



## **LESSON 1** Hill and Mountain Driving



## **LESSON 2** Skids



## **LESSON 3** Avoiding or Minimizing Crash Damage



## **LESSON 4** Challenging Environmental Factors

### **What Environmental Challenges Can Affect Vehicle Control?**

You and your vehicle's limits may be tested when you need to steer, brake, or accelerate under adverse conditions in the environment outside the vehicle. Mountain driving poses special challenges. One of the biggest problems is managing a skid when traction is lost. If you know the possibilities that can occur, you can be prepared to successfully control the vehicle regardless of environmental conditions.

**Driver Ed**  
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# Hill and Mountain Driving

## OBJECTIVES

1. **Describe** how to drive uphill and downhill.
2. **Describe** the procedures for safe driving on mountain roadways.

Mountain driving presents special problems for you as a driver. Driving on hills takes extra effort and more concentration on steering and speed control, regardless of whether your vehicle has an automatic transmission or a manual transmission. It is more difficult to control your speed as you go up and down hills, and your visibility and stopping distance are also affected in this driving environment.

## How Do You Drive in the Mountains?

Driving on hills or mountain roads isn't easy. Roads are often curved, with reduced visibility, and grades may be steep. Shoulders may only be on one side of the road, with a sharp drop on the other side. Because of the force of gravity, you need to use extra care to be able to control your vehicle under these conditions.

### GRAVITY IN THE MOUNTAINS

Whenever you drive, you always have an invisible passenger with you. That passenger is the force of gravity. Gravity works both inside and outside your vehicle at the same time.

When you drive uphill, gravity pulls against your vehicle, so you need to use more power. When you drive downhill, gravity is working with you, pulling you down faster, so you need to use less power, and you may have to use your brakes. For more information about how gravity affects your vehicle, see Chapter 12.

Whether you are driving uphill or downhill, the force of gravity is pulling on your car. **How does gravity affect the power of your vehicle when driving uphill and downhill?**





## DRIVING UPHILL

As you drive uphill, your vehicle needs more power in order to keep moving at the same speed. When driving up a mountain, you sometimes encounter steep grades, which require a lot more power. You'll need to push the accelerator pedal harder, of course, but exactly how you provide that power depends on whether your vehicle has an automatic or a manual transmission.

**Automatic transmission.** Before your vehicle begins to lose speed while moving uphill, slowly increase the amount of pressure you are putting on the gas pedal. Notice your speedometer and pay attention to the feel of the vehicle and the sound of the engine. When you reach the speed you want to maintain, keep your foot at that point until you near the crest of the hill or need to slow down for any reason. If you have been driving in Overdrive, shift to Drive just prior to going uphill; this will give your vehicle more power.

**Manual transmission.** Before your vehicle begins to lose power and speed, downshift to a lower gear in order to increase the engine's pulling power. With a 5-speed manual transmission, for instance, you may have to downshift from Fifth to Fourth gear to make it up a hill. For more information on downshifting, see Chapter 5.

Listen to your engine. If the engine slows down, the vehicle is slowing down and losing power, too. If the engine revs too slowly, your power will drop dramatically. Know where your engine's best "power band" is (in revolutions per minute). Try to keep the engine near that range by selecting the proper gear.

## DRIVING DOWNHILL

As you drive downhill, gravity will cause your vehicle to gain speed, although it does it slowly at first. You will need to decrease the engine power. How you do this depends on whether you have an automatic or a manual transmission.

**Automatic transmission.** Ease up on the pressure you are applying to the gas pedal. Your vehicle will begin to coast, although your transmission will have a slight braking effect. If your vehicle begins to pick up too much speed, and the hill is small, press the brake pedal lightly to slow down. If you are going to go down a long, steep hill, it is best to move the selector lever to a lower gear before starting down the hill, if possible. Doing so gives you better control of your speed and steering and saves on braking. If you need to use the brake, use periodic light to medium pressure, depending on the size of the hill. Do not ride the brake pedal. When brakes are applied continually down a long hill, the buildup of heat will reduce the efficiency and friction of the materials and "brake fade" will occur. It will feel as if the brakes are failing.

**Manual transmission.** If you are going to go down a long, steep hill, it is best to downshift to a lower gear before you start down the hill. For instance, with a 5-speed manual transmission, you may need to downshift from Fifth to Fourth gear. Doing so gives you more control over the speed of your vehicle. In a lower gear, taking your foot off the accelerator will slow down the car more than in a higher gear. If you wait to downshift until you are moving downhill and picking up speed, you will gain a little speed while you have the clutch depressed. Therefore, you may need to apply the brakes a little while

## Did You Know?



In the 1400s, the Inca Empire stretched from the border between Colombia and Ecuador to central Chile in South America. From Cuzco, the empire's capital, roads that were well-constructed ran to all parts of the empire. The total length of this road system was about 9,500 miles, and it was designed for people on foot. Relay runners were stationed at posts along the road to carry messages and parcels quickly to and from the capital.





## Energy Tip

If your vehicle is equipped with cruise control, do not use it when you are driving uphill or downhill. It wastes gas. Save it for flat, straight roadways.

downshifting. If the hill is steep, a little braking power may not be enough to slow the vehicle. You may need to continue to apply the brakes and to downshift again. Use your brakes to slow down even more if necessary.

### RUN-OFF AREAS

Some steep hills contain run-off areas to help big trucks that are having difficulties in braking come to a stop. These run-off areas usually occur before a curve or at the bottom of a long hill, and they allow high-speed vehicles to continue off the road and then up a hill, using gravity and sometimes a soft road surface to slow down the vehicle. Usually, you will not need to use these areas unless you are driving a tractor-trailer truck or other large vehicle, but they help make you safer because they allow trucks going too fast to safely stop.

## How Is Your Visibility Limited in the Mountains?

Some special visibility problems occur in the mountains. Sharp curves, steep grades, and other vehicles limit how much of the road ahead you can see at one time, whether it is day or night.

When you come to a curve where it is difficult to see oncoming traffic, slow down before the curve. If necessary, tap your horn and flash your lights to warn approaching drivers. If you are behind a truck or vehicle with a trailer, increase your following distance, and don't pass until you are positive it is safe to do so. Most mountain roads have passing zones; don't try to pass unless you're in one of these zones. Pay attention to signs and pavement markings.

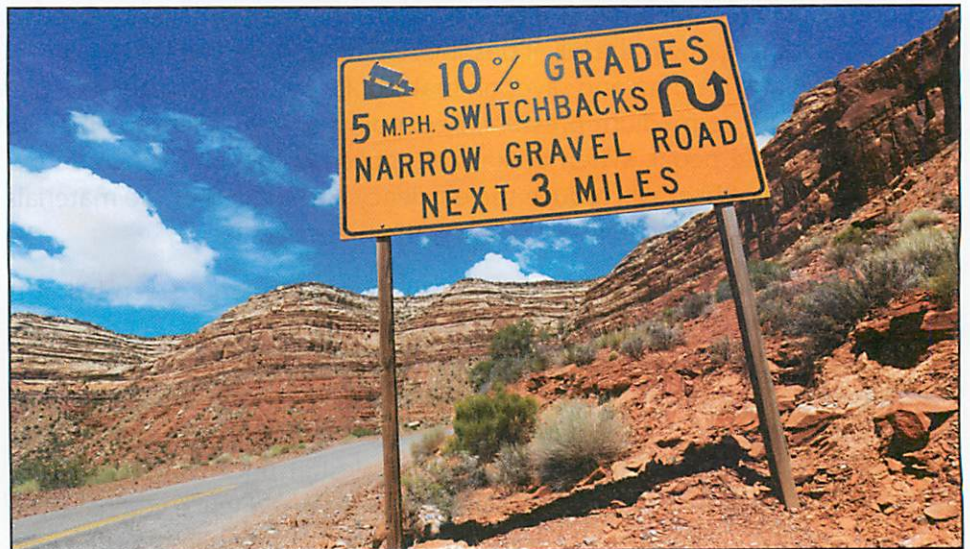
### EFFECTS OF HIGH ALTITUDE

High altitudes in the mountains can affect either the driver or the vehicle. In high altitudes, the air contains less oxygen. Lack of oxygen can cause you to feel short of breath and sleepy. Your heart may beat faster, and you may get a headache. If any of these symptoms occur, change drivers, stop driving, or find a route at a lower altitude, if possible.



Shift to a lower gear to control speed when driving down a long, steep hill.

**What is the difference between driving down hill with an automatic transmission and a manual transmission?**





Mountain air also affects your vehicle's engine. The engine gets less oxygen and loses power. The engine heats up faster, and gas may vaporize in the fuel line, causing the engine to sputter and stall. Keep an eye on the temperature gauge. Engines that are not well maintained are prone to overheat under difficult conditions. If your temperature gauge shows red or hot, stop in a safe area and allow the engine to cool.

## EFFECTS OF BAD WEATHER

Rain, snow, haze, and fog are especially dangerous when you are driving in the mountains. Try to find out about current weather conditions in the area before you begin a mountain drive. Certain seasons are more likely to have treacherous weather and can cause rock or mud slides. You should know when these times occur in your particular area. Remember that strong gusts of wind are also associated with mountain terrain and can occasionally send your vehicle into a skid.

## SAFETY TIP

Be especially alert when you are driving through a falling rock zone. Be prepared to brake suddenly or to take other evasive maneuvers.



### WHAT WOULD YOU DO?

*Your vehicle has an automatic transmission, and you've been using the Drive gear. Describe your procedure as you are about to head up a hill.*

## Lesson 1 Review

- 1 How are procedures for driving uphill different from those for driving downhill?
- 2 How can high altitude affect you and your vehicle if you are driving in the mountains?
- 3 How can your visibility be limited when you are driving in the mountains?





# Skids

## OBJECTIVES

1. **List** factors that can cause your vehicle to skid.
2. **Name** and describe the various kinds of skids.

## KEY TERMS

- ◆ skid
- ◆ braking skid
- ◆ power skid
- ◆ cornering skid
- ◆ blowout skid

When you go into a **skid**, your vehicle careens wildly across the road. You lose control of the direction and speed of the vehicle. Understanding the natural laws that affect the control of your vehicle can help you regain that control when you lose it through skidding. If you skid, you are not helpless. If you think it through, once you understand what causes a skid, you're already on your way to understanding how to respond to it.

## What Can Make Your Vehicle Skid?

The cause of a skid is too little traction for the action taken. A loss or reduction in traction can be frightening and dangerous. Even experienced drivers fear this loss of vehicle control. When traction is reduced because of a change in conditions, such as water on the road, your tires can lose their grip on the road's surface, and the vehicle may begin to slide. Momentum and inertia might carry your vehicle in a direction you may not want to go. People call this a skid.

Wet roads or excessive speed on a curve are among the things that can cause your vehicle to go into a skid. When your vehicle goes into a skid, tires spin, slip, and slide because the combination of your actions (braking, steering, or accelerating) requires more traction than is available. One of three basic things may have happened: you tried to change speed too quickly, you tried to change direction too quickly, or you tried to steer and change speed too quickly.



## Tips for New Drivers

### DEALING WITH SKIDS

Skidding can be frightening. You can minimize trouble, however, by remembering the following points:

- ▶ Respond quickly and correctly. Concentrate. Do not panic.
- ▶ Do not brake. This will only make the skid worse.
- ▶ Look and steer in the direction you want the front of the vehicle to go.
- ▶ Make steering corrections quickly but smoothly.
- ▶ Do not give up. Keep steering.





Accelerate and brake gradually on snowy roadways. **Why should you accelerate and brake gradually on these roads?**

## CHANGING SPEED TOO QUICKLY

You are on a slippery road, and you want to slow down. You step firmly on the brake pedal, but your vehicle starts to skid. What happened? You tried to change speed too quickly. Traction could not overcome the vehicle's kinetic energy and momentum as fast as you wanted it to. A skid can also result if you try to change speed too quickly by acceleration.

If you are driving a front-wheel drive vehicle, the front wheels lose traction and spin if you over accelerate. In rear-wheel drive vehicles, the rear wheels lose traction and spin if you over accelerate. And if you are driving an all-wheel drive vehicle, all wheels lose traction if you over accelerate.

How fast is a high speed, and what is changing speed too quickly? It depends on the road and the weather. Look at the speed-limit signs posted to determine the maximum safe speed. If road conditions or weather conditions are bad, slow down below the posted speed limit to stay safe and accelerate slowly to avoid spinning your drive wheels.

## CHANGING DIRECTION TOO QUICKLY

Turning a vehicle too quickly is like trying to get a horse to make a sharp turn at a full gallop. Occasionally it works, but usually it doesn't. If you're driving at a high speed, your vehicle has built up a tremendous amount of momentum and kinetic energy. Inertia is also at work, trying to force your vehicle to move in a straight path. Tire traction may not be great enough to compensate for the forces of momentum, kinetic energy, and inertia when you turn or enter a sharp curve, not to mention the centrifugal force pulling your vehicle toward the outer edge of the turn.

Before you negotiate a curve, look at the speed limits posted just below the warning signs as you near a curve. They tell you the maximum safe speed you should use to enter the curve. Remember that centrifugal force will be pulling you toward the edge of the road on curves and that force will be stronger if you have less traction. To remain safe, adjust speed downward according to current conditions.



## CHANGING SPEED AND DIRECTION AT THE SAME TIME

When you try to steer and change speed at the same time, you increase the chance that you will lose traction and go into a skid. At any time there is only so much available traction. If you ask your vehicle to do something that needs more traction than is available, you will skid. If you must steer and change speed at the same time, remember the more you steer the less traction is available to change speed.

**FIGURE 14.1**

### CAUSES OF SKIDS

Cause	Braking skid	Power skid	Cornering skid	Blowout skid
<b>Reason</b>	The brakes are applied so hard that the front or rear tires lose traction.	The gas pedal is pressed too hard.	A turn made too fast	A tire suddenly loses air pressure.
<b>Conditions</b>	A sudden stop A wet, slippery, or uneven road	A sudden, hard acceleration A slippery road surface	Poor tires or a slippery road surface	A punctured, worn, or overinflated tire An overloaded vehicle
<b>What can happen</b>	Steering control can be lost. If the front tires lock or lose traction ( <b>understeer</b> ), the vehicle skids straight ahead. If the rear tires lock or lose traction ( <b>oversteer</b> ), the rear of the vehicle slides sideways. The vehicle may spin around.	A vehicle with front-wheel drive plows straight ahead. In a vehicle with rear-wheel drive, the rear end can skid to the side. The vehicle may spin around.	Directional control can be lost. All four tires can lose traction simultaneously. The vehicle skids toward the inside or outside of the curve or turn.	There is a strong pull toward the side on which a front tire has blown out. A rear-tire blowout may cause a pull toward the blowout, side-to-side swaying, or fishtailing.
<b>What to do</b>	Take your foot off the brake pedal. Look and steer in the direction you want the front of the vehicle to go. Don't give up. If the rear tires are skidding, continue to steer; you may have to make several steering corrections before you regain directional control. When the tires regain traction, steering control will return.	Ease up on the gas pedal until the tires stop spinning. Look and steer in the direction you want the front of the vehicle to go. Don't give up. If the rear tires are skidding, continue to steer; you may have to make several steering corrections before you regain directional control.	Look and steer in the direction you want the front of the vehicle to go. When the vehicle stops skidding, steer in the direction you want to go.	Do not brake. Make firm, steady steering corrections. Do not change speed suddenly. Slow down gradually, and drive off the road.



## What Are the Causes of Skids?

Knowing the cause of the skid you are experiencing will help you manage the risk involved, and it may even help you prevent skidding. Look at **Figure 14.1** for a detailed description of the different causes of skids. Here is a brief summary:

- A **braking skid** occurs when you apply the brakes so hard that the front or rear tires lose traction.
- A **power skid** occurs when you suddenly press on the accelerator too hard.
- A **cornering skid** occurs when all four tires lose traction at the same time.
- A **blowout skid** occurs when a tire suddenly goes flat.

## How Do You Respond to a Rear-Wheel Skid?

Suppose you are driving on an ice-covered roadway. Vehicles are parked alongside the road, and traffic is heavy in both directions. Suddenly the rear of your vehicle begins to skid. Here are the steps to manage the risk of a rear-wheel skid, which might help you safely drive out of it:

1. Continue to look well ahead and focus on the direction that you want the front of the vehicle to go.
2. Stay off the brake and steer toward your intended path.
3. If the rear of the vehicle begins to swing in the opposite direction, turn the wheel smoothly and quickly in the direction in which you want the front of the vehicle to go.
4. Keep steering until you are out of the skid.

### WHAT WOULD YOU DO?

You have a blowout. What is likely to happen? What should you do? Why?



## Lesson 2 Review

- ① What conditions can make your vehicle skid?
- ② Describe four causes of skids.
- ③ Describe how to safely steer out of a skid.





# Avoiding or Minimizing Crash Damage

## OBJECTIVES

1. **Explain** how speed control can help you avoid a collision.
2. **Describe** how knowledge of natural laws can help you avoid a collision.

## KEY TERM

- ◆ antilock brake system (ABS)

Your main goal as a driver should be to get to where you're going without having a collision and sustaining injuries. Natural laws come into play when you drive during adverse weather or road conditions or when other drivers make mistakes. To be a good driver, you must understand how to use accelerating, braking, and steering to help you minimize risk.

## How Can You Use Speed Control or Braking to Avoid a Collision?

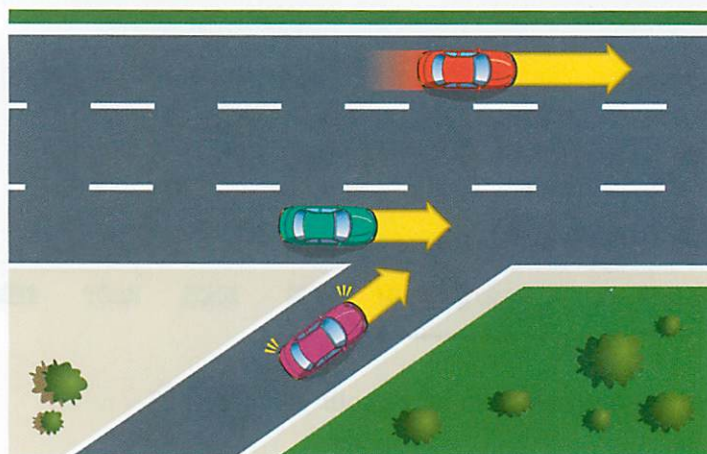
Steering away is a natural reaction to avoid a collision. However, this is not always the correct evasive action. Accelerating or braking are sometimes better choices.

### ACCELERATING TO AVOID COLLISIONS

Accelerating is sometimes your only means of reducing the risk of a collision. Sometimes, you just have to speed up, using the traction of your tires to increase the momentum and inertia of your vehicle. Such situations occur most often at intersections or in merging traffic. A vehicle may be coming at you from one side (see **Figure 14.2**). Putting on the brakes may stop you in

**FIGURE 14.2**

**ACCELERATING AND COLLISIONS**



The driver in the left lane accelerated to avoid the possible collision in the right lane.



the vehicle's path. Steering to the side may be impossible if there are objects on both sides of your vehicle. If the road ahead is clear, a quick burst of speed could take you to safety, or at least move the point of impact to the rear fender of the vehicle. The same is true if you are merging into traffic and must speed up to avoid getting in the way of another vehicle.

## BRAKING TO AVOID COLLISIONS

Braking may be the correct choice when steering to the side or accelerating is not possible. Braking uses friction to slow momentum. Under 25 mph, it actually takes less time and distance to stop than to steer into another lane.

You will only have a few seconds to brake in an emergency when you want to stop quickly without making the wheels lock. Locking the wheels reduces traction, and it will probably throw you into a skid. To brake safely and quickly, use the threshold/squeeze braking method. Use your toes on the brake pedal to sense how much traction exists between the tires and roadway. Keep your heel on the floor and use your toes on the brake pedal. "Squeeze" the pedal down with steady, firm pressure until just before the brakes lock. If the brakes do lock, relax your toes to release brake pressure a little, then immediately "squeeze" the brake pedal again to just short of lockup. Continue this "squeeze" until you reduce to your desired speed or the vehicle comes to a stop. This braking technique allows you to maintain steering control, which you lose in a skid (see **Figure 14.3**).

Most new vehicles are equipped with an **antilock brake system (ABS)**, which eliminates the problem of locked brakes by making it mechanically impossible for locking to occur.

ABS serves the small patch of tire that comes into contact with the road surface. Traction Control technology builds on ABS by adding extra valves to the system's hydraulics. This allows application of the brakes on drive wheels without pressing the brake pedal to minimize wheel spin and improve vehicle control and stability while accelerating.

**FIGURE 14.3**

**SQUEEZE BRAKING**



For best brake control, press the brake pedal with steady, firm pressure.



## FYI

Fifty-eight percent of fatal crashes involved only one vehicle, compared to 30 percent of injury crashes and 30 percent of property-damage-only crashes. The driver leaves the roadway, brakes hard, or oversteers. The driver loses control. The vehicle skids, rolls over, or strikes an object.

## How Can Knowledge of Natural Laws Help You Avoid a Collision?

Knowledge of natural laws, such as friction, traction, and centrifugal force, are helpful in understanding vehicle control and can help you avoid collisions with vehicles, animals, or other roadway obstructions. Knowing how natural laws work is helpful when thinking ahead to evasive maneuvers, such as steering away from a problem and recovering control of the vehicle when you run off the road. Thinking a problem through before you actually encounter it can help you make a reflex action during a crisis that may save your life. Actions you can take include steering to avoid a collision and controlled off-road recovery.

### STEERING TO AVOID A COLLISION

You are driving at 55 mph on a clear day with no glare on the roadway. As you top the hill, you see a disabled vehicle with a flat tire stopped in your lane about 3 seconds ahead of your location. You are going too fast to stop in time. Under normal circumstances and with normal traction, it takes about 4 to 5 seconds to stop your vehicle. You have only 3 seconds. There is traffic in the other direction moving toward you, and that traffic is unable to stop. What can you do?

You should steer to the right road shoulder, if possible. To do that, take the following steps.

1. Turn the steering wheel just enough to get onto the shoulder while keeping your foot off the accelerator and brake.
2. Once you have passed the disabled vehicle, if there is enough space, slow gradually, and then turn the steering wheel to the left to return to the roadway.
3. Once the front wheels are on the road, turn the wheel right to bring your vehicle back into its original path.

Use what you know about traction to steer out of trouble. If you turn the wheel too hard or too quickly, your speed may be too high for traction to overcome centrifugal force.

### CONTROLLED OFF-ROAD RECOVERY

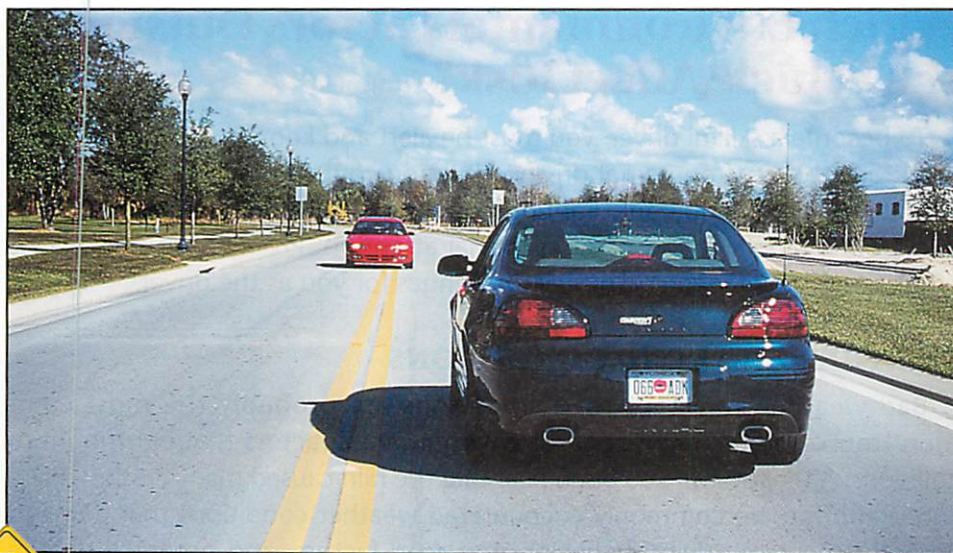
You see a passing vehicle coming toward you in your lane on a two-lane road and realize that the passing vehicle cannot return to its lane in time. What should you do? You should steer to the right. The vehicle passes safely on the left, but now your two right wheels are on the unpaved shoulder. You have two wheels on the shoulder and two wheels on the roadway, but you want to get back on the road. How can you return to the road?

Natural laws will affect your return to the road because tires rolling on different surfaces have different amounts of traction. Paved areas give your tires more grip than unpaved dirt or graveled areas. Your vehicle's center of gravity may be slightly off normal because the shoulder is often lower than the road. In this situation, if you panic and brake or accelerate, this may cause your vehicle to lose traction and go into a skid. Turning the wheel too sharply could cause your vehicle to skid, flip over, or shoot back across the roadway.



Still, it's a manageable situation. For a controlled off-road recovery, do the following:

1. Don't panic—stay off the brake and accelerator.
2. Continue to look in the direction you want the front of the vehicle to go.
3. If there is space, let the vehicle slow gradually.
4. Let the vehicle move right until the wheels on the shoulder are about 12 to 18 inches from the road edge.
5. Look for a spot where the road edge appears to be no more than 2 inches higher than the shoulder.
6. Signal your intention to return to the roadway.
7. Move the steering wheel  $\frac{1}{16}$  to  $\frac{1}{8}$  of a turn to the left. As soon as you feel the right front tire contact the road edge, steer back to the right a little, approximately  $\frac{1}{8}$  to  $\frac{1}{4}$  of a turn. Accelerate smoothly to prevent a rear-wheel skid.
8. Turn the steering wheel straight.



#### **WHAT WOULD YOU DO?**

*A driver has lost control of a vehicle, and it is swerving into your lane. What should you do?*

### **Lesson 3 Review**

- ① Under what conditions can accelerating or braking help you avoid a collision?
- ② How can traction and steering help you avoid a collision?
- ③ How would you use knowledge of force of impact to respond to a head-on or side collision?





# Challenging Environmental Factors

## OBJECTIVES

1. **Identify** environmental factors outside the vehicle that affect risk.
2. **Describe** ways you can minimize risk in multiple environmental combinations.

## KEY TERM

- ◆ grip

Drivers deal with what may be seen as three different environments. The first environment is the one outside the vehicle, which is covered in this chapter. This environment includes risks associated with the roads, the weather, the lighting conditions, and other traffic. These factors often overlap. The two other environments, the baggage and the people and equipment inside the vehicle, are covered in Chapters 4 and 17.

## Which Environmental Factors Outside the Vehicle Affect Risk?

To become a skillful driver, you must be alert and know how to deal with a wide range of environmental driving situations outside the vehicle. Weather conditions, road conditions, lighting conditions, and traffic all have a direct effect on driving risk and deserve special attention. Problems in these areas often occur simultaneously, posing challenges for you as the driver.

## WEATHER AND ROAD CONDITIONS

Bad weather and poor road conditions are probably the most common troublesome combination of environmental factors that contribute to collisions. After a storm, you often hear that the rain caused many crashes. Rain, snow, and fog are commonly encountered weather conditions that demand an adjustment to driving behavior. Add road factors, and potential driving hazards increase significantly. Road factors that affect driving risk include rough pavement, gravel, mud and potholes. Other factors include road design of shoulders, road width, road slope and curve, road lines, curbs, and signs and signals that must be navigated by the driver.

Often the adjustments you must make involve increasing visual search and reducing speed. You can check the weather in the area you plan to visit before you leave.

It is important to manage time and space when driving in wind. **How can you manage time and space when driving in wind?**





Scan for changes in weather that might suddenly occur at that time of year in your area. Be aware of the road surface you are on, and drive accordingly. When in doubt, slow down a little. To be prepared for this combination of factors, your vehicle's tires and suspension should be in optimal shape, since good tires and suspension will give you maximum traction.

## ROAD AND LIGHTING

Poor conditions on the road or in lighting can combine to increase risk. The condition of the road you are on is an important factor in driving. How the road is constructed is important, too. It's important to note that getting that kind of road information is dependent on how much you see. How much you see is directly related to how much light is in the environment.

The light you need in order to see while driving comes from two sources—the sun or artificial sources such as streetlights and headlights. Light from the sun is complete and abundant. At times, it overwhelms the senses. Normal sunlight is generally adequate for all of the usual visual search activities that drivers conduct. At certain times, however, the light is so strong and direct that you have to block it or filter it with a sun visor or sunglasses.

Bright light gives you great visibility in your surrounding environment and helps you see edges and detail. During bad weather, the light level is lower, and light is more diffused or scattered. Poor light hides some of the environmental detail outside the vehicle you might normally see and rely on. Poor light also prevents you from seeing well ahead and getting all the information you need in a timely manner—a very important safe-driving skill. When you can't see well, slow down!

At night, you have no sunlight. The vehicle you are driving provides most of the light you use to drive, although streetlights and other vehicles also contribute light. The moon occasionally adds some light to the situation. Avoid the tendency to stare at the light patch your own headlights project. Instead, scan and search the entire driving environment, both inside and outside the glare of your headlights. At night, be sure to look well down the road at and beyond the area illuminated by your vehicle's headlights. Remember that you tend to drive where you look, and you look where there's light. Make sure to turn down your dash lights to increase your sensitivity to the light out on the road. And remember, don't use your high beams in bad weather. High beams only cause more distraction by reflecting light back at you and interfering with your ability to see farther ahead.

In northern climates, low angles of the sun and abundant snow cover can result in bright intense light shining and reflecting directly into your eyes. It's important to not look directly at this bright light. These bright conditions also exist in other areas during morning or evening drives when the sun is low on the horizon. If you drive in these areas, know the times and places these conditions will affect you and try to avoid them or compensate for them by using sunglasses or your vehicle's sun visors.

In all cases, you must make sure your vehicle is in good condition and be able to deal with light properly. Keep the windshield clean and in good repair. Cracks and pits cause obstructions and distractions to vision and also reflect and refract light and glare. Keep all lights, but especially the headlights, clean and properly aligned.

## Driver Ed

## Online

### Topic: Driving at Night

For a link to more information on driving at night, go to [driveded.glencoe.com](http://driveded.glencoe.com).

**Activity:** Using the information provided at this link, work in small groups to create two checklists of safety tips—one list of tips to prepare your car for night driving and one list of tips to follow while driving at night.







## Dealing with the **UNEXPECTED**

### **HANDLING HYDROPLANING**

When you are driving in rainy conditions, it is possible that your car will start to hydroplane. If this happens, follow these guidelines.

- ▲ Avoid braking or turning suddenly because doing so could cause the car to skid.
- ▲ Ease off the gas pedal until the car slows down and you regain traction.
- ▲ If you need to brake, gently pump the brake pedal.
- ▲ If your car has antilock brakes, you should brake as you normally would. The antilock brakes will prevent the wheels from locking.

### **OTHER TRAFFIC AND LIGHTING**

Traffic and lighting are environmental factors that can interact, too. In the case of traffic, how drivers behave and interact with each other on the roads create situations that frequently lead to congestion, close calls, and collisions. The very design of some roads at times causes drivers to become uncertain, confused, frustrated, and occasionally angry. As a driver, you will deal with good and bad traffic. All you can do is learn to avoid places or times where you might expect bad traffic. If you have to be there, learn to be as patient with other drivers as possible.

Poor lighting adds more risk in heavy traffic, too. When it's difficult to see ahead or the lighting is poor, you won't get enough information to help you understand what is happening in traffic. Consequently, you will probably get frustrated. In situations where lighting is poor, use other drivers ahead as a visual extension. Watch other cars and trucks—pay attention to their signal and brake lights, and react accordingly to keep yourself safe. Notice whether other drivers in your path are slowing, turning, or acting confused. This will help you avoid trouble.

### **MAXIMIZE TRACTION**

Traction is the single most important factor in maintaining vehicle control. Your vehicle can only have a certain amount of traction. Like a bank account, you cannot use more than you have. Those who try usually pay a hefty price—loss of vehicle control and a serious crash! Traction is useful when you accelerate, brake, and steer. When you accelerate too quickly, steer too sharply, or brake too hard, you may exceed the available traction and the tires may lose their **grip**—the ability to change the speed or direction of the vehicle. This is especially true of poorly maintained and older vehicles not equipped with antilock brakes and other traction-control systems.

Generally speaking, you need traction to change vehicle speed or direction. When you need to change speed or direction or both, you create additional demands on the vehicle and may exceed the limits of the available traction.



This is usually okay, but when you try to start, stop, and/or turn the vehicle too quickly, your vehicle may go into a skid. This is especially true on a low-traction surface. When your vehicle skids in these conditions, inertia has exceeded the amount of traction available and the tires lose their grip on the road.

To maintain or improve traction while driving, buy the proper tires for your vehicle, inflate them correctly, and ensure that the vehicle's suspension system is working properly. As previously stated, the laws of nature really dictate how much traction exists between the roadway and the tires. Gravity, weight, inertia, centrifugal force, and friction all play a role in determining how much traction—and vehicle control—you will have.

## ASSESSING MULTIPLE FACTORS

You may experience a combination of three or more hazardous environmental factors—weather, road conditions, other traffic, or lighting. You may have to deal with these problems simultaneously.

When road conditions, weather conditions, and traffic conditions are poor, you should recognize both the individual danger of each environmental element and the multiple dangers of all these elements that the situation presents. When possible, analyze the risky elements in each environmental factor and assess the risk potential before driving. If you decide to drive, consider what strategies and actions you can take to reduce risks you may encounter.

## How Can You Minimize Risk in Multiple Environmental Combinations?

Whenever you get out onto the road, you need to recognize that a multitude of factors affects your ability to drive safely. Some are within your control, such as personal factors, behaviors, attitudes, knowledge, skill, and impairments. Some are beyond your control, such as the traffic, weather, lighting conditions, and road design and condition. But in all cases, you have the choice as to

1. whether to get on the road in the first place.
2. where, when, and how you will go.
3. how you will respond to the constantly changing conditions on the road.

### Barry Thayer

Thayer Driver Education Center  
Danbury, CT

Hill and mountain driving requires extra effort and concentration on steering and speed control. Use your horn and lights to signal your presence when you cannot see around a sharp curve or over a steep hill. Increase your following distance, and be aware of the effects of low oxygen on your body.

Weather, road, lighting, and traffic conditions are environmental factors that affect risk. You can minimize risk in multiple environmental combinations by knowing what could happen in different situations, looking well ahead while driving, and driving at the appropriate speed.

*How does hill and mountain driving differ from driving on an urban street?*





Maximizing your vehicle's traction and looking ahead are two good ways to minimize driving risk.

## KNOWING WHAT COULD HAPPEN IN DIFFICULT SITUATIONS

Your instincts and driving knowledge can often help you in difficult situations. When you know you are in a difficult situation and know what could possibly go wrong, you feel fear, and your survival instinct increases. You naturally become more cautious and behave much more safely. It's an irony of driving that the less safe you feel, the safer you are likely to be.

When you are driving in difficult situations, knowing what to do in an emergency situation makes it more likely that you will take the right action, take the action in good time, and complete the action properly and with the expected outcome. When you know what to do in emergencies, you react to them with less panic, and they then don't seem as dangerous.

## LOOK WELL AHEAD

Time and space allow you to know how to make driving easier, how to anticipate situations, and how to plan ahead and execute effectively. They also allow you to know what's happening 20 to 30 seconds ahead. Finally, they enable you to select options to deal with the danger 12 to 15 seconds before encountering it.

## DRIVE AT APPROPRIATE SPEED FOR SPECIFIC CONDITIONS

No matter what the driving environment, always drive at a safe speed. Speed is directly related to energy, inertia, momentum, stability, and control. When you drive too fast, you lessen your ability to respond to situations and to respond properly. Simple solutions become more complex, and you have to execute them faster. What might have been a simple steering maneuver at 40 mph becomes a crisis brake-and-avoid situation at 60 mph.



?

### WHAT WOULD YOU DO?

*What would you do to compensate for the reduced visibility in this situation?*

## Lesson 4 Review

- 1 What environmental factors outside the vehicle pose a risk to you while driving?
- 2 How can you minimize risk in multiple environmental combinations?
- 3 What strategies can you use to assess multiple risk factors?



### THE TRANS-ALASKA PIPELINE

Oil, the precious resource that is the source of the gasoline that powers our motor vehicles, has been the cause of a confusing mix of benefits and drawbacks to the Inuits of Alaska. In the 1800s, these native people witnessed the exploration of their homeland by navigators searching for a quick Arctic sea route from the New World to the wealth of Asia. This sea route, the Northwest Passage, was finally traveled in 1903 by the Norwegian explorer Roald Amundsen.

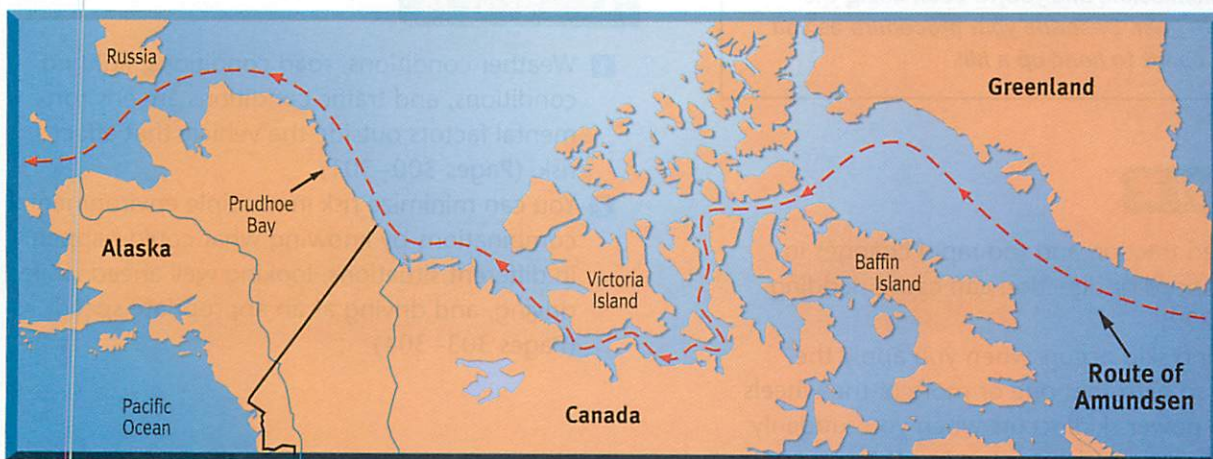
Today the Inuits are affected by another exploration—the search for oil in the waters of the Northwest Passage. With the discovery of oil at Prudhoe Bay on Alaska's north coast, human-made oil-drilling islands have been built amidst the 18,000 islands of the 4,000-mile-long Northwest Passage.

The trans-Alaska pipeline carries the oil from Prudhoe Bay to ports in southern Alaska, where it is transferred to huge ice-breaking tankers that carry the oil to refineries outside of Alaska.

For many Inuits, the frozen-over sea is like the land. Driving a ship through it is like driving a bulldozer across a farmer's field. The tankers also pose a danger to the environment, such as that caused when the *Exxon Valdez* struck a reef and poured 10.9 million gallons of crude oil into Prince William Sound. The oil destroyed wildlife that lived in these waters and was absorbed in the gravel beaches along the shoreline.

The threat to the environment and to the Inuit way of life is somewhat balanced by the increased income that oil has brought to these Native Americans of Alaska. In the Alaskan Native Claims Settlement Act of 1971, the U.S. government gave Alaskans with at least one Native American grandparent a share in the oil-rich lands.

The Inuits are in the forefront of a movement that recognizes the need for oil and its economic benefit yet also recognizes the need to protect the environment. The threat of pollution has been an important topic in the five Inuit Circumpolar Conferences that have been held since 1977 to discuss the future of Arctic peoples.



### WHAT DO YOU THINK NOW?

How can the need for oil and the economic advantages it brings be balanced by the need to protect and preserve the environment?



## Key Points

### Lesson 1

- 1 To drive up or down hills, downshift and accelerate or brake as necessary. (Page 289)
- 2 Use your horn and lights to signal your presence when you cannot see around a sharp curve ahead. Increase your following distance, and be aware of the effects of low oxygen on your body and your vehicle. (Page 290)



#### WHAT WOULD YOU DO?

*Your vehicle has an automatic transmission, and you've been using the Drive gear. Describe your procedure as you are about to head up a hill.*

### Lesson 3

- 1 It is possible to avoid some collisions by accelerating and steering if the roadway is clear. At speeds under 25 mph, braking requires less time and space than steering to avoid a collision. (Pages 296–297)
- 2 You may be able to avoid a collision by understanding the relationship between steering, speed, and friction. (Page 298)



#### WHAT WOULD YOU DO?

*A driver has lost control of a vehicle, and it is swerving into your lane. What should you do?*

### Lesson 4

- 1 Weather conditions, road conditions, lighting conditions, and traffic conditions are environmental factors outside the vehicle that affect risk. (Pages 300–301)
- 2 You can minimize risk in multiple environmental combinations by knowing what could happen in different situations, looking well ahead while driving, and driving at an appropriate speed. (Pages 303–304)

### Lesson 2

- 1 Reduced traction and too rapid changes in either speed or direction can cause skidding. (Page 292)
- 2 A braking skid occurs when you apply the brakes so hard that one or more of the wheels lock. A power skid occurs when you suddenly press on the accelerator too hard. A cornering skid occurs when you lose directional control in a turn, curve, or lane change. A blowout skid occurs when a tire suddenly goes flat. (Page 294)



On a separate sheet of paper, write the letter of the answer that best completes each sentence.

- 1 When driving downhill in a vehicle with a manual transmission, you should
  - a. downshift to gain more control.
  - b. upshift to decrease engine power.
  - c. ride the clutch to maintain an even speed.
- 2 Driving on mountain roads can cause you to
  - a. become short of breath and feel sleepy.
  - b. lose control of the gears.
  - c. lose the effects of gravity.
- 3 When trying to avoid a collision while traveling under 25 mph, it takes less time and distance to
  - a. steer into another lane.
  - b. accelerate.
  - c. brake.
- 4 A braking skid occurs when you
  - a. apply the brakes too hard.
  - b. press the accelerator too hard.
  - c. downshift too quickly.
- 5 The most important factor in maintaining vehicle control is
  - a. the condition of the road.
  - b. grip.
  - c. traction.
- 6 A power skid occurs when you
  - a. apply the brakes too hard.
  - b. press the accelerator too hard.
  - c. downshift too quickly.

## Projects

- 1 Make a photo display of potential low-traction areas in your community. Label each photo, and list the potential danger. Return to the area to check out your suspicion. Make sure to position yourself so that you are safe and will not become a danger to traffic.
- 2 Check the shoulders and off-road areas of some local highways. Are they well designed and maintained? Do they provide an escape path in an emergency? What dangers do they pose to drivers? How could they be improved?

On a separate sheet of paper, write the word or phrase that best completes each sentence.

altitude  
braking  
grip  
skidding

- 7 \_\_\_\_\_ is the ability to change the speed or direction of the vehicle.
- 8 Driving at a high \_\_\_\_\_ can affect the performance of your vehicle.
- 9 \_\_\_\_\_ is loss of control over the direction in which your vehicle is moving because of reduced traction.
- 10 \_\_\_\_\_ uses friction to slow momentum.

## Writing

### Driver's Log

*In this chapter, you have learned about the effect that natural laws have on a variety of driving situations. Summarize, in a few sentences for each, the meaning of inertia, gravity, and momentum. Explain how these laws help you anticipate and manage risk.*



Chapter

**15**

# Vehicular Emergencies

