Traction Loss Concerns

21

Contents

Foresight is a characteristic of the good driver. Certain road conditions present problems of loss of traction, or at least, reduced-traction. Selecting driver inputs that maintain the balance and stability of your vehicle are a prime consideration in these types of driving environments.

Foresight also relates to mental preparation. You need to prepare yourself mentally for the hazards of the ever-changing seasons and driving environments. Be aware of the reduced traction conditions and how to adapt. Know the limitations of your vehicle, and input vehicle controls that remain within these limitations.

Don't leave it to chance; your safety depends on proper preparation of your vehicle and yourself.

AFTER COMPLETING THIS CHAPTER, THE STUDENT MUST BE ABLE TO RECOGNIZE, IDENTIFY, AND CHOOSE APPROPRIATE COUNTER MEASURES FOR:

- adverse road conditions.
- vehicle imbalance.
- driver errors.
- loss of vehicle control.

21-A Road Conditions

When asked about traction loss, skidding, or problems of steering control, most drivers think of winter with wet snow or ice-covered roads. In fact, skidding is a major contributor to traffic crashes at all times of the year. To understand traction conditions, you must comprehend some basics.

INERTIA

Sir Isaac Newton, the British scientist, stated three laws dealing with motion.

The first law is called the **LAW OF INERTIA**.

THIS LAW STATES, IN PART:

A body at rest tends to remain at rest (**static inertia**).

A body in motion will continue in a straight line unless some force acts upon it (**dynamic inertia**).

Vehicle control (and the occupants) are affected by inertia. You have felt the effect of acceleration (**static inertia**), of deceleration (**dynamic inertia**), and of the vehicle turning a corner or in a curve (**dynamic inertia**).

The more kinetic energy) the vehicle and the occupants accumulate, the greater the effect of inertia pulling towards the outside of the curve (commonly referred to as **centrifugal force**). In a curve, the sharpness of the change of direction is also a factor that increases the force.

For your vehicle to turn, the traction of the tires (commonly called **centripetal force**) must exceed the effect of inertia. If it does, the vehicle will follow the travel path that you intended. If it does not, the vehicle will skid off the roadway. (A blowout is possible if the force exerted exceeds the tire sidewall strength.)

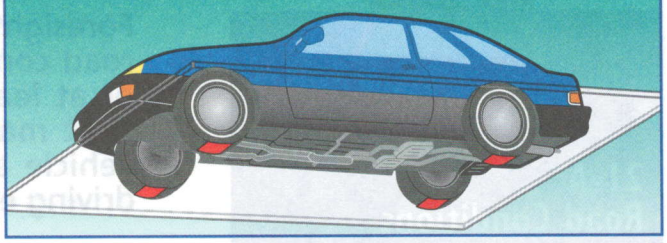
FRICTION

Friction is the resistance to motion between two objects in contact with each other. This resistance to slipping between the four patches of rubber and the road surface, produces the **TRACTION** that is used to control your vehicle.

These four traction points are used to:

- **put your vehicle in motion**
  Press the accelerator, the drive wheels turn rubbing against the pavement; your vehicle advances or reverses.
- **change the direction of your vehicle**
  Turn the steering and the front wheels turn. They rub against the road causing the vehicle to change direction.
- **stop your vehicle**
  Apply the brake pedal and the brake system

TIRE CONTACT WITH THE PAVEMENT



slows the rotation of the tires. They react against the pavement slowing the vehicle.

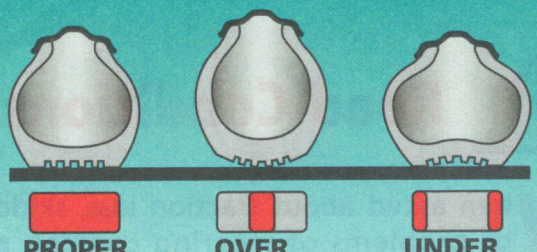
The amount of traction produced is limited, even when all the factors are ideal. When driving, you must avoid making the situation worse by dividing the available traction. When you brake in a straight line, you can use all the available traction for braking. If, however, you brake and steer, or accelerate and steer, you divide the available traction. If traction requirements exceed the amount available, the vehicle will skid.

THE FACTORS AFFECTING TRACTION

TIRES: Tires are designed with grooved surfaces called treads. These are designed to channel water, snow, etc. through the grooves and keep the rubber in contact with the road. Different tread patterns are intended for special uses such as snow tires.

Tire inflation is also very important. As shown in the diagram, properly inflated tires produce the largest "footprint" with the pavement; therefore giving the best traction. (Under

INDIVIDUAL TIRE "FOOTPRINT"



PROPER INFLATION | OVER INFLATION | UNDER INFLATION

NEW TECHNOLOGY: TPMS
The tire pressure sensor monitor lights up to alert the driver if tire pressure is too low (and too high - in some cases).

SAFETY TIPS

If you drive on under-inflated tires, ***the temperature of the tire rises and you risk a blow-out.*** *Tires lose pressure under normal conditions. They can also lose pressure due to hitting curbs, crossing potholes, etc.* ***Checking tire inflation with a good tire gauge is essential!***

inflation causes excessive wear and overheating, and may result in a blowout.)

As the tire wears, the rubber tread thins and eventually becomes smooth (bald tire). The best traction for all weather conditions is produced when the treads are in good condition.

THE ROAD SURFACE: The best traction is available on smooth dry pavement. Any variation, and the friction factor diminishes accordingly. Refer to the chart, the starting point is a friction factor of 1; a stationary vehicle parked on a flat smooth surface with the brakes applied (**static friction**). It has the greatest resistance to movement.

FRICTION FACTORS	TYPES OF SURFACE
0.9	Smooth dry asphalt
0.70	Average dry pavement
0.60	Wet asphalt-based concrete
0.50	Dry or wet gravel
0.40	Wet concrete, wet and oily gravel
0.35	Average damp pavement and melted ice
0.20	Muddy and frozen asphalt
0.05	Ice

SPEED: There is greater traction between a stationary wheel and the road than there is between a rolling wheel and the road (**rolling or dynamic friction**). There is less traction when the wheel is sliding (**sliding friction**) , than when it is rolling. This is why you must keep the wheels rolling and not lock the brakes when trying to steer a vehicle that is sliding. The Anti-lock Braking System applies this concept when you apply the brakes.

The speed at which you drive also decreases traction. As speed increases, distortions in the tire shape reduce the surface area touching the pavement. The increased air flow under the vehicle, as your speed rises, tends to reduce the pressure exerted by the weight of the vehicle on the tires. Both of these factors cause a decrease in traction as the speed of your vehicle increases.

MECHANICAL CONDITION: The wheel alignment, the suspension, and the steering will reduce traction when not in proper operating condition. One example: the shock absorbers are intended to keep the tires in contact with the pavement. When in poor condition, the tires tend to skip on the pavement, causing loss of contact and reduced traction, as well as premature "spotty" wear of the treads.

VEHICLE BALANCE

Driver inputs - acceleration, braking, and steering - also cause a transfer of the concentration of weight from one point on the vehicle to another.

Acceleration transfers weight to the rear, lightening the front and reducing front traction. Conversely, braking transfers weight to the front, lightening the rear and rear traction. Steering input transfers weight to the opposite side of the vehicle; steer left - the weight transfers to the right. Two inputs produce two transfers. The driver must minimize weight transfer or utilize it to increase vehicle control.

Moreover, vehicle balance can also be affected by some mechanical or vehicle factors. If the brakes are not properly adjusted, the application of the brake pedal will apply different braking actions at the wheels, causing an imbalance that can result in loss of control. Uneven tire wear or inflation will produce different coefficients of traction at the wheels, resulting in an unforeseen shift in the balance

of the vehicle when you input any changes in vehicle control.

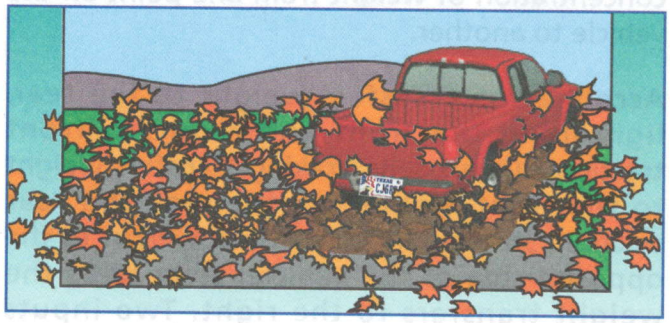
Another problem, which should never occur, is created when a driver installs different tires (size, manufacturer, etc.) on the same axle of the vehicle. This is especially dangerous on the front axle of front wheel drive vehicles. Many crashes have been caused by this error.

ROAD SURFACE CONDITIONS

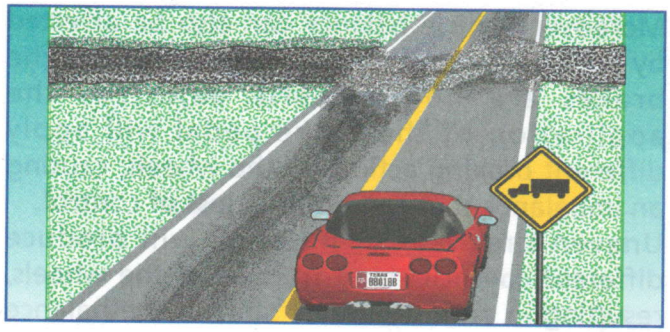
Besides the factors already mentioned, other road surface conditions require special adaptations.

SAND or **GRAVEL** on the pavement acts like tiny ball bearings between the tires and the road. Avoid turning, braking or accelerating while crossing the sand or gravel. Reduce your speed before this hazard and coast over it. Resume speed once you are safely past the danger.

FALLEN LEAVES on the road reduce traction (especially when wet). Maneuver gently. Increase your following distance and, if you must brake, use a gentle pumping action to counteract the layers of leaves that slip against each other.

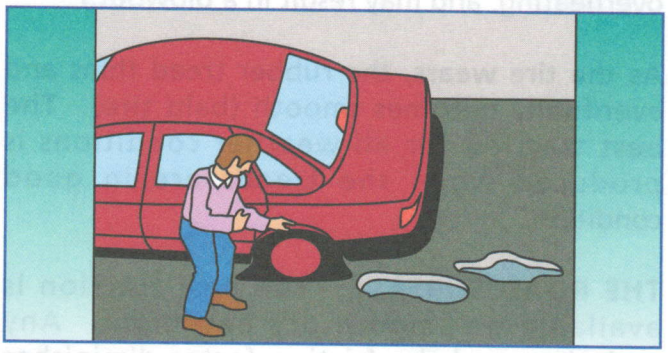


HEAVY VEHICLE or truck crossings, and the immediate vicinity, may have the pavement coated with mud, earth, sand or gravel.



Anticipate this possibility and reduce your speed.

POTHOLES or bumps in the pavement occur more frequently during the spring thaw season. However, you should be on the lookout for them whenever you drive.



It is advisable to avoid them by driving around them whenever safety permits. They can prove disastrous to rims, tires, suspension, and steering components. In order to maintain control of your vehicle and minimize damage, when you cannot avoid the hazard, **you should:**

- Check your rear-view mirror.
- Activate the hazard lights.
- Reduce speed as much as possible.
- Release the brakes just prior to the hazard (allow suspension to stabilize - weight transfer).
- Roll over the hazard (clutch depressed in standard transmission).
- Return to normal speed.
- Deactivate the hazard lights.

If you were unable to slow sufficiently to roll over the hazard at a safe speed (the impact felt severe), leave the hazard lights operating and look for a place to park. Check for damage before proceeding.

APPROACHING UNPAVED ROADWAYS

Two hazards are usually present; gravel on the paved portion of the roadway near the end of the pavement, and potholes on the gravel side, just after the end of the pavement.

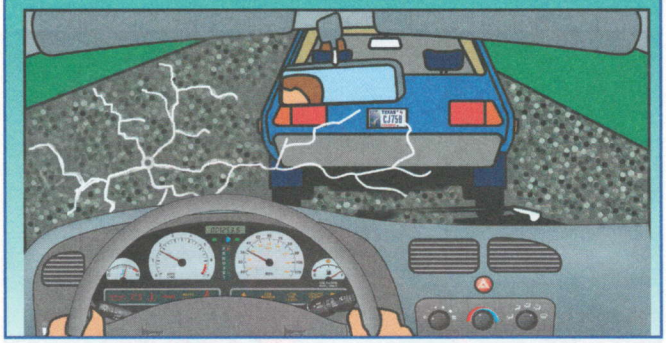
Think ahead; reduce your speed while approaching the end of the pavement. You will avoid sliding on the gravel as you apply the

brake to reduce speed, and you will reach the potholes at a reduced speed.

DRIVING ON UNPAVED ROADWAYS

On gravel or dirt roads, traction is reduced and even more so when these roads are wet or oil sprayed. The posted speed limit on unpaved roads is lower than on paved roads; you should consider driving below the posted speed, adapting to the road conditions. Following any vehicle creates danger from the cloud of dust obscuring vision and/or flying rocks damaging the windshield or headlights.

DRIVING ON UNPAVED ROADS



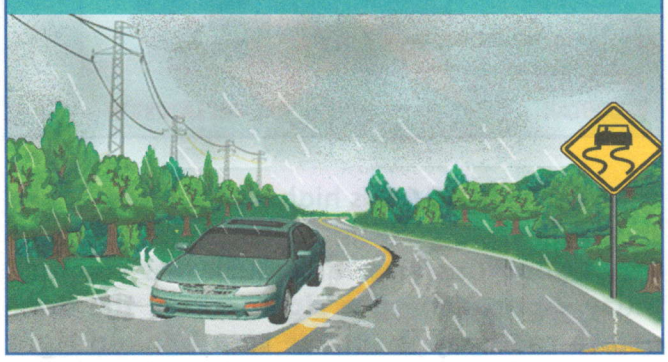
To drive safely, you should:

- Drive at a much slower speed in keeping with the reduced traction.
- Lengthen your following interval especially when clouds of dust or large vehicles block your vision.
- Avoid the ruts in the road especially when raining.

RAIN AND STANDING WATER

Rain reduces traction as well as visibility. Roads are especially slippery when the rain begins to fall after a long dry period of hot weather. The water lifts the oil and dust from the pavement causing them to float. This creates an oily film (commercial drivers call this a "sudsy" road condition), recognize the danger, and reduce speed considerably. As the rain continues, the film will wash away. The time this takes will vary with the rate of the rainfall and the slope of the roadway.

DRIVING IN THE RAIN



As the rain continues, standing water may accumulate on the road surface. Puddles, sheets of water and, in extreme cases, flooded pavement become possible hazards. (Wet snow and slush also reduce traction, hide potholes, and clog the tire treads.)

To reduce the risk:

- Reduce speed in proportion to the slippery conditions (test the traction by lightly applying the brakes).
- Lengthen your following distance.
- Check traffic all around your vehicle.
- Drive in the tracks of other vehicles (avoid ruts or grooves where water may collect).
- Be gentle and smooth with all vehicle control inputs (braking, steering, and acceleration).
- Maximize your visibility (low beams, wipers, windshield washers, defroster, defogger, ventilation, HVAC, and air conditioning).
- Activate the hazard lights (extreme cases).

The mechanical condition of the vehicle should have been checked. If the tires and their inflation, the brakes and their adjustment, as well as the suspension are not in proper working order, they will negatively affect your ability to control your vehicle in these reduced traction conditions.

When approaching puddles and sheets of water, they may be deeper than they seem, or they may hide potholes. Avoid them if possible. Be aware of and try to minimize the splashing that will ensue for your vehicle and also for pedestrians.

Rainy weather also presents hazardous situations such as flash floods, deep puddles, hydroplaning, and loss of brakes (wet brakes). Review Chapter 18 for how to adapt to these rain-related dangers.

CURVES

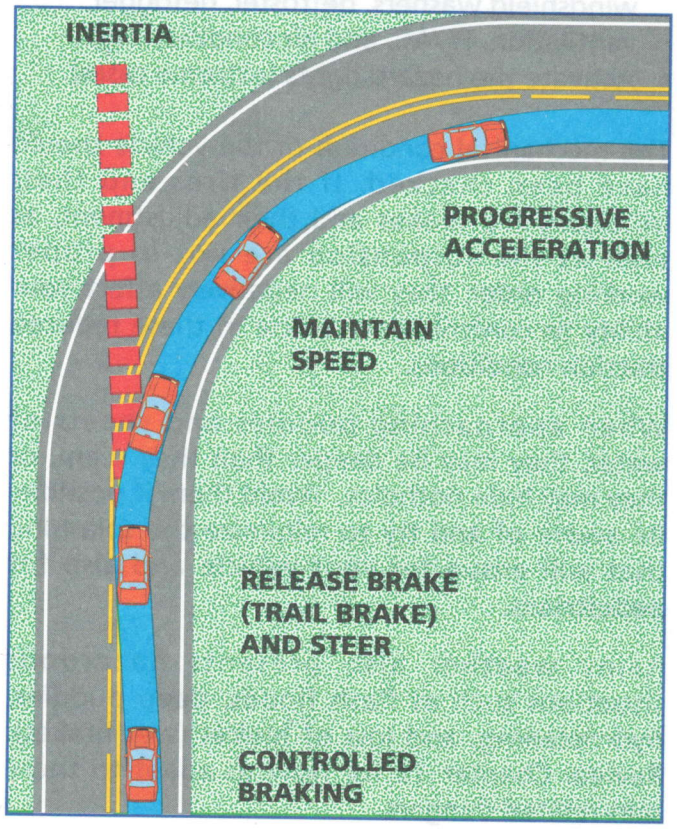
You have no control over the sharpness of the curve or the weight of your vehicle; **you do have control of your speed.**

If you brake on a curve, you divide up the available traction that is needed to steer. As well, you further upset vehicle balance (two inputs - two weight transfers) that is already reacting to the effect of inertia.

Nearing curves, **reduce speed while driving in a straight line**, respect suggested speeds, check the sharpness of the curve, and verify the slant (sideways slope) of the road.

As you reach the curve, **ease off the brake (or trail brake) and then steer** by aiming as far ahead as possible into the curve, and input smooth steering control.

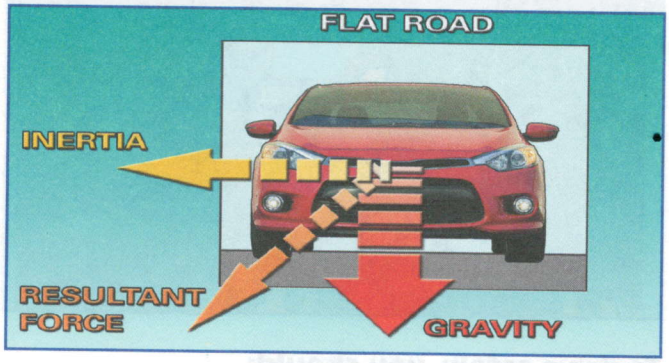
While rounding the curve, **apply a slight pressure on the accelerator to maintain speed,** as well as vehicle balance (to minimize weight transfer). When your line of sight extends far down the roadway (straight), begin to **straighten the steering wheel, and accelerate smoothly as you exit.**



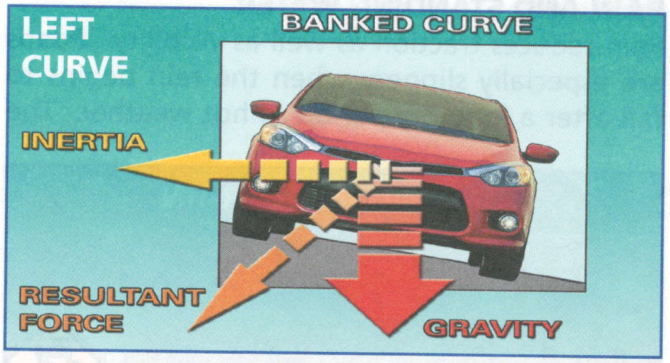
THE SLOPE OF THE ROAD

The slope of the road surface on a curve will affect the ability of your vehicle to follow the intended path of travel. Just as you lean into a curve while riding a bicycle or motorcycle, the engineers slope the road, on a well designed highway, to facilitate handling in the curve.

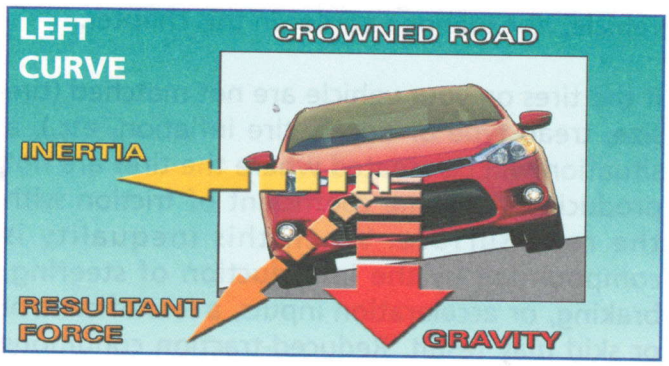
A FLAT ROAD has no slope and will not assist the vehicle in negotiating the curve. Note the resultant force arrow which indicates where the combined force of gravity and inertia (centrifugal force) is being applied. As long as this arrow remains within the wheelbase of the vehicle, control can be maintained.



A BANKED CURVE has a higher edge on the outside of the curve and slopes down to the inside. The vehicle will lean toward the inside of the curve (like a bicycle). Inertial energy (the resultant force arrow) partly pushes the tires into the pavement increasing traction. This allows you to negotiate the curve safely at a higher speed than on a flat road.



A CROWNED ROAD is higher at the center and slopes down to both sides. These curves can be very dangerous and are much less common today. **Approaching a right curve**, the slope of the roadway is similar to a banked right



curve and, as such, you do not have to reduce speed as much.

In a left curve, (see diagram above) a crowned road is very dangerous as the slope is in the wrong direction (negative slope). The resultant force can easily be outside the vehicle wheelbase, which increases the likelihood of skidding or sliding. To prevent this loss of control, you must reduce the force of inertia and keep the resultant force (orange arrow) inside the front wheels. In order to achieve this, the only factor under your control is your speed. You must reduce speed prior to the curve. **A curve with a negative slope should therefore be negotiated at a much slower speed.**

In reduced-traction driving conditions (rain, snow, etc.), all of these factors dealing with curves present a greater risk. You must adapt your speed to a multiplication of the physical forces.

When you drive vehicles with a higher center of gravity, special caution must be exercised in curves. Reduce speed more than you would when driving a car. Remember, it is better to enter more slowly; you can always accelerate gradually. If you enter too fast, a loss of control may become inevitable.

The **dead pedal** (footrest) should be used to brace yourself on curves or during sudden maneuvers to maintain a proper seating position, rather than relying on the seat belt, or hanging on to the steering wheel "for dear life." This technique permits you to maintain steering control in any driving situation.

SAFETY TIPS

***The natural forces that act upon your vehicle do not require a police officer to ensure that they are obeyed.* They are always in force. *Disregard them and the result will be a loss of vehicle control and a potential crash.* You must be aware of the laws of physics and act in good time to maintain control of your vehicle.**

21-B Vehicle Factors

Traction loss and vehicle imbalance can also result from the mechanical condition of your vehicle. In fact, at all times of the year, many traffic crashes occur because of improper vehicle maintenance. When reduced-traction conditions are present, any mechanical problem can aggravate an already hazardous situation. You are responsible for keeping your vehicle in proper running condition.

BRAKE SYSTEM

The brake system allows you to reduce speed or stop your vehicle. When you apply the brake pedal, the reaction against the pavement by each of the four tires, which reduces your speed, creates a vehicle imbalance. There is a weight transfer to the front of the vehicle. This occurs every time the pedal is applied.

If the brakes are not properly adjusted and one of the tires begins braking before the others (or brakes harder than the others), your vehicle will pull in one direction when you input braking control, instead of remaining in a straight line. This will create an abnormal transfer of weight.

If the braking action were sudden or severe, or in reduced-traction conditions, the shift would be sufficient to provoke a skid. Have the system checked by a certified service technician whenever any abnormal braking or any unusual noise occurs.

WHEEL ALIGNMENT

Though not a direct cause of traction loss or vehicle imbalance, if the wheels are out of alignment and you input steering or braking control, these two conditions can occur. Have your steering system aligned at least once a year, as well as after any serious impacts (potholes, sidewalks, or collisions).

TIRES

The four tire patches in contact with the road surface provide the traction which controls your vehicle, as explained earlier in this chapter.

If the tires on your vehicle are not matched (tire size, tread type or depth, tire inflation, etc.), a situation will be created where the tires are not producing the same coefficient of friction with the road surface. When this inequality is compounded by the introduction of steering, braking, or acceleration inputs, a loss of control or skid may result. Reduced-traction conditions will increase this risk. Check the tires regularly (inflation, and tread). Have them balanced prior to installation.

SUSPENSION

Defective shocks/springs cause tires to lose contact with the road. This also diminishes traction and can cause an imbalance. Have the suspension checked.

Driver Error

Traction loss and vehicle imbalance (resulting in crashes) can also be caused by the actions of the driver, even in the best driving conditions. When reduced-traction conditions are present, any sudden or aggressive driver inputs will normally result in a loss of control.

STEERING INPUT

Any sudden steering action on a reduced-traction surface will cause a weight transfer and most probably a traction loss. The traction requirement for the one front wheel to supply the demanded change in direction will normally exceed that which is available. The vehicle will not respond as the driver directed. A skid or sliding action will result.

When excessive speed is combined with an abrupt input of steering control, the same result occurs in ideal driving conditions, and for the same reason.

BRAKING INPUT

Any hard application of the brake pedal (panic stop) on a downhill grade, in a curve, or on a slippery road surface will cause a sudden weight shift to the front of the vehicle. The extra weight combined with the braking input will cause the front brakes to lock (not with ABS). This precipitates a sliding reaction with a loss of traction. The same result occurs when you brake hard at excessive speed.

ACCELERATION INPUT

Any abrupt changes in vehicle speed will cause a transfer of weight to the rear and wheelspin at the drive wheels (not with TCS). On an icy or slippery road surface, as well as at high speeds, the resulting loss of traction may initiate a skid or loss of control.

SIMULTANEOUS ACTIONS

Any combination of vehicle control inputs (steering and braking, or steering and acceleration) will place excessive requirements of traction on one or more of the tires. The traction available will not satisfy the demand. The tire (or tires) will lose traction and slide.

SOLUTIONS

The first step is to recognize the warning signs of impending traction loss. You must notice the weight transfer. You must recognize and understand the meaning of the front of the vehicle rising, the front of the vehicle moving downward, or the hood movement downward at one corner and upward at the other corner. This will permit you to identify which part of the vehicle is about to lose traction in order to implement the correct response for this situation.

Remember, when traction loss occurs, this will compound the problem of regaining control and the crash consequences.

Skid Control

A vehicle can lose traction in the front or rear when the driver steers, brakes, or accelerates improperly for the situation. The resulting traction loss will be to either the front or the rear tires.

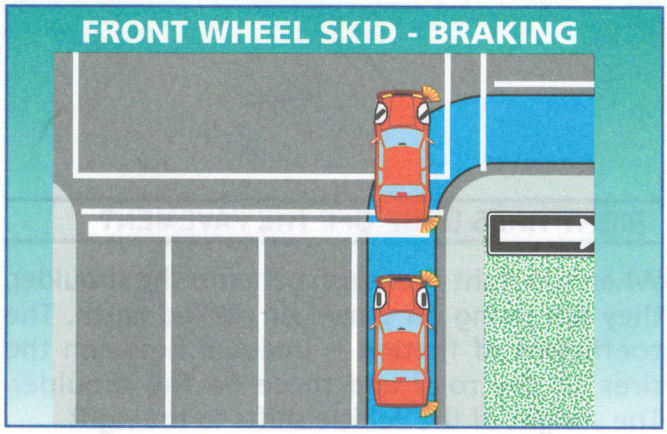
FRONT WHEEL SKIDS

The front wheels slide and your vehicle continues straight ahead.

Braking skid (excessive brake pressure)
The front wheels slide and the vehicle will not respond to the steering. It stays straight.

WHAT TO DO

- Release the brake pedal.
- Look and steer in the desired direction.
- Reapply the brake more gently to continue reducing speed.



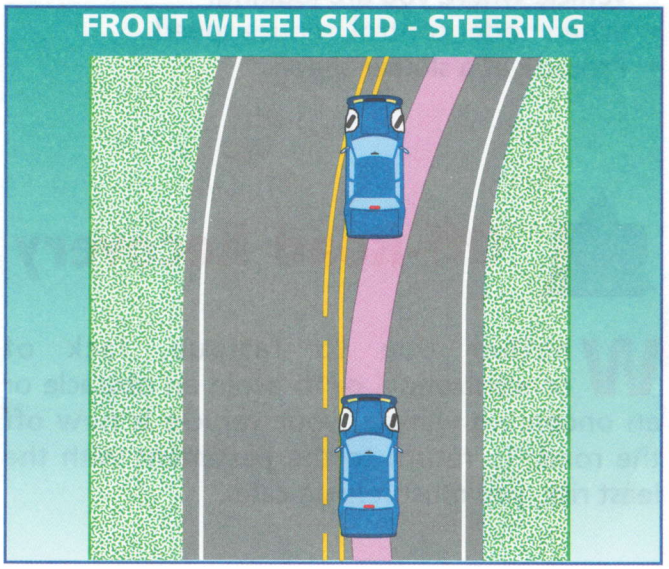
Steering skid (understeer)

1) A sharp turn of the steering wheel and your vehicle continues straight. (Tires tend to roll under.)

WHAT TO DO

- Unwind the steering wheel slightly to regain steering control.
- Reestablish front wheel rolling traction. Jab the brake to shift weight forward, encouraging rolling traction.
- Look and steer in the desired direction.

2) **With a front wheel drive vehicle**, while accelerating, you turn the steering and your vehicle continues straight



WHAT TO DO

- Shift to neutral (depress the clutch).
- Re-establish rolling traction. (With ABS, applying the brake is a helpful tool to regain steering, while slowing.)
- Look and steer in the desired direction.
- Reduce your speed after the turn.
- Re-engage the transmission and proceed at a slower speed.

REAR WHEEL SKIDS (OVERSTEER)

The rear wheels slide and the rear of your vehicle moves to the right or left.

1) **While turning**, the rear of your vehicle slides towards the outside of the curve.

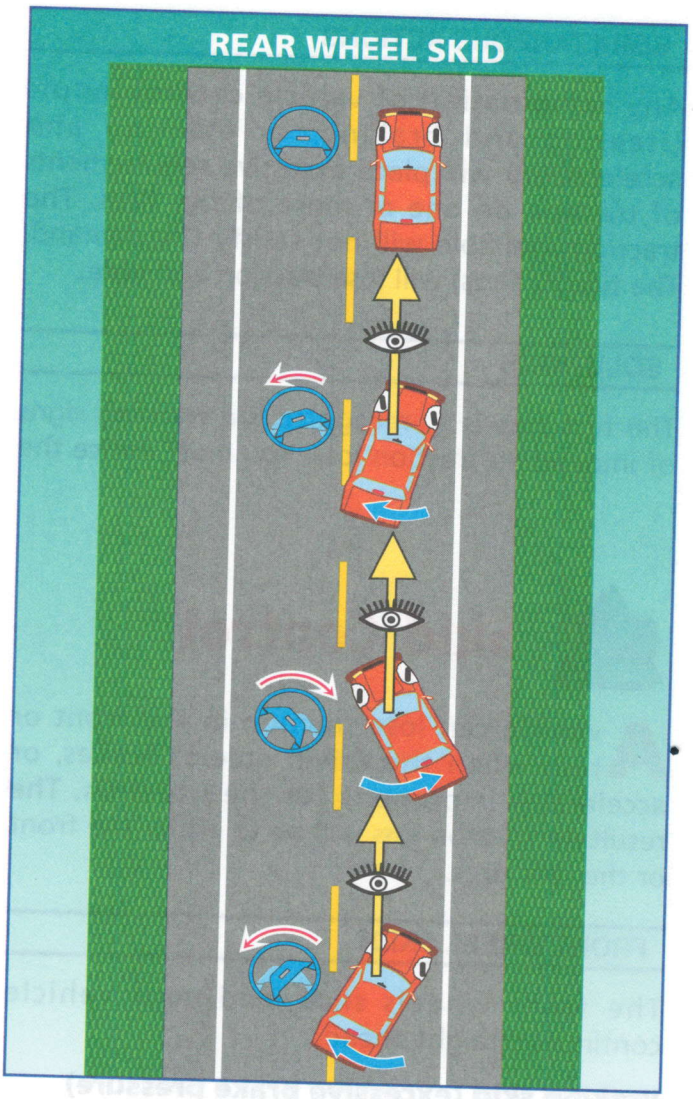
2) **While driving** in poor traction conditions, you downshift, release the accelerator quickly, or accelerate sharply, and the rear of your vehicle begins to skid to the side.

WHAT TO DO

- Ease off the pedal (brake or accelerator).
- Look and steer in the desired direction. (Light progressive acceleration will help return rolling traction to rear wheels, if TCS/ESC/ESP equipped.)

As you straighten from the skid, the rear of your vehicle may begin to slide in the opposite direction (fishtail, lateral force).

- Keep targeting your path of travel.
- Steer quickly and smoothly to direct your vehicle where you are looking.
- When under control, reduce speed.
- Proceed at a slower speed.



ABORT - RETRY

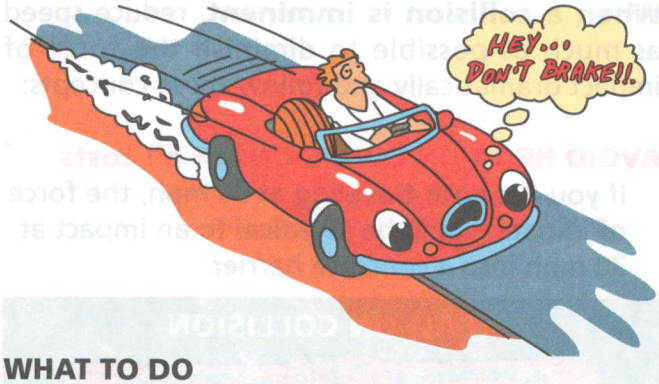
As in all driving maneuvers, if at first you don't succeed, don't give up. Keep trying to correct the situation, and you will succeed. A course in skid control would be well advised.

Off-Road Recovery

Whether due to fatigue, lack of concentration, or to avoid an obstacle or an oncoming vehicle, your vehicle is now off the road. To return to the pavement with the least risk, you must remain calm.

RIGHT TIRES DROP OFF THE PAVEMENT

When the right tires drop off onto the shoulder, they are riding on gravel or packed earth. The coefficient of friction is unequal between the tires on the road and those on the shoulder. The weight of the vehicle shifts to the right.



WHAT TO DO

- Grip the steering firmly.
- Stabilize your vehicle parallel to the pavement (weight transfer).
- Ease off the accelerator and allow the vehicle to reduce speed (to 20 mph; do not brake - traction is unequal).
- Check traffic, mirrors, and blind spot.
- Activate the left turn signal.
- Turn the steering wheel 1/8 to 1/4 turn towards the roadway.
- When the right front wheel climbs the edge, countersteer 1/4 to 1/2 turn to stabilize the vehicle, and then steer to center the vehicle in the lane.
- Accelerate and turn off the signal.

HEAD-ON COLLISION

This is the worst type of collision as the force of impact is among the highest. Avoid a head-on collision at all costs; almost any other collision is preferable.

WHAT TO DO

- Begin an emergency stop (reducing your speed reduces the force of impact, gives you more time to act, and may give the other driver time to recover).
- Signal with your horn and headlights.
- Select the safest path of travel (the shoulder, off the road completely).
- Ease off the brake pedal.
- Target / steer towards your open path of travel.

Once out of the way, apply the steps listed for "tires off the pavement" in order to stabilize your vehicle, and then return to the roadway.

If a collision is inevitable, choose objects that will "give" on impact or sideswipe rather than hit directly (see Page 21.16).

21-F

Controlling the Consequences

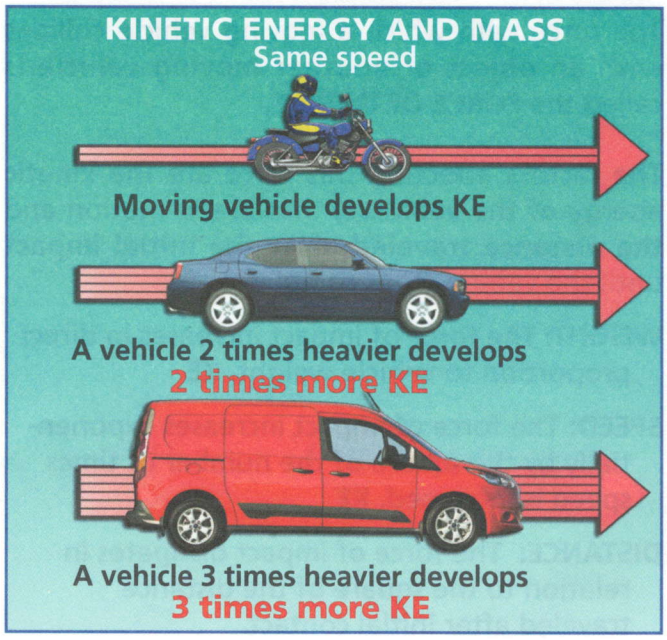
Any body in motion acquires **KINETIC ENERGY** or momentum. (The word kinetic is derived from the Greek meaning "to move") The formula for calculating this energy is **kinetic energy equals one-half the mass** (weight of the object) **times the velocity** (speed) **squared**.

$$KE = 1/2\ M\ V^2$$

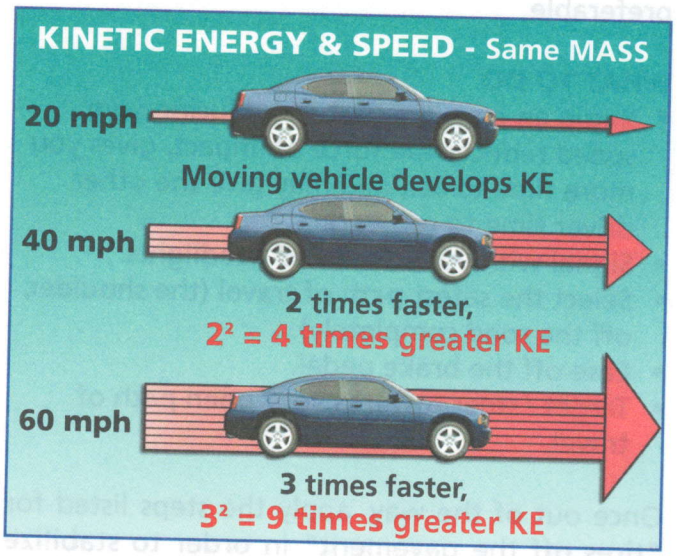
In the formula above, any increase in **MASS** (weight) **proportionally increases** the kinetic energy (**KE**) of an object in motion.

In the formula, any increase in **SPEED** multiplies the kinetic energy **by the *SQUARE* of the number of times the speed is increased**.

This acquired kinetic energy comes into play in all aspects of driving. To stop, you must



dissipate the kinetic energy by braking or by hitting another object (force of impact). **To steer**, you must overcome the momentum (inertia) of the vehicle in order to change direction (path of travel).



The most important factor in kinetic energy is your speed.

First of all, a small change in speed has a **tremendous effect** on kinetic energy.

Secondly, **this factor is under your control**. Slow your vehicle, reduce the speed by half, and the kinetic energy acting on your vehicle is only one quarter of what it was before braking.

FORCE OF IMPACT

The force with which a moving vehicle collides with an object or another moving vehicle is called the **FORCE OF IMPACT**.

The factors affecting this force are the **kinetic energy of the vehicle(s)** that are in motion and **the distance traveled after the initial impact** until the vehicle stops completely.

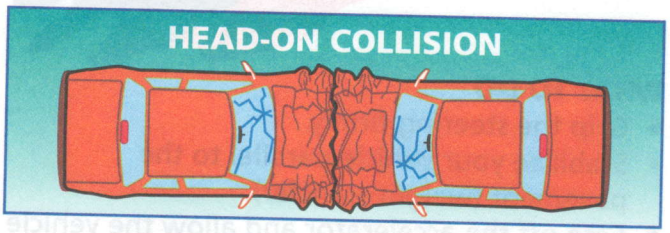
WEIGHT: The force of impact increases in direct proportion to vehicle weight. **KE**

SPEED: The force of impact increases exponentially by the square of the number of times speed is increased. **KE**

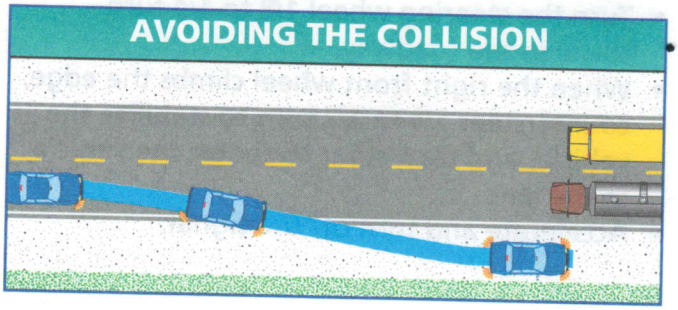
DISTANCE: The force of impact dissipates in relation to the square of the distance traveled after initial contact.

When a collision is imminent, reduce speed as much as possible to diminish the force of impact dramatically and follow these concepts:

AVOID HEAD-ON COLLISIONS at all costs If you are both traveling at 30 mph, the force of impact would be identical to an impact at 30 mph into a concrete barrier.



DRIVE OFF ROAD RATHER THAN SKID OFF the road. This will give you better directional control. You can select your path of travel and steer towards it.



STEER TOWARDS OBJECTS that will give on impact. Hit something "**soft**" rather than something "**hard**." As objects yield, the accumulated energy is absorbed in proportion to the distance it "**gives**". This diminishes the energy your vehicle must absorb and lessens the risk of injury.

HIT SOMETHING MOVING IN THE SAME direction rather than a stationary object. The kinetic energy involved will be the difference in speed. This diminishes the energy to be absorbed and increases your chance of avoiding injury.

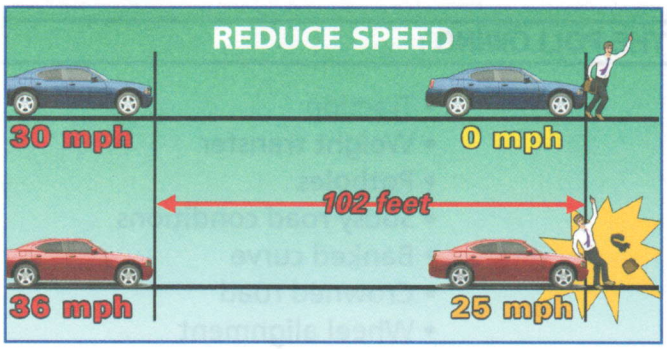
HIT A STATIONARY OBJECT WITH A GLANCING BLOW Deflecting the crash will diminish the force of impact resulting from the contact. This diminishes the energy your vehicle must absorb and lessens the risk of injury.

HIT A STATIONARY OBJECT RATHER THAN an oncoming object. The stationary object has no kinetic energy and, at the same time,

will provide a crumple zone (energy absorbing crushing). This diminishes the energy your vehicle must absorb and increases your chance of avoiding injury.

STEER TO AVOID ONCOMING TRAFFIC

Despite the fact that there will be two crumple zones available in this type of collision, there are also two kinetic energies to be absorbed.



REDUCE YOUR DRIVING SPEED

In the illustration above, two drivers in identical situations; one driving at 30 mph, the other at 36 mph. Both see a man running, react and hit the brakes within 1.3 seconds (very quickly). The slower blue car stops in 102 feet. **The red car hits the pedestrian at 25 mph. The man is killed. No matter how good of a driver you are; a difference of 6 mph in this situation results in a 25 mph difference at the point of impact**. To diminish the consequences, slow down! **Only the DRIVER can avoid collisions. This is the best solution.**

WHEN LEAVING THE ROADWAY

Whether to avoid a collision or because your vehicle has become disabled, if you must leave the roadway, you must realize that you may be dealing with unstable surfaces (traction will be unpredictable). Be prepared for the worst case scenario.

Try to reduce speed as much as possible while still on the roadway. Check the traffic flow and make a reduced risk-decision about moving off the roadway. Communicate your intentions. Direct your vision on your targeted path of travel. Steer to your target and move off the road as gradually as possible.

Don't panic. Once off the roadway, avoid slamming the brake pedal and/or quick steering wheel movement which most of the time result in a rollover. Stabilize your vehicle parallel to the roadway with smooth, steady steering wheel actions.

Once your vehicle is stable, check the traffic and follow the steps described in Off-Road Recovery on Page 21.10-11 to return safely to the roadway and continue on your way.

RESPONSIBILITIES IN A CRASH

- Move the vehicle, if possible, to avoid blocking the flow of traffic, and to protect it from further loss or damage.
- Call the police if someone is killed or injured - a vehicle cannot be moved - or the collision involved a hit-and-run driver. Uninsured motorist insurance coverage pays for damages only if the crash is reported to the police.
- Help the injured and call for skilled professionals as soon as possible.
- Exchange and record the required information with the other driver (make sure the insurance company name and policy number are exact).
- Obtain the names, addresses, and telephone numbers of witnesses.

If you damage an unattended vehicle or property, you must either locate the owner or leave your name, address, the name of the owner of the vehicle you were driving, and a statement of the event on the damaged vehicle/property where the owner will find it.

You must report the incident to a law enforcement agency for investigation.

SAFETY TIPS

No one can predict when a collision will occur. A tenth of a second can be the difference between a minor crash and a fatal collision. When a crash occurs, the single most effective safety device is the safety belt. Protect yourself and your passengers - buckle up!

DRIVING PLAN

The student formulates a Driving Plan incorporating the knowledge and skills of Module Nine (Adverse Conditions) to endorse, to promote and to sustain lifelong legal and responsible reduced-risk driving practices in the HTS.

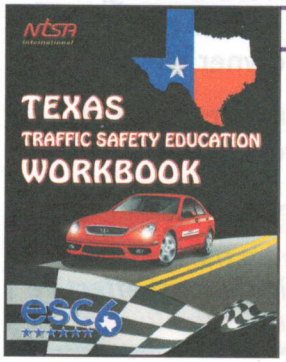
Module Nine Review

VOCABULARY - WRITE A SHORT DEFINITION FOR THE FOLLOWING :

- Foresight
- Arroyo
- Flash floods
- "Sudsy" conditions
- Hydroplaning
- Air turbulence
- Over-driving your headlights
- Dash lighting
- Glare
- Night mirror
- Smog
- Fog lights
- Sun visor
- Survival kit
- Traction aids
- Inertia
- Friction
- Traction
- Weight transfer
- Potholes
- Sudsy road conditions
- Banked curve
- Crowned road
- Wheel alignment
- Head-on collision

TEST A- ANSWER THE FOLLOWING QUESTIONS.

1. A) Describe the adverse driving conditions that Texas weather presents to drivers.
   B) How should you adapt to each condition to reduce the risk?
2. A) Describe the adverse visibility conditions that occur in Texas.
   B) How should you adapt to each condition to reduce the risk?
3. A) Explain the National Weather Service's "Turn Around Don't Drown" Program
4. A) Which road conditions can create traction loss conditions?
   B) How can you reduce the risk in each traction loss condition identified?
5. A) Name examples of situations where other road users can suffer traction loss and impact on your driving.
   B) How can you reduce the risk in each of these situations?
6. A) How would you control the consequences when a collision is imminent?
7. A) What are your obligations at a crash scene?



TEXAS TSE STUDENT WORKBOOK

*Check your comprehension and mastery of the contents of this Module by completing the corresponding exercises that are found in the complement to the **TEXAS TSE STUDENT MANUAL:***

TEXAS TSE STUDENT WORKBOOK

Complete the assigned questions in the workbook. If necessary, review the chapters when uncertain of an answer and refer to your instructor for further guidance.