weight on them. And if only there were more weight up front to keep from popping a wheelie.

Oxen handle a load rather differently. Their yoke sits at the top of their neck. I don't think it'd work very well to try and put a breast strap on top of a horse's shoulder. But it's also important that it's not too low. Again, picture it at an extreme. Drop it to the level of their knees and you would majorly restrict their ability to use their limbs. So, bringing it up on their shoulder high enough to allow freedom of movement is very important. With a breast strap, it should sit right below where the windpipe enters the chest. Higher than that could restrict their air. Have you ever been half-strangled? I discovered, to my chagrin, it's very easy to use too large a collar. Oh well, she finally got over her balking now.

We need to always remember that we are requesting (demanding) our servant, the horse, to do a strenuous job for us. It is up to us to do what we can to provide them with as much comfort as we can as they labor. Proverbs 12:10 tells us, "The righteous care for the needs of their animals, but the kindest acts of the wicked are cruel."

The breeching strap needs to line up with the direction of the pull from the holdback ...

Natural Movement

Another area crucial to a horse's ability to perform unhindered has to do with the horse's natural movements of its hindquarters and the breeching. When we set these buckles, just remember, if we set them in such a way as to restrict the movements of the hindquarters, we are heading down a path filled with chiropractor visits (due to sore muscle), trying out different feeds, blaming the shoer for messing up the horse (he has sore muscles!), have two different equine professionals tell you three different opinions.

- It has a chip in a joint. How does he know, X-ray vision?
- It has an old injury and now has scar tissue (hey, maybe he's psychic).
- Its heels are too high, causing concussion to travel up its leg, through its neck and causing its jaw to constantly be out of place (seriously, a fella once actually said that to a horse owner).

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Figure 1

Horses use their body weight when starting to pull a heavy load. They press downward into the breast strap and collar as they push with their feet back.

Again, it might be easier to visualize if we take it to the extreme. In **Figure 2**, you can see that the holdback ring is high above the shafts. The shaft loops are down pretty far. It's easy to see when the buggy runs into the back end of the horse, such as at a stop sign or going down a hill. The holdback will pull the big, wide breeching strap, that's supposed to take all the force, in a downward direction, which puts a lot of pressure on the hip strap. That strap is a lot thinner. Shouldn't we put all the weight on the big fat one? When the hip strap catches some of the load, it puts pressure at the lumbosacral joint at the top of the rump. This is an area that does not thrive from receiving a lot of pressure. In fact, they'll get very sore there. So, if you watch the top of a horse's rump at a trot, you'll notice it bounces up and down — a lot.

A horse's spine allows it to tuck the hind end down to engage their hind feet under themselves just like a dog — although a dog can arch its back or engage its hind legs significantly more than a horse. Picture the up and down movement you would experience in a saddle if a horse's spine had that much movement. A gentle canter would make a guy flop up and down like a towel on a windy

REUBEN MILLER

Figure 2

The holdback ring is significantly above the shafts and the shaft loops are down too far. When the buggy runs into the back of the horse approaching a stop sign, the holdback will pull the breeching strap down, putting pressure on the hip strap.

REUBEN MILLER

Figure 3

In proper harness fit, the breeching strap lines up with the direction of pull from the holdback. The hip strap should be floppy or bulge outward as the muscle group below the point of the hip sticks out and hits the hip strap when viewed from behind and with the horse is at a trot.

wash day. How great is God to foresee this in this beast of burden? (By the way, why do you think I like riding gaited horses?)

Proper balanced movement would then have them thrusting hard and then following through, bringing their hindquarters back up. So, when the hip strap has pressure on it, that goes over that lumbosacral joint, a horse can compensate by keeping its hindquarters kind of hunched. This moves their stride underneath them a little, robbing them of who knows how much propulsion. If you listen carefully, you might now be able to hear this horse forge. The other extreme would be to drop the breeching down to just above its hocks. That'd probably cause them to wipe out, wouldn't it? At least the holdbacks wouldn't be causing his hips to be constantly out of place, would they?

Warning Sign

Since I learning this, I have "cured" more long-standing "shoeing" issues than with any shoeing tip I have learned over the last 10-plus years.

A warning sign this might be going on is when the horseshoe is showing unusual wear on the outside half of the shoes on the back feet. It makes me think the feet are being shoved in and forward under him. That's a big red flag. Something's going on. Why is it doing that? Hips out? Why are its hips out?

So, what needs to happen? What does normal look like **(Figure 3)**? The breeching strap needs to line up with the direction of pull from the holdback. At a trot, viewed from behind, the hip strap should be floppy or bulge outward as the muscle group below the point of the hip sticks out and hits the hip strap. Please reread the last two sentences three times. They are what this article is about.

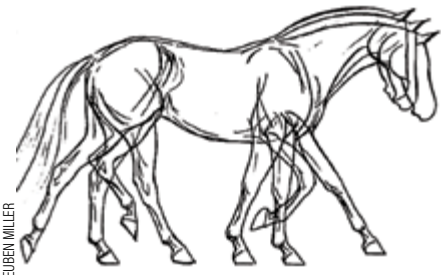
In **Figure 2**, you need to lengthen the hip strap and shorten the shaft loops. If the shafts are becoming worn where the shaft loops ride, take 10 minutes, use a leather punch/hot screwdriver to make more holes, if needed, and save yourself a whole lot of money by moving your shaft loops up a few inches. You'll quickly see that if your shaft loops are lower than your tugs, it gives it more leverage to push the tips of the shafts downward.

You can reduce that leverage by finding that sweet spot. Moving your shaft loops up will line your holdbacks up better on that big old Dutch or Friesian that just can't quit forging. Now, this little tidbit isn't a silver bullet that cures all that's wrong, but if this detail is wrong, have fun with horses that forge, hit their ankle, run with a hike, pull for the middle/ditch, dog track, are short-strided, lame, etc. This issue can turn into a real money pit for a horse owner. And it's so cheap to move a buckle.

Heads Up

Now, for a different area of harness fit. This one can have a great effect on many things. Look at the angle of those foreheads in **Figure 1** in relation to the ground. Do you think it helps them do their job if we fastened a strap to their bit, run it up between their ears and used it to pull their nose in the air? Why is this done? I don't really know for myself. I guess it might not be quite as handy for them to kick if they can't duck their head between their knees. Do you think your 10-year-old woman driver would kick under almost any circumstances?

Again, let's look at a few extremes. A horse needs to have its head up to perform to its full potential. It helps them perform in a collected frame. If a little is good, more would be better, right? There's probably a line that could be crossed, but where is it? Or, are we stuck with thinking it should be about three holes shorter to make it look like the neighbor's horse? Can some guidelines be defined? Why don't we have a tiny come-along attached to their overcheck rein and just crank 'em up till it won't go up? That would be an extreme, right? Well, we also don't want them with their nose at their knees, shuffling along in an unbalanced manner.



REUBEN MILLER

Figure 4

The head and neck are critical for a horse to maintain balance. When the harness fit is incorrect, it can lead to movement that leads to uneven muscle development and shoeing issues.

If you took a razor-sharp 3-foot-long sword and handed it to a giant and had him severe a horse's neck and head from the body, you would find it weighs quite a bit. So, it makes sense when you say the head and neck are an important means of maintaining balance **(Figure 4)**.

Humans tend to use hands and arms. Try having someone tie your hands behind your back. Now lift them. Come on, that's not high enough. Here, let's use this handy strap to help, we'll put one end in your mouth then run it over your head to your hands. There, now run!

We can imagine that we can cause muscle fatigue, which leads to cramps, which leads to horses moving in an unhealthy manner, causing uneven muscle development, leading to shoeing issues. Then you hear, "Maybe you should try my horseshoer."

Maintenance Man or Miracle Worker?

It leads to the question: Is a horseshoer a maintenance man or a miracle worker in your eyes? What about once your horse has an issue? How do you view it then? Please briefly consider human nature as you wonder why I added that last question.

Take a white paint marker, piece of duct tape or something that shows up on your horse's hair. Make a line starting at the base of the ear down the side of their head. Now, have someone pull on the overcheck rein. A horse's neck vertebrae have a lot of movement in them, but they do have a limit. The neck can be raised only so far. After that they will lift their noses and make that line you drew become closer to parallel with the ground. Because of where the overcheck runs, lifting their nose in the air will bring the overcheck snap closer to the saddle. Once that line you drew becomes more parallel to the ground, this will do harm to the horse's musculoskeletal frame, affecting its balance and cycle of movement (and cost you money).

I've seen horses that maxed out their necks and the overcheck rein still had about 5 or 6 inches to go. That means the horse really had to bring its nose up. No room left for balancing gestures there.

Setting buckles to restrict hindquarter movement leads to problems ...

"Ever since you were here [2 days after purchase] that new horse I got started forging like crazy! I don't know what you're doing wrong …." (All the shoers reading this are probably smiling and nodding.) Some people who drive an unruly horse rein them up like that to "wear them down a little." Tires them out, doesn't it? We have also all heard of pre-Civil War times of cruel and inhumane slave masters. Wonder how our Father in Heaven views this specific

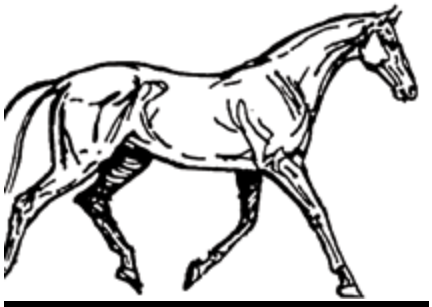
issue? The horse's Creator will be our judge on the last day! Maybe those individuals need to focus on learning how to train in a manner that the horse can understand instead.

Raising the Head Properly

Getting a horse to raise its head properly helps them to round their back and have an engaged or collected frame, which brings their hind legs underneath them to efficiently thrust and propel themselves **(Figure 5)**.

Go too far with the head **(Figure 6)** and they have to invert their back to help hold their neck and head up (does anyone know about how much a 1,000-pound horse's head weighs?), which hinders its ability to engage its hind legs. Remember all that thrust and propulsion? **(Figure 1)**. Kiss a portion of that bye-bye. It has been proven via slow motion video that reining a horse up too high can cause it to run closer together in the back.

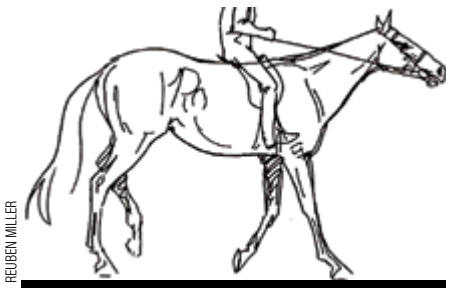
Does your horse tend to hit its ankles? Do you like it when they do? Would it be reasonable/fair to try something to see if it'd help?



REUBEN MILLER

Figure 5

Raising a horse's head properly helps them round their back and engage or collect their frame, which brings their hind legs under them to efficiently thrust and propel them forward.



REUBEN MILLER

Figure 6

When the head is too far forward, the horse must invert their back to help hold their neck and head up, which hinders the ability to engage the hind legs.

I encourage you to hitch up your horse and take a critical look at your harness fit. I would like to point out that I will not benefit from this. You and your horse will. Unfortunately, I had to learn this the hard way and wish to share with fellow pilgrims.

In regard to the overcheck rein, I use a bit with a curb chain to help him begin to tuck his nose. It made him use different muscles. He got tired on the first few trips. Enough so that I had to start slowly and recondition my 11-year-old gelding. Lengthening the overcheck, driving a half mile and then deciding it didn't help is not enough time for a horse to adjust to the change, develop muscles properly, or allow current soreness to leave. It might take a chiropractic treatment to help things get back on the right path, after the irritant (improper harness fit) has been taken care of.

If you find something helpful in this article, give God the honor and use it. And remember, knowledge is a little bit like a pile of manure. If it just sits in one spot, it kills anything growing underneath it. However, if you spread it around, it tends to do some good.

Reuben Miller owns and operates Millers Farrier Service in Leesburg, Ind. He's been a farrier since 2010.

How Geometry Improves Balance

International Horseshoeing Hall of Famer Steve Kraus explains the effects on the hind end

By Katie Navarra, Contributing Writer

Car manufacturers know placing the power at the rear of the vehicle allows for better balance. Nearly all race cars are rear-wheel drive so when accelerating from a stop, the vehicle's weight transfers to the back of the car and provides increased traction.

Thinking of horses as rear-wheel drive animals has similar benefits because the hind end functions as a piston, says Steve Kraus, the retired head of Farrier Services and Senior Lecturer of Large Animal Surgery at Cornell University. He points to draft horses as proof. Heavy horses needed to stay sound to do draft-type work. Buyers selected horses based on hocks pointing toward each other with parallel cannon bones and a slight toe-out. This configuration places the lateral side of the hind hooves under the plumb line dropped from the lateral point of the hips to the ground.

"It's not just draft horses," he says, "all horses need the base under their hips."

Despite the hind end providing the power and support horses need to perform, it's often overlooked with an emphasis on the front end. In part, basic horse-handling skills encourage this. Handlers are taught to approach a horse from the front and make eye contact to avoid spooking it. Walking around a strange horse and yanking its tail is not advisable, but carefully moving the tail is necessary in a full evaluation, Kraus says.

"When I started evaluating the hind end first," he says, "I received positive feedback from my clients about improved performance and balance."

When he evaluates and trims based on the hind end, the front-end problems cease, and the horses carry themselves better. Performance horses need to work off their hind ends. It starts with proper hind end geometry.

The Triple Threat

Unsuitable conformation, inaccurate trimming or inadequate fitting shoes is what Kraus calls the triple threat. A horse with one or a combination of the three leads to lameness and underperformance.

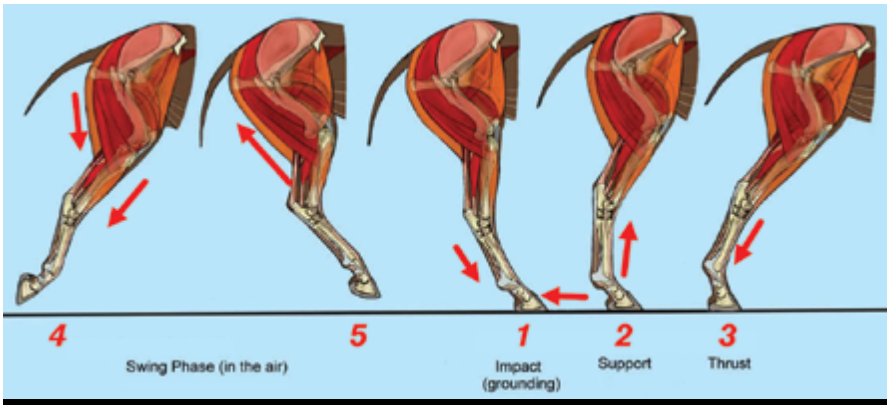


Figure 1

In the impact phase, a lot of forces affect the lower part of the limb. As the horse loads the foot, the forces travel up the limb. During the thrusting phase, these forces are going back down the limb. In the swing phase, they're traveling farther up the leg as the horse is extending. As the swing phase is completed, it goes farther up the backside of the leg.

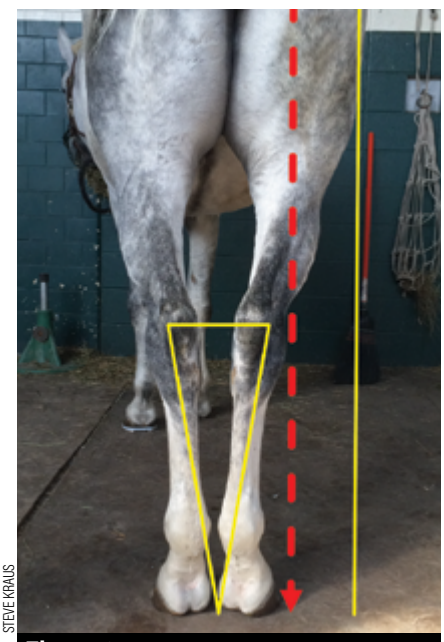
"In the impact phase **(Figure 1)**, a lot of forces affect the lower part of the limb," he explains. "As the horse moves over the foot, those forces travel up the limb. When the leg gets to the thrust phase, these forces go down the limb. As the horse is in the swing phase, they travel farther up the leg as it's extending. As they complete the swing phase, it goes farther up the backside of the leg."

Proper geometry produces efficient movement that promotes soundness because the physical forces are distributed evenly. Thinking in terms of an X-, Y-, and Z-axis and using visual plumb lines from critical places on the horse's body reveal how a horse is balanced. In a side view, the point of the hip is the Z-axis. The view from behind the horse creates the X-axis and the plumb line begins at the center of the buttocks, runs down to the hocks and finishes at the ground.

"The X-axis determines whether the horse is base-wide, or base-narrow," he says. "The Y-axis can only be seen if you are looking straight up the leg or straight down from above. The Y-axis describes bone alignment and rotation of the leg."

When the horse loads a hoof unevenly because of conformational defects, the forces transmitted up the leg cannot be dissipated properly. Load intensity varies based on gait. It matters in disciplines such as reining, dressage, jumping, polo, racing and pulling/driving when the horse is asked to move off its hind end.

"I think about alignment above the hoof," he says. "It's all about how the mass above aligns with the base."



STEVE KRAUS

Figure 2

This gray Thoroughbred presents a typical base-narrow conformation with its mass coming down on the outside of the foot.

STEVE KRAUS

Figure 3

This horse's feet are positioned in front of the plumb line; thus, it's standing under itself.

STEVE KRAUS

Figure 4

This "windswept" horse has a fairly normal alignment on the left side, while the right is not.

STEVE KRAUS

Figure 5

A camped out or strung out horse behind has its hocks behind the plumb line, leaving its hind end behind as it moves forward.

Bad Geometry

Foals with poor hind-end conformation should be corrected at that age and to the extent possible through corrective trimming, medial, lateral and caudal extensions when possible. Horses that are base narrow, standing under themselves, camped out behind, post legged or cow hocked suffer from bad geometry.

"They have hooves inside the plumb line," he says, "the osteoarthritis is usually in the hock and stifle, there's a medial flare on the foot, a lateral heel crush and poor hind-end engagement."

Figure 2 is classic base-narrow conformation. The mass is on the outside of the foot. Kraus compares it with a person standing with their weight on the outside heel. When the individual lifts their right leg, the left shoulder falls sideways because there's no support. But if the stance is evened up and the mass is shifted under the core, it's easier to stand.

Trimming is the foundation for correcting a faulty hind end, he says. Shoeing is an enhancement, and he cautions against over trimming. For the Thoroughbred pictured, he trimmed the excess off the inside and achieved about 1½ inches between those hind legs.

"That's all I'm going to get," Kraus says. "It's the way the horse wants to stand."

When a horse stands like the bay in **Figure 3**, it's under itself. Its feet are positioned in front of where the plumb line falls. Like any of these situations, start with the trim. With the heel location under the bulbs, Kraus avoids setting the shoes back and squaring the toes because the horse needs its toe to propel forward and challenge the deep digital flexor tendon (DDFT). These horses usually have a negative plantar angle of P3.

"Shoeing helps some on this horse, but we're not going to change much on mature horses," Kraus says. "We must pay attention to how we fit the shoes. An extended heel can be helpful on horses that stand under or sometimes going up to a longer, bigger shoe helps, too."

Another common fault is "windswept." The left alignment is fairly normal, but the right side isn't **(Figure 4)**. The straight hock is usually on the right side. This defect causes the horse to track unevenly, have weak dressage scores or poor turning ability to the right.

"The windswept horse needs each foot shod individually," he says. "Often a wider lateral branch shoe of the straight hock side and rolling the toe medially helps. The opposite foot is shod normally."

Camped out or strung out horses behind are also problematic. **Figure 5** reveals the hocks are behind the plumb line, so the horse leaves its hind end behind as it moves forward. Improper hind end muscle development and gluteal and back strains are common. They'll struggle to collect, lack impulsion and move in a strung-out fashion.

"They may be helped with some artificial heel elevation, after a proper geometric trim," Kraus says. "Wedge pads, bar wedges and wedge shoes move the base forward. If a wedge pad is used, a longer shoe should be used to support the heels."

Improving posture is always the goal. Although Kraus doesn't often use wedges on hind feet, in some situations they help move the center of balance forward so it stands in a more normal posture. With a wedge, the shoe might need to be a size larger or an extended heel.

"Don't put the same size shoe on a wedge without length behind the foot because you'll create a fulcrum and the horse will fall off the back of it," he says.

Upright hind feet with joints that are too straight and legs that are forward of the buttocks are called post legs. The stiff structure cannot absorb shock, and these horses often suffer from ringbone and chip fractures in the hock and stifle.

"Every power thrust is like a pogo stick," Kraus says. "They injure easily because each stride jams the bones hard."

It's less common to see a post-legged horse compared with the others described, he says. Rocker toes are likely the only option as they add flexion. Synthetic shock-absorbing packing may reduce concussion. Ω

Katie Navarra is a freelance writer who draws from her experiences owning and showing horses.

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