Words of Wisdom – Riding Skills

Updated 7/28/07

The following has been collected from various posts in the Shadow Aero 750 Forum. While some are specific to the Aero, most apply to any motorcycle.

These are updated on a frequent schedule and you are encouraged to check for newer versions as well as add your own in the forum.

These Riding Skill tips do not take the place of a motorcycle training course such as the Motorcycle Safety Foundation course. They are presented as a reminder of the items all should practice on a regular basis to be a good rider.

Two very important rules when riding a motorcycle:

1) Look down, you'll go down

2) Stare at something, you'll drive into it.

Keeps your head and eyes toward where you want to go.

Riding Skills

When pulling out and turning either left or right, keep your RPM’s up and use the friction zone of your clutch to control speed. Also drag your back break. This helps stabilize the bike and keep it upright.

Try a one-man "slow" race and see how slow you can ride the bike in a straight line w/o touching down a foot. First practice using no rear brake and then try it with applying the rear brake. You'll likely find you can better control the bike with the application of rear brake while applying throttle.
Be sure to keep the throttle in the "friction zone" at the same time for more precise slow speed handling. The "friction zone" is that area between a full engaged/disengaged clutch. Keep the clutch partially engaged and keep your RPM's high.

Accomplished riders will tell you it's slow speed handling, not high speed, that sets apart the skilled riders from those with less skills. There's no reason to duck walk your bike around a parking lot. The ability to handle the bike at slow speeds automatically improves one's high speed (i.e. riding speed) skills.

Learning a new bike

Start your exercises with low-speed work. A deserted parking lot is perfect, provided the surface is clean and free of defects, bumps, obstacles, or slippery stuff.
Begin with circles at low speeds. You should keep your head turned and you eyes up near the horizon to see where you're going. As speeds get slower, you shouldn't have to put a foot down. Eventually, your speed control and feel for the bike should enable you to make complete 360-degree turns with the steering turned to full lock and your feet on the footpegs or floorboards. You may discover the handlebar should be repositioned or the throttle cable needs some play taken up to smooth out initial acceleration.
Next, try some tight figure eights, which will teach you how the bike responds in low-speed, side-to-side transitions. Again, your feet should never need to touch the ground until you stop. Find or set some marks you have to hit every time around to force you to be precise and consistent. You'll expand your feel for the throttle response in this exercise.

If the surface offers solid traction, your practice area has enough space and your confidence is high, repeat the exercises at higher speeds. You may want to come back in a few days to try these. When you have a feel

for the bike and learn to keep your head turned and your eyes up, you should be able to draw precisely the same circle every lap. Those direction reversals in the figure eight will teach you how much pressure your new ride needs for direction changes and how the bike reacts as it rolls into a corner. Keep your eyes moving ahead of you, try to hit the same marks every time around and don't put those feet down.

You might also learn the cornering limits of your bike. That loud dragging noise may be unnerving at first, but on most bikes you should learn to keep turning despite it. This peg scraping sound is just your bike saying it’s approaching maximum lean angle. Leaning further will risk scraping something solid, such as an engine guard or part of your bike’s frame. That can lift the front wheel off the pavement if you plant it too firmly. However, most footpegs and boards simply fold up and don't unsettle the bike at all, though the noise may startle you.
Dragging the bike's pegs will teach you to anticipate and ignore the grinding sound of the floorboard scraping the pavement. The idea is to teach you not to be startled and straighten up as a reaction to the noise. That reaction which can cause you to run off the road when you have to lean the bike over a bit harder than you anticipated while negotiating a corner. It will also teach you how much cornering clearance your bike really has, thereby giving you an idea of how far you can lean it into a corner. If your bike drags too easily for comfort, try stiffening the spring preload (if that is an option) or changing to longer or stiffer suspension components.

Screeching Halt

Learning panic stops are a good thing. Then they’ll be less panic and more stop.

If you perform panic stops approaching a stop sign, pick a point before the intersection where you actually plan to come to a stop.
You can also use your low-speed exercise area to practice stopping. Hard stops will teach you what sort of traction your tires offer, how powerful and sensitive your brakes are, and how the bike handles when braking hard -- even with the rear wheel locked.

Stopping with the back tire sliding helps to determine how much traction you can call on; it also shows you what to expect when this happens in a real-life panic stop. You CAN steer your bike with the rear brake locked up. Deliberately locking up the rear tire reveals how your

bike behaves in an emergency and lets you adjust to it. Practice steering into any sideways skid that develops during these low-speed lock-ups.

The back brake isn't the main event, however. It's important to remember that most of your stopping power comes from the front brake. Once you are comfortable stopping with the rear wheel sliding, focus your attention on the front brake and tire. Since the consequences of overbraking up front can be a crash, you don't want to overdo it too dramatically. But you do want to get a clear sense of how much pressure you can apply to the crucial front brake.

Again, practicing may make it apparent if your brake controls need their positions or engagement points adjusted to better suit you.

Going Faster

Once you have mastered your turning, swerving and stopping skills at low speed, practice again at higher speeds. If your parking lot is big enough, you can do it there, otherwise some lightly traveled sections of road will work.

Look for a corner that offers an open approach so you can see through it. A turn with a maximum apex speed of 60 mph or less and no surface flaws is a perfect place to try cornering at highway speeds. You want to be able to put the bike precisely where you want it at the entrance, the apex and the exit. Again, if you can lean it over far enough to drag things, it will help you learn the bike's limits.

A straight, deserted road is a good place to practice swerving. Using dotted lines as pylons, see how fast you can comfortably go while swerving between them. On roads with raised lane-marker dots, the dots will tell you if you miss. The idea is to learn how to execute a quick, precise swerve -- a vital avoidance maneuver.

You can also practice hard stops on the street when you are clear of any other traffic. In fact, as with the other skills, hard stops can be practiced in the normal course of every ride. Just make sure there is no one close behind you when you jump on the brakes. Pick a safe spot you intend to stop at or before. It should be a short enough distance to challenge you, while also allowing room to overrun if you can't stop at or before your target point.

Take Two

It is worth repeating these exercises with a passenger you carry regularly. This not only gives you a feel for the changing demands of your new bike with a second body aboard, it also provides the passenger with an opportunity to learn what is required in those situations.

Because these exercises involve moderate but varying speeds and engine loads, they are also a good break-in regimen for your engine and brakes. You'll be doing you and your new bike a favor. Some suggest these exercises be performed at least twice a week for the first month of ownership or longer if you don't feel comfortable doing them by that point.

Counter Steering

Our thanks to James R. Davis (www.msgroup.org) for the bulk of this explanation.

Everyone who has driven a motorcycle has experienced it, the MSF classes mention and motorcyclists discuss it all the time. It's also misunderstood by many.

At very slow speeds we steer a motorcycle by turning the handlebar in the direction we wish to go. But you can only do that at speeds of less than about 5 MPH. At any higher speed we do the exact opposite, whether you realize it or not.

Assume you want to turn to the right. You actually want to turn the handlebar left. This results in the front wheel leaning to the right and, as a result of the lean of the wheel, a turn to the right. This is counter-steering.

Why is it most don't get confused regardless of the speed? Because you learned that steering a motorcycle is an effortless chore. That attempt to turn the handlebar to the left FEELS like we are pushing the right grip rather than pulling on the left one. It feels like that because the harder we push it, the more the motorcycle turns to the right and, thus, it feels like the right grip is pushing back at you that much harder. In other words, you quickly learn to associate counter-steering feedback with the hand closest to the direction in which we wish to turn. Even a little bit of experience shows that counter-steering is essentially effortless while trying to turn the handlebar in the direction you want to go is virtually impossible. We learn quickly.

The Physics of the matter

The phenomenon is called Gyroscopic Precession and it doesn't apply here so you can forget that old wife's tale.

No matter how slight, if your front wheel deviates from a straight path your motorcycle will begin to lean in the opposite direction. This is a result of steering geometry – or rake. You can observe it at a complete stop. Just turn your handlebars in one direction and you will see that your bike leans in the opposite direction as a result.

Note that though gyroscopic precession is not a necessary component of counter-steering it facilitates it - makes it smoother - but does NOT cause it. In plain language - centrifugal force is what initiates counter-steering, not gyroscopics.

In the case of a motorcycle, your handlebar input is immediately translated by gyroscopic precession into a lean in the opposite direction. Since your front wheel is attached to the bike's frame, the body of the bike also attempts to lean. It is the lean of the bike that overwhelms the handlebar effort and drags the front wheel over with it - gyroscopic precession merely starts the process and soon becomes inconsequential in the outcome.

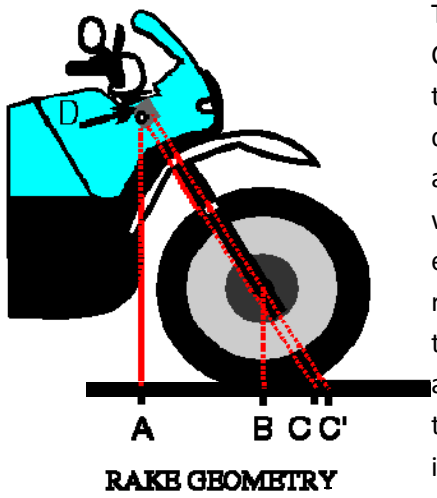
The ONLY WAY to turn a motorcycle that is moving faster than you can walk is via counter-steering it (if it only has two wheels).

Before getting into what is actually somewhat complicated let us say that if you were to let go of your handlebars and provide no steering information whatever (or you were to get knocked off your motorcycle), after some wildly exciting swings from side to side your motorcycle would 'find' a straight course to travel in and would stabilize itself on that course, straight up. That's right, your motorcycle has a self-correcting design built into it - known as its Steering Geometry - that causes it to automatically compensate for all forms of leaning and speed changes and end up standing straight up, going in a straight line, whether you are on the bike or not - until it is traveling so slowly that it will fall down. (This is ignoring some bikes will drift off to the side because of the crown of a road or the extra weight of exhaust pipes on one side). We're trying to keep this somewhat simple.

The handlebars are connected to the steering column (actually called the 'steering stem'). This connects to what is known as the triple-tree where both forks are tied, along with the steering stem, to the bike's frame.

Look at your bike and notice that the forks are not pointing straight down from the triple-tree, but are instead at an angle. This angle is known as the rake. Most rake angles are approximately 30 degrees. Choppers have rake angles that get way out there.

What the rake does for you is very important. For one thing, it causes any lean of the wheel to be translated into a turn of the wheel towards that lean. For another, it slows down your steering. That is, if you turn your handlebar 20 degrees at slow speed your course will change something less than 20 degrees. (At higher speeds you NEVER would turn your handlebars 20 degrees - the front wheel is always pointing virtually straight ahead.) Rake, in the case of higher speed turning then really does SLOW DOWN the realization of the turn.



RAKE GEOMETRY

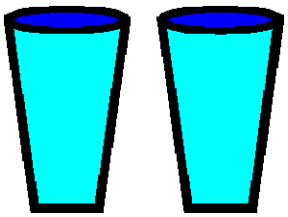
The distance between where B and C (not C') touch the ground is called trail. (Trail, as you can see, is determined by rake angle, offset and tire radius.) Some motorcycles will have the hub of the front wheel either above or below the forks rather than directly in the middle of them. In effect, these placements are designed to reduce or increase the effect of the offset in order to increase or reduce trail.

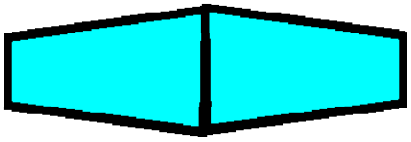
The stability of your motorcycle at speed is a function of how long its trail is. However, have you ever noticed that the front wheel on bikes that have excessive rakes (and therefore long trail like a chopper) have a tendency to flop over (at low speeds) when they are not aligned perfectly straight ahead? This is the phenomena that explains just one of the reasons why your wheel actually turns in the direction you want to go after it begins to lean in that direction. Any lean whatever of the wheel, receives an assist from gravity in its efforts to move the contact patch forward along the trail. Further, notice that the pivot axis of your

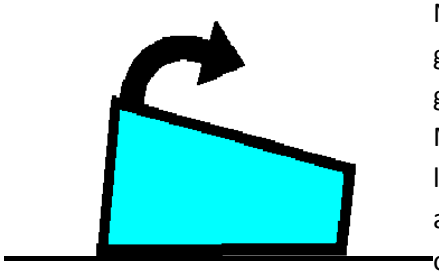
forks is along C, not C' and that this is behind the bulk of the front-end. Thus, gravity plays an even bigger role in causing the wheel to turn than at first glance it would appear. (And now you see why you have steering dampers - so that a little lean doesn't result in a FAST tank-slapping fall of the wheel in the direction of the lean.)

But there is another, more powerful, reason that the lean is translated into a turn - Camber Thrust. Unlike automobile tires, your motorcycle rides on tires that are rounded instead of flat from side to side. When you are riding vertically your contact patch is right in the middle of the tire, at its farthest point from the hub of the wheel. When you are leaning you are riding on a part of the tire that is closer to the hub of the wheel. The farthest parts of the tire from the hub of the wheel are TURNING FASTER than any part closer to that hub. Thus, when you are leaning the outside edge of the contact patch is moving faster than is the inside edge.

Imagine taking two tapered drinking glasses and putting them together. This bears a striking resemblance to the profile of your tires when looking at them head on.







Now imagine placing one of those glasses on its side on the table and giving it a push. Note that the glass MUST move in a circle because the lip of the glass is moving faster than any other part of it. The same is true of your tires. This camber thrust forces your wheel to turn in response to a lean.

Thus, both the rake geometry and camber thrust conspire to cause a leaning front wheel to become a turn in the direction of the lean. Then, of course, the motorcycle body follows the wheel and it, too, leans in the direction of the turn.

So, what keeps that wheel from going all the way to a stop every time a little counter-steer is used?

The answer is centrifugal force and, again, rake geometry. For any given speed and lean combination there is only one diameter of a circle that can be maintained. This is a natural balance point at which gravity is trying to pull the bike down and centrifugal force is trying to stand it up, both with equal results.

If the speed is increased without a corresponding decrease in the diameter of the turn being made, centrifugal force will try to stand the bike more vertically - i.e., decreases the lean angle. This, in turn, decreases the camber thrust and the bike will, of its own accord, increase the diameter of the turn being made.

If the speed had been held constant but the bike attempts to shorten the diameter of the turn beyond that natural balance point then centrifugal forces are greater than gravity and it stands taller, again lengthening the diameter of the turn as described earlier.

Once your bike is stable in a curve (constant speed and constant lean) then it will stay that way until it receives some steering input. i.e., you again use some counter-steering or the road surface changes or the wind changes or you shift your weight in some way or you change speed.

As soon as any form of steering input occurs the stability of the bike is diminished. Momentum, camber forces and rake geometry will then engage in mortal combat with each other which will, eventually, cause the motorcycle to find a way to straighten itself out. That momentum will try to keep the motorcycle going in a straight line is obvious, but it also works with traction in an interesting way. That is, because the front tire's contact patch has traction the momentum of the entire motorcycle is applied to the task of trying to 'scrub' the rubber off that tire. If the body of the motorcycle is aligned with the front tire (only possible if traveling in a straight line) then there is essentially no 'scrubbing' going on. But if the bike is not in perfect alignment with the front tire, then momentum will try to straighten the wheel by pushing against the edge of that contact patch which is on the outside of the curve. As the contact patch touches the ground somewhere near point B, and because that is significantly behind the pivot axis of the front-end (red-dashed line C), the wheel is forced to pivot away from the curve.

More than you ever wanted to know.