Heavier Bike vs. Stopping Distance

You should know this before driving down the mountain

By: James R. Davis

There seems to be a continuing belief amongst many of us that stopping distance increases as a direct function of increased vehicle weight. I would like to try again to put this issue to rest.

While it is true that a heavier vehicle requires more energy to brake to a stop than does a lighter vehicle, (there is, after all, more mass involved), that does NOT mean the heavier vehicle takes more time or more distance to stop.

Let's review how your brakes work. Regardless of type (disk or drum), your brakes work by pressing a non-revolving material against a revolving material and, as a result, converting (via friction) the energy from the revolving material into heat. The harder the materials are pressed together, ***the greater the friction*** and, as a result, the greater the rate of conversion - i.e., the more braking force applied, the quicker you slow down the revolutions of the wheels, and the hotter the brakes become.

The brakes are also designed to radiate the resulting heat into the environment and, thus, allow the brakes to cool down quickly after they are no longer being used. This is a very important part of their design because the braking material used loses efficiency (reduced friction) with high heat. Indeed, if the braking material gets too hot it can be permanently damaged (it will glaze.)

Brakes on an 18-wheeler are substantially larger than those on your car or motorcycle. That is, brakes come in lots of different sizes - each with the ability to convert a range of energy conversion demands. The bike designers select brakes appropriate for your most demanding requirements. In other words, your brakes are perfectly adequate to totally stop the revolution of your wheels, regardless of how heavy the bike is (until it is severely over weight) or how fast those wheels are turning. Mind you, you can severely overload your bike with luggage and passenger to the point that your brakes might not be up to the task of handling that demand efficiently.

Since you know that you can lock a wheel while the bike is still moving, you know that the braking energy you apply to your brakes is NOT WHAT LIMITS HOW FAST YOU CAN STOP! That limit is determined by the amount of traction your tires have.

Further, since it takes more braking energy to stop (lock) a spinning wheel than to merely slow it down, and because a sliding tire (the result of locking your

brake) has less traction than one that is not sliding, your normally functioning brakes are NOT WHAT LIMITS YOUR STOPPING DISTANCE! That limit is also determined by the traction of your tires.

Traction, as we have discussed before, increases with weight. Thus, adding weight decreases your ability to slide the tire and, as a result, gives you the ability to stop more quickly while at the same time increasing the energy that must be converted to heat by your brakes in order to slow down. In effect, adding weight makes it harder to slow at the same time it makes it more possible to do so.

If you so severely overload your bike that the brakes are no longer powerful enough to cause a skid, then you know that the increase in traction gained by that added weight has finally overwhelmed the ability of your brakes and, thus, your brakes then become what limits your stopping ability (time and distance.)

Weight affects your ability to stop in TWO ways:

- It takes more energy (braking) to slow a heavier weight
- Traction INCREASES as a result of added weight such that more braking can be used without starting a skid.

Thus, adding weight essentially CANCELS itself out as an impact on stopping distance. All that you need to do is apply your brakes harder in order to TOTALLY compensate for added weight.

You know this already, of course. Else, for example, how could a car EVER stop as quickly as a motorcycle? Or, how could a heavy Valkyrie or an Ultra Classic Tour Glide EVER stop as quickly as a little 250 cc street bike? Further, any of you that have taken an MSF class know that there is an exercise (and a skill test) that measures how quickly you can stop your bike while moving in a straight line. Your speed is computed by using a stopwatch and measuring your time through a marked interval. Your stopping distance is read directly from marks on the ground. If, for example, you are traveling at 20 MPH when you begin your braking, then you are expected to stop within 23 feet. NOTE - if you are a 300 pound rider or a 100 pound rider, the results are the same! There is no compensation for weight. Now you know why.

Now, mind you that I have been talking about a panic stop capability - or even normal braking THE FIRST COUPLE OF TIMES. The heavier the bike, however, the more heat is created by using those brakes and braking power diminishes with higher heat. Thus, while on a long mountainside decline, if the time interval between brake usages has not been long enough to let the brakes cool down, then you will find that a heavier bike begins to no longer have the braking power of a lighter bike. THAT is why you use engine braking (a lower gear) when going

down a long decline.

But, generally speaking, weight makes no difference in stopping distance because the brakes are more than adequate to handle any normal range of weight for that bike.

And remember: Drive on the right except to pass…