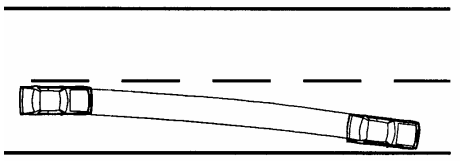
Typical Skid Marks

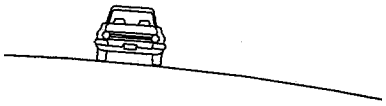
A skid mark is made by a tire that is locked and sliding. The key aspect of a skid mark is that the tire is not rotating. The tire may be locked due to braking or collision damage.

If you were to ask what actually causes the black skid mark that we see on the roadway, most people would tell you it is from the rubber of the tire. We know that the locked tire causes friction, which causes heat. This heat brings up the oils in the road to the surface, leaving the visible mark we call a skid mark. It is for this reason that skid marks on asphalt are darker than skid marks on concrete. Asphalt is oil based while concrete is water based.

For purposes of evidence, skid marks can tell us the location of the tire at the time the mark was made, the wheels were locked and not rotating, the brakes were applied hard and there was a reduction in speed. The minimum amount of speed needed to leave a length of mark can be mathematically determined.

When a vehicle's tires are locked and skidding, it will travel in a straight line. However, we have all seen skid marks that appeared curved (below, left). The **crown** in the roadway causes this. If you could look at a cross section of a roadway, you would notice that it curves down toward the edge (below, right). This curve allows for water to drain off to the side of the road.

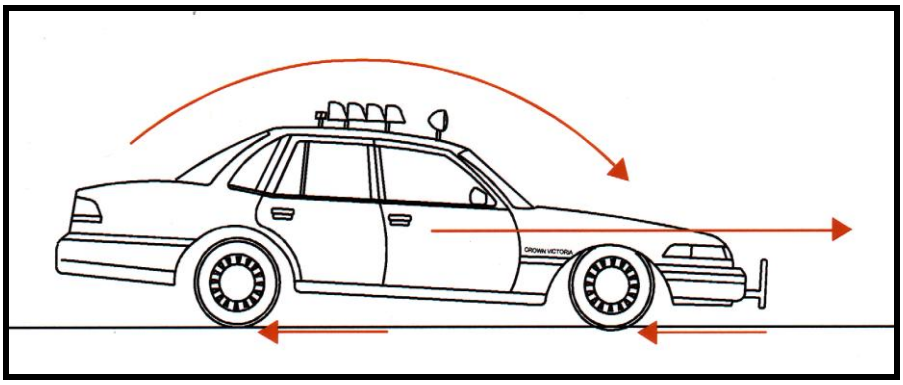




A vehicle skidding over different surfaces, not all wheels braking or a weight shift may also cause a skid mark to curve.

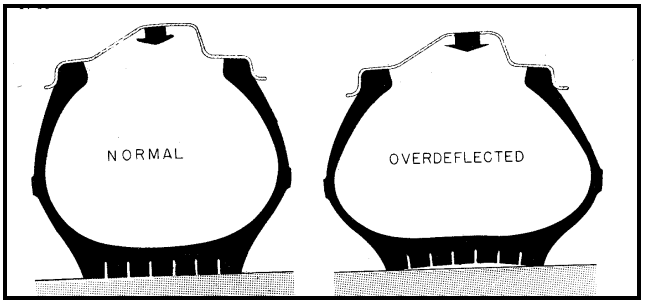
Front and Rear Skids

When we apply the brakes on a vehicle we can feel the front end of the car "dip" down. We also experience the feeling that we are being "thrown" or "moved" forward. The harder the brakes are applied, the more pronounced this is. The force that makes us feel that we are being "thrown" forward is called inertia. Engineers design cars so that the front and rear axles support about the same amount of loads. When the brakes are applied the road surface applies a force in the opposite direction the car is traveling. However, inertia wants to keep moving the car forward (below).



These parallel but opposite forces pitch the vehicle forward, causing weight from the rear wheels to shift to the front wheels (above). Because of this weight shift, the front suspension compresses, causing the front end to dip. As you can see, the rear suspension expands, causing a lifting of the rear tires. On average, about 60% of the weight is now on the front tires. This leaves 40% on the rear tires. Because of this weight shift, front and rear tires leave distinctly different skid marks.

A properly inflated vehicle tire is designed to support the weight bearing down on the axle while keeping the entire tread surface in contact with the road surface. When a car is in a skid the additional load on the front tires, due to the weight shift, causes compression of the tire itself. Because the air in the tire cannot escape, it pushes on the sides of the tire. This causes a slight "bowing" or "lifting" effect of the tread surface. This is called **Overdeflection** (below).



Overdeflection causes more friction at the edge of the tires, making the outside edges of the skid mark darker (below). Since the rear tires are being “lifted”, they become **Underdeflected**. Because there is less weight on the rear tires, there is less friction. This causes a rear tire mark to be lighter and not as wide as the front tire mark.

The math formulas used by a collision investigator to determine speed and braking on a vehicle equipped with **Anti-lock brake systems (ABS)** vehicles will be adjusted due to the different braking efficiencies of those vehicles. .

Other Type of Skid Marks

There are three other types of skid marks that you will see on the roadways.

- Gap Skids
- Skip Skids
- Rear wheellock up

Gap Skids

In a gap skid the tires are locked, released, and locked again. The distance between gaps is usually 15 to 20 feet. Gap skids are commonly associated with car vs. pedestrian or bicycle collisions. The driver may release the brake because he or she is uncomfortable with skidding or they realize that it is not working. This is called a reflex reaction. The gap may also be caused by the driver “pumping” the brake or their foot may have slipped off of the brake pedal. Do not assume that the point of impact is within the gap. Gap skids should be measured as two separate skid marks (left).

Skip Skids

A skip skid is caused by a locked tire "bouncing" down the road. The length of each skid mark is only a few feet and the distance between these marks usually does not exceed three feet (right). The most common cause of skip skids is an empty or lightly loaded semi-trailer. Semi-trailers have air brake systems that are prone to leaks. Every axle on the trailer has a "maxi brake" (parking brake) that works off of a compressed spring. When engaged, the maxi brake locks the wheel. Air in the system is what keeps the maxi brake from being engaged while the truck is moving. If the integrity of the air system is compromised, the maxi brake may engage while the truck is underway. This type of skid mark is very common. When measuring, the gap should be ignored and the entire length should be measured as one mark.

Rear Wheel Lock-up

What keeps a vehicle skidding in a straight line is the stability of the locked wheels in the front. A locked wheel will always want to lead. So what happens if only the rear wheels lock? The vehicle will skid in a straight line for a few seconds. But because the front wheels are still rolling the vehicle will lose lateral stability causing the rear wheels to come around to try to lead the car. If the vehicle is going fast enough, it will spin 180°. A rear wheel lock-up will resemble a critical speed scuff (below, left). As the rear wheels come around, they will start to track outside of the front wheels. This will cause striation marks as the wheels sideslip. However, the rear wheel lock-up should show evidence of the rear tires skidding straight before they start to come around.

If you want to see good examples of rear wheel lock-ups, go and see a movie with a good chase scene. Stunt cars have controls that allow the driver to independently control each brake caliper. By locking one or both of the rear brakes, the driver is able to quickly bring the rear of the car around and make sharp, fast turns.

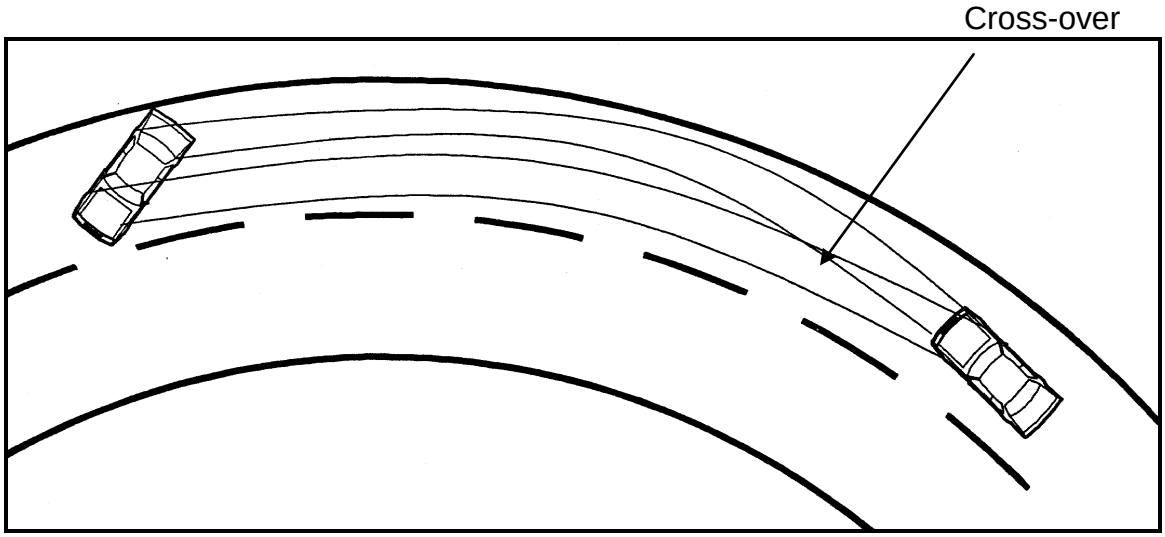
Scuff Marks

A scuffmark differs from a skid mark because a rotating tire, not a locked tire, causes it. Scuff marks include:

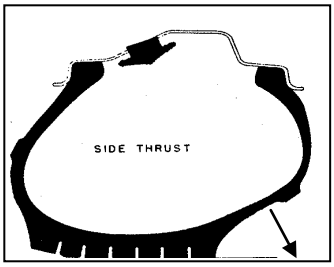
- Critical speed scuff (yaw mark)
- Acceleration scuff

Critical Speed Scuff Marks (Yaw Mark)

Critical speed scuffs occurs when a vehicle takes a turn or curve too fast and loses traction. To be more precise, the mark is caused by a rotating tire sliding sideways (side slipping). Over-steering will also cause this. A scuffmark is also known as a "yaw" mark. "Yaw" is an old sailing term. It is when a boat rotates about its vertical axis as it moves along its path. This can also be applied to vehicles and airplanes. A car that makes a turn or a curve at a safe speed (not side slipping) will have its rear tires track inside of its front tires. A vehicle that is side slipping will have its rear tires track *outside* of its front tires. If the vehicle is side slipping long enough, the drivers' rear tire and the passenger's front tire will "cross-over" (below).

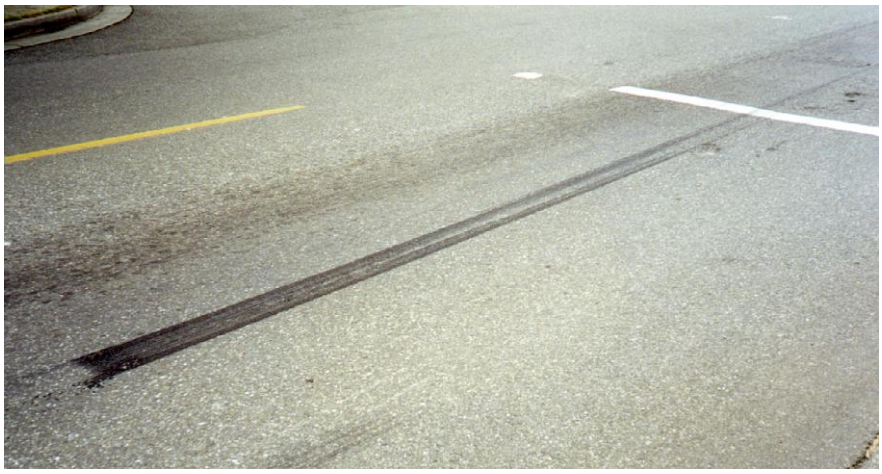


A yaw mark will be noticeably different from a skid mark. Obviously it will be curved. A yaw mark will also have diagonal striations and a scalloped edge (right). These marks are generally shorter than skid marks.



This distinct mark is caused by the outward weight shift of the car causing the side-rib and side-wall of the tire to cuff against the road surface (right). Because the tire is continuously rotating, bringing a new area of tire in contact with the road surface, there is less friction and the mark will generally be lighter than a skid mark with the darkest marks are from normally from tires on the outside of the curve. Depending on the speed, radius, and weight transfer, a yaw mark may be barely visible.

Acceleration Scuffs



An acceleration scuff occurs when enough power is supplied to a drive wheel to make it lose traction and spin. This causes a lot of friction in a small area of road surface. For this reason, an acceleration scuff on hard pavement will leave a distinct mark. The beginning of the mark will be dark and then get lighter as traction is gained and there is less friction (above, right).

Unlike a skid mark, a driver can steer the vehicle as it leaves an acceleration scuff. Sometimes the beginning of the scuff mark will resemble a hook (left). This occurs when the vehicle is going backwards when the power is applied to spin the wheels. Although the wheels are spinning forward, the vehicle will continue backwards a little before enough traction is gained to begin its forward motion. This is what leaves the hook mark.

Imprints & Scrubs

A tire print, or imprint, is caused when a tire rolls over a soft surface such as snow or mud. There is no slipping or sliding. An imprint can also be left after a vehicle tire rolls over a liquid, such as oil or water, and then leaves a print of the tire on a dry surface. Usually an imprint will show the tread pattern of the tire that left it. However, unlike a skid mark, the darkness of the mark should be even across the entire width of the mark.

A scrub mark can actually be defined as a type of skid mark because a locked tire causes it. The difference is that the tire is locked due to damage to the vehicle (not necessarily the wheel), and not because of braking. A scrub mark may also be caused when a vehicle is hit from the side and suddenly forced momentarily to the side. This would lock the tires as the vehicle moves sideways, leaving a scrub mark.

Road Scars

A road scar is a mark, left on the road surface or a fixed object, as a result of a traffic collision. Road scars can be broken down into two general categories:

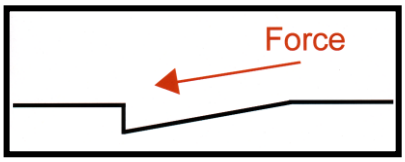
- Scratches
- Gouges

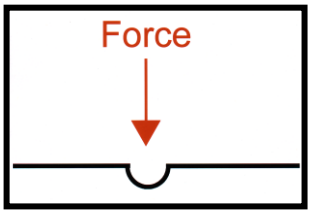
Scratches are made when a metal object is lightly dragged across the road surface. They are so light that you should not be able to feel them if you run your finger across the surface. Paint transfer left on the road surface may also cause a scratch mark.

Gouges are deep marks that are a good indication of the location of the vehicle at maximum engagement. A gouge is deep enough that your finger should feel it. There are three different types of gouges:

- Chops
- Chips
- Grooves

A ***chop*** is a broad, shallow gouge. The mark may look like somebody swung an ax into the pavement at an oblique angle (right)





A ***chip*** is a short and deep gouge. Protruding nuts on the undercarriage making contact with the road surface usually causes this mark. The mark will look like somebody chipped a small hole in the road with a chisel or pick ax (right).

A ***groove*** is a long, narrow gouge mark. Grooves can be either straight or curved, depending on the path of the vehicle. Remember that this differs from a scratch because it is deep enough to be felt with a finger.

All of these road scars are useful in determining the location of the vehicle at the time the mark was made. This may require you to inspect the undercarriage of the vehicle to look for fresh, bare metal on protruding parts.

Debris

Although debris is not thought of as a roadway mark, it still may be important evidence. Debris is defined as any loose material that may be scattered about your scene. Debris is considered short-lived evidence. Some debris may include:

- ❖ Vehicle parts
- ❖ Fluids
- ❖ Bodies and parts/clothing
- ❖ Cargo
- ❖ Undercarriage debris

Vehicle parts are very susceptible to movement during and after the collision. If the parts are small enough they may be moved by vehicles arriving at the scene or be kicked around by people on foot. While their location should be documented, be aware that their final resting position may not be where they were first deposited. Some of these parts may have definite evidentiary value – document them as soon as possible. The make and model of a vehicle involved in a hit & run collision may be determined from parts left at the scene. Broken tempered glass thrown from the vehicle may be useful in determining direction of travel and even speed.

The way that ***fluids*** from a vehicle or a body behave may assist you in investigating a scene. Fluids appear on the road surface in six different ways:

□Spatter □Dribble □Puddle □Run-off □Soak-in □Tracking

Spatter occurs when a container, holding liquid, collapses or is crushed because of the collision. The result of this is that the liquid is forcefully pushed out and splashes on the road surface. This is a good indication of the location of impact.

Dribble occurs when the liquid drains from the damaged container as the vehicle moves to final rest. This would be a good indication of the angle of departure the vehicle took after the collision.

A ***puddle*** forms when the vehicle stops moving and the liquid continues to dribble out. This may be important evidence if the vehicle is moved before you get to the scene.

Run-off occurs when the vehicle stops on a slope. The liquid will run downhill. The run-off will show the crown of the roadway.

Soak-in is what happens when a soft shoulder or soil absorbs the liquid. You will usually see this at the end of the run-off.

Tracking is when a vehicle leaves a print after its tire rolls through a puddle.

When documenting the locations of ***bodies*** at a scene, keep in mind that they may have been moved by aid crew or other people trying to render first aid. **Personal effects** located at the scene may also be helpful in determining contact point, especially in pedestrian/bicycle versus vehicle collisions. Look for blood and clothing left on the roadway as well as shoe scuffs and clothing transfer.

Like shattered glass, spilled ***cargo*** may be a good indication of direction of travel of the vehicle that was carrying it. However, depending on the weight and shape of the cargo, it may be deflected off of its original path once it hits the ground.

Underbody debris is the junk that accumulates under our cars. This could be mud, rust, snow or even gravel. When a collision takes place, this debris may be jarred lose and fall to the ground. This may give you a general idea of the point of impact.