

**Almost any drug can reduce your ability to drive safely.**

It's not just illegal drugs that cause problems. Many over-the-counter drugs and prescription drugs can cause sleepiness and dizziness. These drugs often affect your alertness and reaction time.

**Read the label before taking any drug or medicine.** Look for warnings about the side effects. If you are uncertain about the effects of a drug, ask your doctor or pharmacist.

**Laws prohibit possession and use of many drugs while you are on duty.** It's illegal to be under the influence of any controlled substance, narcotic or other substance that can make a driver unsafe. This includes prescription and over-the-counter drugs that may make you sleepy or affect your driving ability. Possession and use of a drug is legal if your doctor tells you that the drug will not affect your driving ability.

### Alcohol and Drug Testing

Federal regulations require that drivers who operate a commercial motor vehicle and hold a CDL, be tested for misuse of alcohol and the use of controlled substances such as amphetamines, marijuana, opiates, PCP and cocaine.

- ▶ **Testing for misuse of alcohol:**
  - ▶ on a random basis;
  - ▶ for a reasonable suspicion of misuse;
  - ▶ following a crash, and
  - ▶ when returning to duty.
- ▶ **You may be tested for controlled substances:**
  - ▶ prior to employment;
  - ▶ on a random basis;
  - ▶ for reasonable suspicion of use;
  - ▶ following a crash, and
  - ▶ when returning to duty.

Promptly follow your employer's instructions for alcohol and drug testing.

Violation of the regulations for alcohol and drug use and testing can jeopardize your career as a commercial driver.

## Section 2: Air Brakes

Every Virginia CDL test includes information from Section 1: General Knowledge.



**If you plan** to drive a truck or bus with air brakes, you need to study this section. If you plan to pull a trailer with air brakes, you must study this section and Section 3: Combination Vehicles.

Air brakes use **compressed air** to make the brakes work. Air brakes stop large and heavy vehicles safely; but the brakes must be maintained and used correctly.

Air brakes are three different braking systems: service brake, parking brake and emergency brake systems.

- ▶ The **service brake system** applies and releases the brakes when you use the brake pedal during normal driving.
- ▶ The **parking brake system** applies and releases the parking brakes when you use the parking brake control.
- ▶ The **emergency brake system** uses parts of the service and parking brake systems to stop the vehicle if the service brake system fails.

### Air Brake System Parts

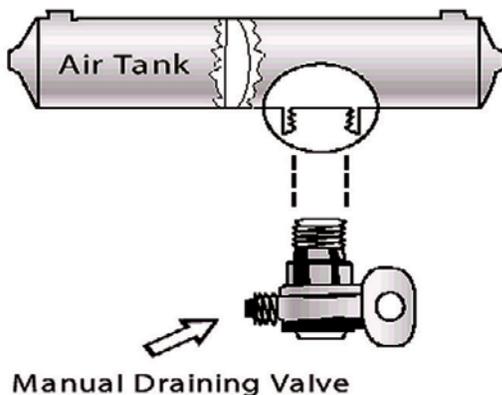
- ▶ **Air compressor** pumps air into the air storage tanks (reservoirs). It is connected to the engine through gears or a v-belt. The compressor may be air cooled or cooled by the engine cooling system. It may have its own oil supply or it may be lubricated by engine oil. If the compressor has its own oil supply, check the oil level during the pre-trip inspection.
- ▶ **Air compressor governor** controls when the air compressor pumps air into the air storage tanks. When air tank pressure rises to the cut-out level (around 125 pounds per square inch—psi), the governor stops the

## Section 2: Air Brakes

compressor from pumping air. When the tank pressure falls to the cut-in pressure (around 100 psi), the governor allows the compressor to start pumping again.

- ▶ **Air storage tanks** hold compressed air. The number and size of the tanks varies among vehicles. The tanks will hold enough air to allow the brakes to be used several times even if the compressor stops working.
- ▶ **Air tank drains** allow you to drain water and compressor oil that may accumulate in the tanks. Water and oil tend to collect in the bottom of the air tank and are bad for the air brake system. The tank must be drained completely to remove all moisture. Otherwise, water can freeze in cold weather and cause brake failure. Each air tank is equipped with a drain valve in the bottom. Be sure to drain the tanks completely. There are two types of drain valves:

- ▶ Manual valves which are operated by turning a quarter turn or by pulling a cable. Refer to the diagram below. You must drain the tank yourself at the end of each day of driving.
- ▶ Automatic valves automatically drain water and oil. They may also be drained manually.



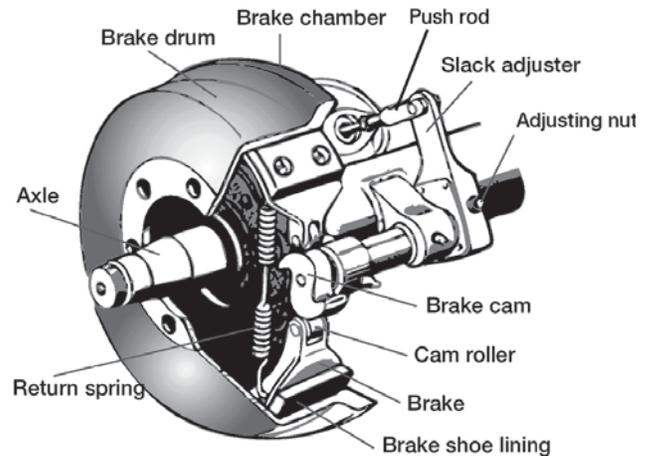
- ▶ **Alcohol evaporator** puts alcohol into the air system. This helps reduce the risk of ice in air brake valves and other parts during cold weather. Ice inside the system can cause brake failure.

Check the alcohol container every day in cold weather and fill it as necessary. You must also drain the air tank every day to get rid of water and oil unless the system has automatic drain valves.

- ▶ **Safety valve** is installed in the first tank that the air compressor pumps air to. The safety valve protects the tank and the rest of the system from too much pressure. The valve is usually set to open at 150 psi. If the safety valve releases air, something is wrong. Have the system fixed by a mechanic.
- ▶ **Brake pedal** applies air pressure and puts on the brakes. Pushing the pedal down harder applies more pressure. Letting it up reduces the air pressure and releases the brakes.

Releasing the brakes lets compressed air out of the system and reduces air pressure in the tanks. The air pressure must be made up by the air compressor. Pressing and releasing the pedal unnecessarily can let out air faster than the compressor can replace it. If the pressure gets too low, the brakes may lock up.

- ▶ **Foundation brakes** are used at each wheel. The most common type is the S-cam drum brake. Refer to the diagram.



Brake drums are located on each end of the vehicle's axles. The wheels are bolted to the drums. The braking mechanism is inside the drum. To stop, the brake shoes and linings are pushed against the inside of the drum. This causes friction which slows the vehicle and creates heat. The amount of heat that a drum can take without damage depends on how hard and how long the brakes are used. Too much heat can make the brakes stop working.

- ▶ **Supply pressure gauges** tell you how much pressure is in the air tanks. These gauges are on all air-braked vehicles.
- ▶ **Application pressure gauge** shows how much air pressure you are applying to the brakes. This gauge is not on all vehicles. If the application pressure decreases when you are holding the same speed, it means that the brakes are fading. Slow down and use a lower gear. The need for increased pressure can also be caused by brakes that are out of adjustment, air leaks or mechanical problems.
- ▶ **Low air pressure warning** comes on before the air pressure in the tanks falls below 60 psi. This warning signal is required on all vehicles with air brakes. The warning is usually a red light. In some vehicles, a buzzer may also come on.

Another type of warning is the wig-wag. This device drops a mechanical arm into your view when the pressure in the system drops below 60 psi. An automatic wig-wag will rise out of your view when the pressure goes above 60 psi.

On large buses, the low pressure warning signal often comes on at 80-85 psi.

- ▶ **Stop light switch** turns on the brake lights when you put on the air brakes.
- ▶ **Front brake limiting valves** were used in vehicles made before 1975 to reduce the chance of the front wheels skidding on slippery surfaces. Actually, the limiting valves reduce the stopping power of the vehicle. The control is usually marked “normal” and “slippery.” When you put the control in the slippery position, the limiting valve cuts the air pressure to the front brakes by half.

Front wheel braking is good under all conditions. Tests have shown that front wheel skids from braking are not likely even on ice. Make sure the control is in the normal position so that you will have normal stopping power.

Many vehicles have automatic front wheel limiting valves. These valves reduce air to the front brakes except when the brakes are put on very hard (60 psi or more application pressure). These valves cannot be controlled by the driver.

- ▶ **Spring brakes** are used for emergency and parking brakes. Emergency and parking brakes must be held by a mechanical force because air pressure can leak away.

When driving, powerful springs are held back by air pressure. If the air pressure is removed, the springs put on the brakes. A parking brake control in the cab allows the driver to let the air out of the spring brakes. This lets the springs put on the brakes. A leak in the air brake system which causes all air to be lost will also cause the springs to put on the brakes.

Tractor and straight truck spring brakes will come on fully when air pressure drops to a range of 20 to 40 psi. Do not wait for the brakes to come on automatically. When the low air pressure warning light and buzzer first come on, bring the vehicle to a safe stop while you can still control the brakes. The braking power of spring brakes depends on the brakes being in adjustment. If the brakes are not adjusted right, the regular brakes and the emergency/parking brakes will not work correctly.

- ▶ **Parking brake controls.** In newer vehicles with air brakes, you put on the parking brakes with a diamond shaped, yellow, push-pull control knob. You pull the knob out to put on the parking brakes (spring brakes) and you push the knob in to release them. On older vehicles, parking brakes may be controlled by a lever.

**Never push down the brake pedal when the spring brakes are on.** The brakes could be damaged by the combined force of the springs and air pressure.

- ▶ **Modulating control valves** may be used to apply the spring brakes gradually. A control handle on the dashboard is spring loaded so you have a feel for the braking action. The more you move the control lever,

the harder the brakes come on. This allows you to control the spring brakes if the service brakes fail. When parking a vehicle with a modulating control valve, move the lever as far as it will go and hold it in place with the locking device.

- ▶ **Dual parking control valves.** If the main air pressure is lost, the springs brakes come on. Some vehicles, such as buses, have a separate air tank which can be used to release the spring brakes. This allows you to move the vehicle in an emergency.

One of the valves is a push-pull type and puts on the spring brakes for parking. The other valve is spring-loaded in the “out” position. When you push the control in, air from the separate air tank releases the spring brakes so you can move. When you release the button, the spring brakes come on again. There is only enough air in the separate tank to do this a few times. So, plan carefully when moving.

Use the parking brakes whenever you park.

## Dual Air Brake Systems

Most newer heavy-duty vehicles use dual air brake systems for safety. A dual air brake system has two separate air brake systems which use a single set of controls. Each system has its own air tank, hoses, lines, etc. One system operates the regular brakes on the rear axle or axles. The other system operates the regular brakes on the front axle and possibly one rear axle. Both systems supply air to the trailer if there is one. The first system is called the primary system. The other is called the secondary system.

Before driving a vehicle with a dual air system:

- ▶ Allow time for the air compressor to build up a minimum of 100 psi pressure in both the primary and secondary systems.
- ▶ Watch the primary and secondary air pressure gauges (or needles if the system has two needles in one gauge).
- ▶ Pay attention to the low-air warning light and buzzer. The warning light and buzzer should shut off when air pressure in both systems rises to a value set by the manufacturer. This value must be greater than 60 psi.
- ▶ The warning light and buzzer should come on before the air pressure drops below 60 psi in either system. If this happens, stop driving right away and park the vehicle.
- ▶ If one air system is low on pressure, either the front or rear brakes will not operate fully. This means it will take you longer to stop. Bring the vehicle to a safe stop and have the air brake system fixed.

### Inspecting Air Brake Systems

Use inspection method described in Section 1 to inspect your vehicle. However, remember that there are more things to inspect on a vehicle with air brakes than on one without them.

#### ▶ Engine Compartment Check

- ▶ Check the air compressor drive belt if the compressor is belt driven. Check the condition and tightness of the belt.

#### ▶ Walk-Around Inspection

- ▶ Check the manual slack adjusters on the S-Cam brakes.
- ▶ Park on level ground and chock the wheels.
- ▶ Turn off the parking brakes so you can move the slack adjusters.
- ▶ Use gloves and pull hard on each slack adjuster that you can reach.
- ▶ If a slack adjuster moves more than about one inch where the push rod attaches to it, it probably needs adjustment.
- ▶ Adjust it or have it adjusted. Vehicles with too much brake slack can be hard to stop. Out-of-adjustment brakes are the most common problem found in roadside inspections.
- ▶ Check the brake drums (or discs), linings and hoses.
- ▶ Brake drums or discs cannot have cracks longer than half the width of the friction area.
- ▶ Linings (friction material) cannot be loose, soaked with oil or grease. They cannot be dangerously thin.
- ▶ Mechanical parts must be in place and should not be broken or missing.
- ▶ Check the air hoses connected to the brake chambers to make sure they are not cut or worn due to rubbing.

#### ▶ Check the Air Brake System.

Checking the air brake system is different from the hydraulic brake check shown in Section 1: General Knowledge.

- ▶ Test the low pressure warning signal.
  - ▶ Shut off the engine when you have enough air pressure so that the low pressure warning signal is off.
  - ▶ Turn on the electrical power and step on and off the brake pedal to reduce air tank pressure.
  - ▶ The low air pressure warning signal must come on before the pressure drops to less than 60 psi in the air tank (or tank with the lowest air pressure in dual air systems).

- ▶ If the warning signal doesn't work, you could lose air pressure without knowing it. This could cause sudden emergency braking. In dual systems, the stopping distance will be increased. Only limited braking can be done before the spring brakes come on.
- ▶ Be sure that spring brakes come on automatically.
  - ▶ Chock the wheels, release the parking brakes when you have enough air pressure and shut off the engine.
  - ▶ Step on and off the brake pedal to reduce the air tank pressure.
  - ▶ The parking brake knob should pop out when the air pressure falls to the manufacturer's specification (usually between 20 and 40 psi). This causes the spring brakes to come on.
  - ▶ Check the rate of air pressure build-up.
  - ▶ When the engine is at operating RPM (check the manufacturer's specifications to determine the correct operating RPM), the pressure should build from 85 to 100 psi within 45 seconds in dual air systems.
  - ▶ If the vehicle has larger than minimum air tanks, the buildup time can be longer. Check the manufacturer's specifications.
  - ▶ In single air systems (built before 1975), pressure typically builds from 50 to 90 psi within 3 minutes with the engine at an idle speed of 600-900 RPM.
  - ▶ If air pressure does not build fast enough, your pressure may drop too low during driving. This will require an emergency stop. Don't drive until you get the problem fixed.
- ▶ Test the air leakage rate.
  - ▶ When the air system is fully charged (between 120 and 125 psi), turn off the engine, release the service brake and time the air pressure drop. The loss rate should be less than 2 psi in one minute for single vehicles. It should be less than 3 psi in one minute for combination vehicles.
  - ▶ Apply 90 psi or more with the brake pedal. After the initial pressure drop, if air pressure falls more than 3 psi in one minute for single vehicles (4 psi for combination vehicles), the air loss rate is too high.
  - ▶ Check for air leaks and fix them before driving or you could lose your brakes while driving.
- ▶ Check the air compressor governor cut-in and cut-out pressures.
  - ▶ Air compressor pumping should start at about 100 psi and stop at about 125 psi. Check the manufacturer's specifications.

- ▶ Run the engine at a fast idle. The air governor should cut out the air compressor at the manufacturer's specified pressure. The air pressure shown by your gauge(s) will stop rising.
- ▶ With the engine idling, step on and off the brake to reduce the air tank pressure. The compressor should cut in at the manufacturer's specified cut-in pressure. The pressure should begin to rise
- ▶ If the air governor does not work as described above, it may need to be repaired. A governor that does not work correctly may not keep enough air pressure for safe driving.
- ▶ Test the parking brake.
  - ▶ Stop the vehicle, put on the parking brake.
  - ▶ Put the vehicle in low gear and **gently** release the clutch until you feel the vehicle pulling against the brake. The vehicle should not move.
- ▶ Test the service brakes.
  - ▶ Wait for normal air pressure to build, release the parking brake, move the vehicle forward slowly (about 5 mph) and apply the brakes firmly using the brake pedal.
  - ▶ Watch to see if the vehicle pulls to one side, feels unusual or stops slowly.
  - ▶ This test can show you problems which you would not know about until you used the brakes on the road.

## Using Air Brakes

### To Brake Normally

- ▶ Push down the brake pedal;
- ▶ Control the pressure so that the vehicle comes to a smooth, safe stop;
- ▶ If you have a manual transmission, don't push in the clutch until the engine RPM is down close to idle;
- ▶ When stopped, select a starting gear.

### To Brake in an Emergency

- ▶ Brake so that you keep your vehicle in a straight line. This will allow you to turn if it becomes necessary. Use the controlled braking or stab braking method described in Section 1: General Knowledge.

## Braking On Downgrades

On a long and steep downgrade, use your brakes only as a supplement to the braking effect of the engine.

- ▶ Apply the brakes just hard enough to feel a slowdown.
- ▶ When your speed is approximately 5 mph below your safe speed, release the brakes.
- ▶ When your speed has increased to your safe speed, repeat steps 1 and 2.
- ▶ Repeat these steps until you reach the end of the downgrade.

## Stopping Distance

Air brakes increase your stopping distance. Hydraulic brakes (used on cars and light/medium trucks) work instantly. Air brakes take half second or more for the air to flow through the lines to the brakes. Thus vehicles with air brakes require more stopping distance than vehicles with hydraulic brakes.

Stopping distance for vehicles with air brakes is made up of **four** different factors:

- ▶ **Perception distance** – the distance your vehicle travels from the time your eyes see a hazard until your brain recognizes it.
- ▶ **Reaction distance** – the distance your vehicle travels from the time your brain tells your foot to move from the accelerator until the time your foot pushes the brake.
- ▶ **Brake lag distance** – the distance your vehicle travels from the time your foot pushes the air brake until the brake takes hold.
- ▶ **Braking distance** – the distance your vehicle travels between the time the brakes take hold and the vehicle stops.

The air brake lag distance at 55 mph on dry pavement adds about 32 feet. At 55 mph with good traction and braking conditions, the total stopping distance for a vehicle with air brakes is more than 313 feet. That's longer than a football field.

## Brake Fading or Failure

Excessive use of the service brakes causes overheating and leads to brake fade. Excessive heat in the brakes causes chemical changes in the lining which reduces friction and causes the brake drums to expand. As the overheated drums expand, the brake shoes and linings have to move farther to contact the drums. The force of contact between the shoes and drums is also reduced. Overuse may increase brake fade until the vehicle cannot be slowed or stopped at all.

## Section 2: Air Brakes

Brakes that are out of adjustment may also cause brake fade. To safely control the vehicle, every brake must do its share of the work. Brakes out of adjustment stop doing their share before brakes that are in adjustment. This causes the other brakes to overheat and fade. Brakes can get out of adjustment quickly especially when they are hot. Therefore, brake adjustment must be checked frequently.

### Low Air Pressure

If the low pressure warning comes on, stop and safely park your vehicle **as soon as possible**. You could have an air leak in the system. Controlled braking is possible only while enough air remains in the air tanks. Once air pressure drops between 20 and 40 psi, the spring brakes will come on. A heavily loaded vehicle will take a long distance to stop because the spring brakes do not work on all axles. Lightly loaded vehicles or vehicles on slippery roads may skid out of control when the spring brakes come on. Therefore, it is much safer to stop while there is enough air in the tanks to use the foot brakes.

### Parking Brakes

Use the parking brakes any time that you park **except**:

- ▶ if the brakes are very hot (from having just come down a steep grade); or
- ▶ if the brakes are very wet in freezing temperatures.

If the brakes are hot, they could be damaged by the heat. Let the brakes cool before using the parking brakes. Use wheel chocks to hold the vehicle.

If the brakes are wet and the temperatures are freezing, they can freeze so that the vehicle cannot move. Use the brakes lightly while driving in a low gear to heat and dry them. Or, use wheel chocks to hold the vehicle.

Never leave your vehicle unattended without applying the parking brakes or chocking the wheels. The vehicle could roll, causing injury and damage.

## Section 3: Combination Vehicles

Every Virginia CDL test includes information from Section 1: General Knowledge.



**Study this** section if you plan to drive combination vehicles (tractor-trailers, doubles, triples or a straight truck with a trailer). The information in this section gives you the minimum knowledge that you need to drive combination vehicles. Study Section 4: Doubles and Triples if you plan to drive these vehicles.

### Combination Vehicle Air Brakes

Study Section 2: Air Brakes before you read this section. In combination vehicles, the braking system has parts to control the trailer brakes. This section describes the parts that control the trailer brakes.

#### Trailer Hand Valve

- ▶ The trailer hand valve is also called the trolley valve or Johnson bar. It only operates the trailer brakes. Not all towing vehicles (trucks or tractors) have trailer hand valves.
- ▶ Use the hand valve to test the brakes. Do not use it when driving because it could make the trailer skid.
- ▶ When you are driving, use the foot brake. The foot brake sends air to all brakes on the vehicle, including the trailer(s).
- ▶ Never use the hand valve for parking. All the air might leak out and unlock the brakes in trailers that don't have spring brakes. This would allow the vehicle to roll away.
- ▶ Always use the parking brakes when parking. If the trailer does not have spring brakes, use wheel chocks to keep the trailer from moving.
- ▶ Turn off the tractor engine and put the transmission in the lowest forward gear or reverse for parking.

## Tractor Protection Valve

- ▶ If the trailer breaks away or develops a bad leak, the tractor protection valve closes and keeps air in the tractor or truck.
- ▶ The tractor protection valve is controlled by the trailer air supply control in the cab.
- ▶ The trailer air supply valve allows you to open and shut the tractor protection valve.
- ▶ The tractor protection valve will close automatically if air pressure is low (in the range of 20 to 40 psi)
- ▶ When the tractor protection valve closes, it stops air from going out of the tractor. It also lets air out of the trailer emergency line. This causes the trailer emergency brakes to come on.

## Trailer Air Supply Control

On **newer vehicles**, the trailer air supply control is a red 8-sided knob. You use this knob to control the tractor protection valve.

- ▶ Push it in to supply air to the trailer. Pull it out to shut off the air and put on the trailer emergency brakes.
- ▶ If air pressure drops into the range of 20 to 40 psi, the valve will pop out and close the tractor protection valve.

On **older vehicles**, tractor protection valve controls or emergency valves may not operate automatically.

- ▶ You may have a lever rather than a knob.
- ▶ Use the normal position for pulling the trailer.
- ▶ Use the emergency position to shut off air and put on the trailer emergency brakes.

## Trailer Air Lines

- ▶ Every combination vehicle has two air lines: the **service line** and the **emergency line**. They run between each vehicle—tractor to trailer, trailer to dolly, dolly to second trailer.
- ▶ The **service line** is also called the control line or signal line. It carries air which is controlled by the foot brake or the trailer hand brake.
- ▶ Pressure in the service line changes depending on how hard you press the foot brake or hand valve.
- ▶ The service line is connected to relay valves. These valves allow the trailer brakes to be applied more quickly.
- ▶ The **emergency line** is also called the supply line. It has two purposes;
  - ▶ First, it supplies air to the trailer air tanks;
  - ▶ Second, it controls the emergency brakes on combination vehicles.
  - ▶ Loss of air pressure in the emergency line causes the trailer brakes to come on. Loss of pressure

could be caused by the trailer braking loose and tearing apart the emergency air hose. It could also be caused by a hose, metal tubing or other part which breaks and lets out the air.

- ▶ When the emergency line loses pressure, it also causes the tractor protection valve to close. When this happens, the air supply knob will pop out.
- ▶ Emergency lines are often coded with the color red—red hose, red couplers. This keeps them from getting mixed up with the blue service line.

## Hose Couplers or Glad Hands

- ▶ Glad hands are coupling devices. They connect the service and emergency air lines from the truck or tractor to the trailer.
- ▶ Couplers have a rubber seal which prevents air from escaping.
- ▶ Clean the couplers and rubber seals before connecting the lines.
- ▶ When you connect the glad hands, press the two seals together with the couplers at a 90 degree angle to each other. A turn of the glad hand attached to the hose will join and lock the couplers.
- ▶ Some vehicles have dead end or dummy couplers. Attach hoses to these when they are not in use. This prevents water and dirt from getting into the coupler and the air lines. If the vehicle does not have dummy couplers, the glad hands can sometimes be locked together.
- ▶ When coupling, make sure that you couple the right glad hands together. To help avoid mistakes, some vehicles have color-coded hoses and couplers. Blue is used for the service lines and red is used for the emergency (supply) lines. Sometimes metal tags with the words “service” and “emergency” are attached to the lines.
- ▶ If you cross the air lines, supply air will be sent to the service line and will not charge the trailer air tanks. Air will not be available to release the trailer spring brakes (parking brakes). If the spring brakes don’t release when you push the trailer air supply control, check the air line connections.
- ▶ Older trailers do not have spring brakes. If the air supply in the trailer air tank has leaked away, there will be no emergency brakes and the trailer wheels will turn freely. If you crossed the air lines, you could drive away, but you would not have trailer brakes. This is very dangerous.
- ▶ Always test the trailer brakes before driving. Use the hand valve or pull the air supply control (tractor protection valve control). Pull gently against the trailer in a low gear to make sure the brakes work.

## Section 3: Combination Vehicles

### Trailer Air Tanks

- ▶ Each trailer and converter dolly has one or more air tanks.
- ▶ These air tanks **are filled by the emergency (supply) line** from the tractor.
- ▶ The tanks provide the air pressure used to operate the trailer brakes.
- ▶ Air pressure is sent from the air tanks to the brakes by the relay valves.
- ▶ Pressure in the **service line tells** how much pressure the relay valves should send to the trailer brakes. The pressure in the service line is controlled by the brake pedal and the trailer hand brake.
- ▶ Don't let water and oil build up in the air tanks. If you do, the brakes may not work.
- ▶ Each tank has a drain valve on it. Drain each tank every day.
- ▶ If your tanks have automatic drains, they will keep the moisture out. But open the drains to make sure.

### Shut-off Valves

- ▶ Shut-off valves are also called cut-out cocks. They are used in the service and emergency air lines at the back of trailers that tow other trailers.
- ▶ These valves let you close the air lines when another trailer is not being towed.
- ▶ Check that all shut-off valves are in the open position except the ones at the back of the last trailer. The valves at the back of the last trailer must be closed.

### Trailer Service, Parking and Emergency Brakes

- ▶ **New trailers** have spring brakes just like trucks and truck tractors.
- ▶ **Converter dollies and trailers built before 1975** are not required to have spring brakes.
  - ▶ Trailers that do not have spring brakes have emergency brakes which work from the air stored in the trailer air tank.
  - ▶ The emergency brakes come on whenever air pressure in the emergency line is lost.
  - ▶ These trailers do not have a parking brake.
  - ▶ The emergency brakes come on whenever the air supply knob is pulled out or the trailer is disconnected. But, the brakes will not hold if there is not sufficient air pressure in the trailer air tank.
  - ▶ Eventually, the air will leak away and there will be no brake.
  - ▶ Therefore, always use wheel chocks when you park trailers without spring brakes.

- ▶ **A major leak in the emergency line** will cause the tractor protection valve to close and the trailer emergency brakes to come on.
- ▶ You may not notice a leak in the **service line** until you put the brakes on. Then, the air loss from the leak will lower the air tank pressure quickly. If it goes low enough, the trailer emergency brakes will come on.

## Inspecting a Combination Vehicle

Use the inspection procedure described in Section 1: General Knowledge to inspect your combination vehicle. You will also have some new things to check. Make the following checks in addition to the ones already listed in Section 1.

### Coupling System and Landing Gear

- ▶ **Check the lower fifth wheel.**
  - ▶ Mounting to the frame should be secure.
  - ▶ Check to be sure there are no missing or damaged parts.
  - ▶ Be sure there is enough grease (if the trailer is not hooked up).
  - ▶ You should not see space between the upper and lower fifth wheel.
  - ▶ Locking jaws should be around the shank, **not** the head of the kingpin.
  - ▶ The release arm should be properly seated and the safety latch/lock engaged.
- ▶ **Check the upper fifth wheel.**
  - ▶ Be sure the glide plate is securely mounted to the trailer frame.
  - ▶ Be sure that the kingpin is not damaged.
- ▶ **Check the sliding fifth wheel.**
  - ▶ There should not be any damaged or missing parts.
  - ▶ It should be properly greased.
  - ▶ All locking pins should be present and locked in place.
  - ▶ If air powered, there should be no air leaks.
  - ▶ Check that the fifth wheel is not so far forward that the tractor frame will hit the landing gear or that the cab will hit the trailer during turns.
- ▶ **Check the air and electric lines to the trailer.**
  - ▶ Be sure that the electrical cord is plugged in and secured.
  - ▶ Air lines should be properly connected to the gland hands. You should not have air leaks. Air lines should be secured with enough slack for turns.
  - ▶ All lines should be free from damage.

- ▶ **Check the landing gear.**
  - ▶ Be sure that the landing gear is fully raised. Check for missing, bent or damaged parts.
  - ▶ Make sure the crank handle is in place and secured.
  - ▶ If the landing gear is power operated, make sure that there are no air or hydraulic leaks.

## Air Brakes

Make these checks in addition to the pre-trip checks that you make for your air brakes. Check the airbrakes on a double or triple trailer the same way you check them for any combination vehicle.

- ▶ **Be sure air flows to all trailers.**
  - ▶ Use the tractor parking brake or chock the wheels to hold the vehicle.
  - ▶ Wait for the air pressure to reach normal, then push the red trailer air supply knob. This will send air to the emergency (supply) lines.
  - ▶ Use the trailer handbrake to send air to the service line.
  - ▶ Go to the back of the last trailer. You should hear air escaping. This shows that the entire system is charged.
  - ▶ Close the emergency line valve.
  - ▶ Be sure that either the trailer handbrake or the service brake pedal is on. Open the service line valve to check that service pressure goes through all trailers. Then, close the valve. If you **do not** hear air escaping from both lines, be sure that the shut-off valves on the trailer(s) and dolly(s) are **open**. You **must** have air all the way to the back for all the brakes to work.
- ▶ **Test the tractor protection valve.**
  - ▶ Charge the trailer air brake system. Build up normal air pressure and push in the air supply knob.
  - ▶ Turn off the engine.
  - ▶ Step on the brake pedal several times to reduce air pressure in the tanks.
  - ▶ When the air pressure falls into the pressure range specified by the manufacturer (usually within the range of 20 to 40 psi), the trailer air supply control should pop out or go from the normal position to the emergency position. The trailer air supply control may also be called the tractor protection valve control.
  - ▶ If the tractor protection valve doesn't work correctly, an air hose or trailer brake leak could drain all the air from the tractor. This would cause the emergency brakes to come on and you could lose control.

- ▶ **Test the trailer emergency brakes.**
  - ▶ Charge the trailer air brake system and check that the trailer rolls freely.
  - ▶ Stop and pull out the trailer air supply control (tractor protection valve control or trailer emergency valve) or place it in the emergency position.
  - ▶ Pull the trailer gently with the tractor to be sure that the trailer emergency brakes are on.
- ▶ **Test the trailer service brakes.**
  - ▶ Check for normal air pressure.
  - ▶ Release the parking brakes and move the vehicle forward slowly.
  - ▶ Apply trailer brakes with the hand control (trolley valve).
  - ▶ You should feel the brakes come on. This tells you that the trailer brakes are connected and working.

Note: The trailer brakes should be tested with the hand valve. In normal operation, however, control the trailer brakes with the foot pedal. The foot pedal applies air to the service brakes at all wheels.

## Coupling and Uncoupling Combination Vehicles

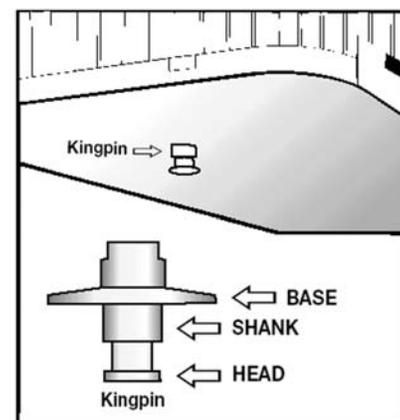
Coupling and uncoupling is basic to the safe operation of combination vehicles. Wrong coupling and uncoupling can be dangerous. The makes and models of rigs are different. So, learn the details of coupling and uncoupling for the trucks that you will operate.

### Coupling Tractor-Semitrailers

- ▶ **Inspect the fifth wheel.**
  - ▶ Check for damaged or missing parts.
  - ▶ Check to see that the mounting to the tractor is secure. Make sure there are no cracks in the frame.
  - ▶ Be sure that the fifth wheel plate is greased. Failure to keep the fifth wheel plate greased could cause steering problems because of friction between the tractor and trailer.
  - ▶ Make sure the fifth wheel is in the proper position for coupling:
    - ▶ The wheel should be tilted down toward the rear of the tractor.
    - ▶ The jaws should be open.
    - ▶ The safety unlocking handle should be in the automatic lock position.
  - ▶ If you have a sliding fifth wheel, make sure it is locked.

### Section 3: Combination Vehicles

- ▶ Make sure that the trailer kingpin is not bent or broken.
- ▶ **Inspect the area and chock the wheels.**
  - ▶ Make sure the area around the vehicle is clear.
  - ▶ Be sure the trailer wheels are chocked or the spring brakes are on.
  - ▶ Be sure that cargo is secured so that it will not move while the tractor is being coupled to the trailer.
- ▶ **Position the tractor.**
  - ▶ Put the tractor directly in front of the trailer. Never back under the trailer at an angle. You might push the trailer sideways and break the landing gear.
  - ▶ Use your mirrors to check your position by looking down both sides of the trailer.
- ▶ **Back slowly.**
  - ▶ Back until the fifth wheel touches the trailer.
  - ▶ Don't hit the trailer.
- ▶ **Secure the tractor.**
  - ▶ Put on the parking brake.
  - ▶ Put the transmission in neutral.
- ▶ **Check the trailer height.**
  - ▶ The trailer should be low enough that it is raised slightly by the tractor when you back the tractor under it.
  - ▶ Raise or lower the trailer as needed. If the trailer is too low, the tractor may strike and damage the nose of the trailer. If the trailer is too high, it may not couple correctly. This can result in damage to the back of the cab and could require heavy equipment to move the tractor from the trailer.
- ▶ **Connect the air lines to the trailer.**
  - ▶ Check the glad hand seals and connect the tractor emergency air line to the trailer emergency glad hand.
  - ▶ Check the glad hand seals and connect the tractor service air line to the trailer service glad hand.
  - ▶ Make sure the air lines are safely supported so that they won't be crushed or caught while you back the tractor under the trailer.
- ▶ **Supply air to the trailer.**
  - ▶ From the cab, push in the trailer air supply knob or move the tractor protection valve control from the emergency to the normal position. This will supply air to the trailer brake system.
  - ▶ Wait until the air pressure is normal.
  - ▶ Check the brake system for crossed air lines.
    - ▶ Shut off the engine so you can hear the brakes.
    - ▶ Apply and release the trailer brakes and listen for the sound of the trailer brakes being applied and released. You should hear the brakes move when applied and air escape when the brakes are released.
  - ▶ Check the air brake system pressure gauge for signs of major air loss.
- ▶ When you are sure the trailer brakes are working, start the engine.
- ▶ Make sure the air pressure is up to normal.
- ▶ **Lock the trailer brakes.**
  - ▶ Pull out the trailer air supply knob or move the tractor protection valve from normal to emergency.
- ▶ **Back under the trailer.**
  - ▶ Use the lowest reverse gear.
  - ▶ Back the tractor slowly under the trailer to avoid hitting the kingpin too hard.
  - ▶ Stop when the kingpin locks into the fifth wheel.
- ▶ **Check the connection for security.**
  - ▶ Raise the trailer landing gear slightly off the ground.
  - ▶ Pull the tractor gently forward while the trailer brakes are locked to be sure that the trailer is locked onto the tractor.
- ▶ **Secure the vehicle.**
  - ▶ Put the transmission in neutral.
  - ▶ Put on the parking brakes.
  - ▶ Shut off the engine. Take the key with you so someone else won't move the truck while you are under it.
- ▶ **Inspect the coupling.**
  - ▶ Use a flashlight if necessary.
  - ▶ Make sure that there is no space between the upper and lower fifth wheel. If there is space, something is wrong. The kingpin may be on top of closed fifth wheel jaws and the trailer would come loose very easily.
  - ▶ Go under the trailer and look into the back of the fifth wheel. Make sure the fifth wheel jaws have closed around the shank of the kingpin. Refer to the diagram.



- ▶ Check that the locking lever is in the lock position.
- ▶ Check that the safety latch is in the position over the locking lever. On some fifth wheels the catch must be put in place by hand.

If the coupling isn't right, don't drive the coupled unit. Get it fixed.

- ▶ **Connect the electrical cord and check the air lines.**
  - ▶ Plug the electrical cord into the trailer and fasten the safety catch.
  - ▶ Check the air lines and electrical lines for signs of damage.
  - ▶ Make sure the air and electrical lines will not hit any moving parts of the vehicle.
- ▶ **Raise the front trailer supports (landing gear).**
  - ▶ Use low gear range to begin raising the landing gear. Once free of weight, switch to the high gear range.
  - ▶ Raise the landing gear all the way up. Never drive with the landing gear part of the way up. It could catch on railroad tracks or other things.
  - ▶ After raising the landing gear, secure the crank handle.
  - ▶ When the full weight of the trailer is resting on the tractor:
    - ▶ Check for enough clearance between the rear of the tractor frame and the landing gear. When the tractor turns sharply, it must not hit the landing gear.
    - ▶ Check for enough clearance between the top of the tractor tires and the nose of the trailer.
- ▶ **Remove the trailer wheel chocks.**

### Uncoupling Tractor-Semitrailers

- ▶ **Position the rig.**
  - ▶ Make sure the surface of the parking area can support the weight of the trailer.
  - ▶ Line up the tractor with the trailer. Pulling out at an angle can damage the landing gear.
- ▶ **Ease the pressure on the locking jaws.**
  - ▶ Shut off the trailer air supply to lock the trailer brakes.
  - ▶ Ease pressure on the fifth wheel locking jaws by backing up gently. This will help you release the fifth wheel locking lever.

- ▶ Put the parking brakes on while the tractor is pushing against the kingpin. This will hold the rig with pressure off the locking jaws.
- ▶ **Chock the trailer wheels.**
  - ▶ Chock the trailer wheels if the trailer doesn't have spring brakes or if you aren't sure. The air could leak out of the trailer air tank and release the emergency brakes. Without chocks, the trailer could move.
- ▶ **Lower the landing gear.**
  - ▶ **If the trailer is empty**, lower the landing gear until it makes firm contact with the ground.
  - ▶ **If the trailer is loaded**, turn the crank in low gear a few extra turns after the landing gear makes firm contact with the ground. This will lift some weight off the tractor. This makes it easier to unlatch the fifth wheel. It also makes it easier to couple next time.
- ▶ **Disconnect the air lines and electrical cable.**
  - ▶ Disconnect the air lines from the trailer. Connect the glad hands to the dummy couplers at the back of the cab or couple them together.
  - ▶ Hang the electrical cable with the plug down to prevent moisture from entering it.
  - ▶ Make sure the lines are supported so they won't be damaged while driving the tractor.
- ▶ **Unlock the fifth wheel.**
  - ▶ Raise the release handle lock.
  - ▶ Pull the release handle to the open position.
  - ▶ Keep your feet and legs clear of the rear tractor wheels to avoid serious injury in case the vehicle moves.
- ▶ **Pull the tractor partly clear of the trailer.**
  - ▶ Pull the tractor forward until the fifth wheel comes out from under the trailer.
  - ▶ Stop with the tractor frame under the trailer. This prevents the trailer from falling to the ground if the landing gear collapses or sinks.
- ▶ **Secure the tractor.**
  - ▶ Apply the parking brake.
  - ▶ Place the transmission in neutral.
- ▶ **Inspect the trailer supports.**
  - ▶ Make sure the ground is supporting the trailer.
  - ▶ Make sure the landing gear is not damaged.
- ▶ **Pull the tractor clear of the trailer.**
  - ▶ Release the parking brakes.
  - ▶ Check the area and drive the tractor forward until it clears the trailer.

## Driving Combination Vehicles

### Rollovers

More than half of truck driver deaths in crashes result from truck rollovers. Piling up cargo in the truck moves the center of gravity higher from the road. A higher center of gravity makes it easier for the truck to turn over. A fully loaded rig is 10 times more likely to roll over in a crash than an empty rig.

Two things can help keep you from rolling your vehicle:

- ▶ Keep the cargo as close to the ground as possible. Also, load the cargo so that it is centered on your rig. Cargo that is loaded to one side can make the trailer lean and could cause the vehicle to roll over.
- ▶ Drive slowly around turns. Reduce your speed on on- and off-ramps. Avoid quick lane changes, especially when fully loaded.

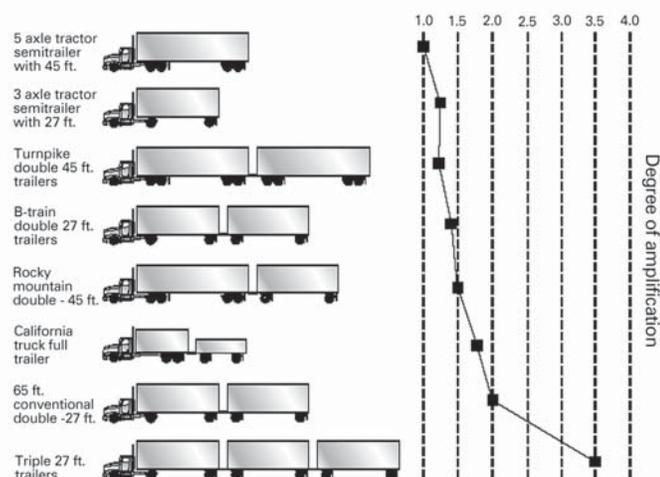
Read Section 6: Transporting Cargo for important information about loading your rig.

### Rearward Amplification and the Crack-the-Whip Effect

The effects of motion increase as the motion travels from the front of the truck to the rear. This is called rearward amplification and causes the crack-the-whip effect or fish-tailing. When you make a quick lane change, the crack-the-whip effect can turn over the trailer.

The chart shows eight types of combination vehicles and the rearward amplification of each when it makes a quick lane change. Rigs with the greatest rearward amplification are shown at the bottom of the chart.

Rearward amplification of 2.0 in the chart means that the rear trailer is twice as likely to turn over as the tractor. Triples have a rearward amplification of 3.5 and are 3 and one-half times as likely to turn over as a five-axle tractor and trailer.



### Steering

To avoid the crack-the-whip effect, steer gently and smoothly when you pull a trailer or trailers.

- ▶ Follow far enough behind other vehicles—at least one second for each 10 feet of your vehicle length plus another second if you are going over 40 mph.
- ▶ Look far enough down the road to avoid having to make a sudden lane change.
- ▶ At night, drive slowly enough to see obstacles soon enough that you can change lanes or stop gently.
- ▶ Always slow down to a safe speed before going into a turn.

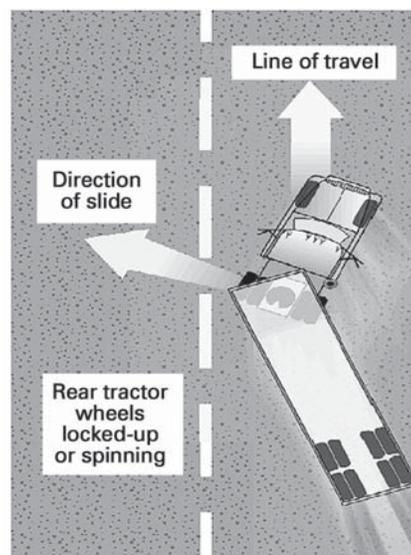
### Braking

- ▶ Control your speed to avoid having to make sudden stops.
- ▶ Large combination vehicles take longer to stop when they are empty than when they are fully loaded
- ▶ When lightly loaded, the stiff suspension springs and strong brakes make it easy to lock the wheels. Your trailer can swing out and strike other vehicles. Your tractor can jackknife very quickly.
- ▶ Bobtail tractors (tractors without semitrailers) can be hard to stop smoothly. It takes longer to stop a bobtail than it takes to stop a tractor-semitrailer loaded to the maximum gross weight.
- ▶ In any combination rig, allow plenty of following distance. Look far enough ahead so that you can brake early.

### Preventing Skids

When the wheels of a trailer lock up, the trailer tends to swing around. This is called a trailer jackknife. This is more likely to happen when the trailer is empty or loaded lightly. To stop a skid, follow these steps:

- ▶ **Recognize the skid.** You can check for a skid by looking in your mirrors. Any time that you apply the brakes hard, check the mirrors to make sure the trailer is staying straight behind your vehicle. Once the trailer swings out of your lane, it's very difficult to prevent a jackknife.

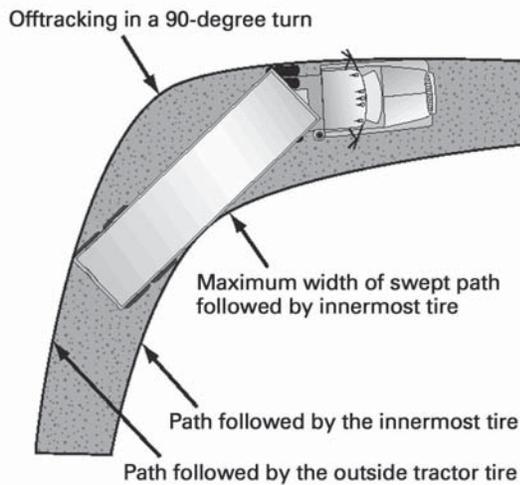


- ▶ **Stop using the brake.** Release the brakes to get traction. Do not use the trailer hand brake to straighten the trailer. This is the wrong thing to do since brakes on the trailer wheels caused the skid in the first place. Once the trailer wheels grip the road again, the trailer will start to follow the tractor and straighten out.

## Offtracking

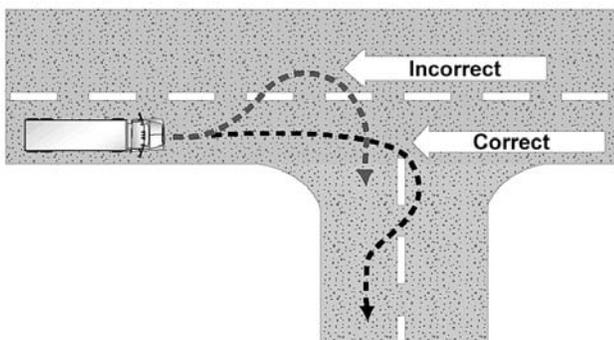
When a vehicle goes around a corner, the rear wheels follow a different path than the front wheels. This is called “offtracking” or “cheating.”

Because of offtracking, the path followed by a tractor-semi is wider than the rig itself. See the figure below. The rear wheels of the powered unit will offtrack some. The rear wheels of the trailer will offtrack even more. If there is more than one trailer, the rear wheels of the last trailer will offtrack the most. The longer the vehicle, the greater the amount of offtracking.



## Steering

- ▶ Steer the front end of your vehicle wide enough around a corner so that the rear end does not run over the curb, pedestrians and other vehicles.
- ▶ At the same time, keep the rear end of your vehicle close to the curb. This will stop other drivers from passing you on the right.
- ▶ If you cannot complete the turn without entering another traffic lane, turn wide as you complete the turn. Refer to the diagram below.



## Section 4: Doubles and Triples

Every Virginia CDL test includes information from Section 1: General Knowledge.



**Use the inspection** procedure described in Section 1: General Knowledge to inspect your combination vehicle. Remember, that there is a lot more to inspect on a combination vehicle than on a single vehicle—more wheels, tires, lights, reflectors, etc. There are also some new things to check.

## Inspecting Doubles and Triples

### Coupling System, Landing Gear and Double/Triple Trailers

- ▶ **Check the lower fifth wheel.**
  - ▶ Mounting to the frame should be secure.
  - ▶ Check to be sure there are no missing or damaged parts.
  - ▶ Be sure there is enough grease.
  - ▶ You should not see space between the upper and lower fifth wheel.
  - ▶ Locking jaws should be around the shank, **not** the head of the kingpin.
  - ▶ The release arm should be properly seated and the safety latch/lock engaged.
- ▶ **Check the upper fifth wheel.**
  - ▶ Be sure the glide plate is securely mounted to the trailer frame.
  - ▶ Be sure that the kingpin is not damaged.
- ▶ **Check the sliding fifth wheel.**
  - ▶ There should not be any damaged or missing parts.
  - ▶ It should be properly greased.

## Section 4: Doubles and Triples

- ▶ All locking pins should be present and locked in place.
- ▶ If air powered, there should be no air leaks.
- ▶ Check that the fifth wheel is not so far forward that the tractor frame will hit the landing gear or that the cab will hit the trailer during turns.
- ▶ **Check the air and electric lines to the trailer.**
  - ▶ Be sure that the electrical cord is plugged in and secured.
  - ▶ Air lines should be properly connected to the glad hands. You should not have air leaks. Air lines should be secured with enough slack for turns.
  - ▶ All lines should be free from damage.
- ▶ **Check the landing gear.**
  - ▶ Be sure that the landing gear is fully raised. Check for missing, bent or damaged parts.
  - ▶ Make sure the crank handle is in place and secured.
  - ▶ If the landing gear is power operated, make sure that there are no air or hydraulic leaks.
- ▶ **Inspect the double and triple trailers.**
  - ▶ Make sure that all shut-off valves are in the correct position. Shut-off valves are located at the rear of the trailer and in the service and emergency lines. Shut-off valves should be open/closed as follows:
    - ▶ Shut-off valves at the rear of the front trailers should be open.
    - ▶ Shut-off valves at the rear of the last trailer should be closed.
    - ▶ Converter dolly air tank drain valve should be closed.
  - ▶ Be sure the air lines are supported and glad hands are properly connected.
  - ▶ If the spare tire is carried on the converter dolly, make sure it's secured.
  - ▶ Make sure the pintle hook is latched. The pintle hook locks one trailer to another.
  - ▶ Make sure that the safety chains are secured to the trailers.
  - ▶ Be sure light cords are firmly in the sockets on the trailers. The light cords run from the battery and operate the lights.
- ▶ Wait for the air pressure to reach normal, then push the red trailer air supply knob. This will send air to the emergency (supply) lines.
- ▶ Use the trailer handbrake to send air to the service line.
- ▶ Go to the back of the last trailer. You should hear air escaping. This shows that the entire system is charged.
- ▶ Close the emergency line valve.
- ▶ Be sure that either the trailer handbrake or the service brake pedal is on. Open the service line valve to check that service pressure goes through all trailers. Then, close the valve. If you **do not** hear air escaping from both lines, be sure that the shut-off valves on the trailer(s) and dolly(s) are **open**. You must have air all the way to the back for all the brakes to work.
- ▶ **Test the tractor protection valve.**
  - ▶ Charge the trailer air brake system. Build up normal air pressure and push in the trailer air supply knob.
  - ▶ Turn off the engine.
  - ▶ Step on the brake pedal several times to reduce air pressure in the tanks.
  - ▶ When the air pressure falls into the pressure range specified by the manufacturer (usually within the range of 20 to 40 psi), the trailer air supply control should pop out or go from the normal position to the emergency position. The trailer air supply control may also be called the tractor protection valve control.
  - ▶ If the tractor protection valve doesn't work correctly, an air hose or trailer brake leak could drain all the air from the tractor. This would cause the emergency brakes to come on and you could lose control.
- ▶ **Test the trailer emergency brakes.**
  - ▶ Charge the trailer air brake system and check that the trailer rolls freely.
  - ▶ Stop and pull out the trailer air supply control (tractor protection valve control or trailer emergency valve) or place it in the emergency position.
  - ▶ Pull the trailer gently with the tractor to be sure that the trailer emergency brakes are on.
- ▶ **Test the trailer service brakes.**
  - ▶ Check for normal air pressure.
  - ▶ Release the parking brakes and move the vehicle forward slowly.
  - ▶ Apply trailer brakes with the hand control (trolley valve).
  - ▶ You should feel the brakes come on. This tells you that the trailer brakes are connected and working.

### Air Brakes

Make these checks in addition to the pre-trip checks that you make for your air brakes. Check the air brakes on a double or triple trailer the same way you check them for any combination vehicle.

- ▶ **Be sure air flows to all trailers.**
  - ▶ Use the tractor parking brake or chock the wheels to hold the vehicle.

Note: The trailer brakes should be tested with the hand valve. In normal operation, however, control the trailer brakes with the foot pedal. The foot pedal applies air to the service brakes at all wheels.

## Coupling and Uncoupling Doubles and Triples

Coupling (connecting) and uncoupling is basic to the safe operation of combination vehicles. Wrong coupling and uncoupling can be dangerous. The makes and models of rigs are different. So, learn the details of coupling and uncoupling the trucks that you will operate.

### Coupling Twin Trailers

- ▶ **Secure the second (rear) trailer.**
  - ▶ If the second trailer doesn't have spring brakes, drive the tractor close to the trailer.
  - ▶ Connect the emergency line and charge the trailer air tank.
  - ▶ Disconnect the emergency line.
  - ▶ If the slack adjusters are set correctly, this will set the trailer emergency brakes.
  - ▶ If you aren't sure about the trailer brakes, chock the wheels.
- ▶ **Couple the tractor and first semi-trailer.**
  - ▶ To couple the tractor and first semi-trailer, follow the steps in Section 3: Combination Vehicles.

**Caution:** The semi-trailer with the heaviest load should be behind the tractor. The lighter trailer should be in the rear.

**Definition:** A converter gear or dolly is a coupling device with one or two axles and a fifth wheel. It is used to couple a semi-trailer to the rear of a tractor trailer combination, forming twin trailers.

- ▶ Move the dolly to the rear of the first semi-trailer and couple it to the trailer.
  - ▶ Lock the pintle hook.
  - ▶ Secure the dolly support in the raised position.
  - ▶ Pull the dolly into position as close as possible to the nose of the second semi-trailer.
  - ▶ Lower the dolly support.
  - ▶ Unhook the dolly from the first trailer.
  - ▶ Wheel the dolly into position in front of the second trailer in line with the kingpin.
- ▶ **Connect the converter dolly to the front trailer.**
    - ▶ Back the first semi-trailer into position in front of the dolly tongue.
    - ▶ Hook the dolly to the front trailer.
      - ▶ Lock the pintle hook.
      - ▶ Secure the converter gear support in the raised position.
    - ▶ Be sure that the trailer brakes are locked or that the wheels are chocked.
    - ▶ Make sure the trailer height is correct. It must be slightly lower than the center of the fifth wheel so that the trailer is raised slightly when the dolly is pushed under it.
    - ▶ Back the converter dolly under the rear trailer.
    - ▶ Raise the landing gear slightly off the ground to prevent damage if the trailer moves.
    - ▶ Test the coupling by pulling against the pin of the rear semi-trailer.
    - ▶ Make a visual check of the coupling.
      - ▶ Make sure that there is no space between the upper and lower fifth wheel. If there is, something is wrong.
      - ▶ Make sure the fifth wheel jaws have closed around the shank of the kingpin.
    - ▶ Connect the safety chains, air hoses and light cords.
    - ▶ Close the converter dolly air tank petcock and shut-off valves at the rear of the second trailer. The service and emergency line shut-off valve at the rear of the second trailer should be closed.
    - ▶ Open the shut-off valves at the rear of the first trailer and on the dolly.
    - ▶ Raise the landing gear.
    - ▶ Charge the trailers' air supply.
      - ▶ Push in the trailer air supply knob.
      - ▶ Check for air at the rear of the second trailer by opening the emergency line shut-off valve.
      - ▶ If there is no air pressure there, something is wrong and the brakes won't work.
- ▶ **Position the converter dolly in front of the second (rear) trailer.**
    - ▶ Release the dolly brakes by opening the dolly air tank petcock. If the dolly has spring brakes, use the dolly parking brake control.
    - ▶ If it isn't too far, wheel the dolly into position by hand. Line it up with the kingpin.
    - ▶ Or, use the tractor and first semi-trailer to pick up the converter dolly.
      - ▶ Position the combination (tractor and first semi-trailer) as close as possible to the converter dolly.

### Uncoupling Twin Trailers

- ▶ **Uncoupling the rear trailer**
  - ▶ Park the rig in a straight line on firm level ground.
  - ▶ Apply the parking brakes so that the rig won't move.
  - ▶ Chock the wheels on the second trailer if it doesn't have spring brakes.
  - ▶ Lower the landing gear of the second trailer enough to remove some weight from the dolly.
  - ▶ Close the air shut-off valve at the rear of the first trailer and on the dolly.
  - ▶ Disconnect all dolly air and electric lines and secure them.
  - ▶ Release the dolly brakes.
  - ▶ Release the converter dolly fifth wheel latch.
  - ▶ Slowly pull the tractor, first trailer and dolly forward to pull the dolly from under the second trailer.
- ▶ **Uncouple the converter dolly.**
  - ▶ Lower the dolly landing gear.
  - ▶ Disconnect the safety chains.
  - ▶ Apply the converter gear spring brakes or chock the wheels.
  - ▶ Release the pintle hook on the first trailer.
  - ▶ Slowly pull clear of the dolly.

**Caution:** Never unlock the pintle hook with the dolly still under the rear trailer. The dolly tow bar could fly up. This could cause injury and would make it very difficult to re-couple.

### Coupling and Uncoupling Triple Trailers

- ▶ **Couple the second and third trailers.**
  - ▶ Couple second and third trailers using the method of coupling doubles.
  - ▶ Uncouple the tractor and pull away from the second and third trailers.
- ▶ **Couple the tractor and first trailer to the second and third trailers.**
  - ▶ Couple the tractor to the first trailer. Use the steps outlined in Section 3: Combination Vehicles.
  - ▶ Move the converter dolly into position and couple the first trailer to the second trailer using the steps outlined for coupling doubles. The triple rig is now complete.

- ▶ **Uncouple the triple rig.**
  - ▶ Uncouple the third trailer by pulling out the dolly. Then unhitch the dolly using the steps outlined for uncoupling doubles.
  - ▶ Uncouple the rest of the rig the same way you would uncouple a double-bottom rig. Follow the steps already outlined.

### Pulling Doubles/Triples Trailers

- ▶ **Prevent roll-overs.**
  - ▶ Double and triple tractor-trailer combinations are less stable than other commercial vehicles. Therefore, steer gently and go slowly around curves, corners and on-and off ramps.
  - ▶ Remember, a safe speed on a curve for a straight truck or a single trailer combination vehicle may be too fast for a set of double or triple trailers.
- ▶ **Beware of the crack-the-whip effect.**
  - ▶ Doubles and triples are more likely to turn over than other combination vehicles because of the crack the whip effect. You must steer gently when pulling trailers. The last trailer in a combination is the most likely one to turn over.
  - ▶ Study Section 3: Combination Vehicles to make sure you fully understand the crack-the-whip effect.
- ▶ **Look ahead.**
  - ▶ You must drive doubles and triples very smoothly to prevent a rollover or jackknife. Therefore, look far ahead so you can slow down or change lanes gradually if necessary.
- ▶ **Manage your space.**
  - ▶ Doubles and triples take up more space than other commercial vehicles. They are longer and also need more space because you cannot turn or stop them suddenly.
  - ▶ Allow more following distance.
  - ▶ Make sure you have large enough gaps before entering or crossing traffic.
  - ▶ Be sure you are clear on the side before you change lanes.
- ▶ **Be even more careful in adverse conditions.**
  - ▶ In bad weather, slippery conditions or when driving in the mountains, you must be very careful when driving doubles and triples.
  - ▶ You have greater length and more dead axles to pull with your drive axles than with other vehicles. There is more chance for skids and loss of traction.

## Section 5: School Buses

Every Virginia CDL test includes information from Section 1: General Knowledge.



**To drive a school bus**, you must be at least 18 years of age. You must also hold a valid commercial driver's license. Depending on the weight and size of the bus that you will drive, you will be issued a Class B or Class C license. Additionally you must have a passenger bus endorsement and a school bus endorsement on your CDL. Individuals required to register with the Virginia State Police Sex Offender and Crimes Against Children registry are prohibited from obtaining a school bus endorsement during any period in which registration is required.

### School Bus Endorsement

To get your CDL and the endorsement to drive a school bus, you must pass:

- ▶ the written general knowledge test
- ▶ the written passenger bus test
- ▶ the written school bus test
- ▶ the written air brakes test if your vehicle is equipped with air brakes.
- ▶ the skills test required for the class of vehicle that you plan to drive. If you plan to drive a bus equipped with air brakes, you must take the skills test in a bus equipped with air brakes.

To prepare for these tests, study:

- ▶ Section 1: General Knowledge
- ▶ Section 2: Air Brakes (if your vehicle will be equipped with air brakes)
- ▶ Section 5: School Buses
- ▶ Section 8: Transporting Passengers

If you plan to drive a school bus designed to carry fewer than 16 passengers, including the driver, you do not need to obtain a CDL, or the passenger bus endorsement. However, you must have the school bus endorsement on your driver's license. Therefore, you will need to pass the school bus knowledge and skills tests. You will be restricted to driving buses designed to carry fewer than 16 passengers including the driver and this restriction will be printed on your license.

Fees are not charged for a school bus endorsement on the driver's license or the commercial driver's license. The fee for a driver's license with a school bus endorsement is \$4.00 per year.

If you wish to operate a school bus that is designed to carry 16 or more passengers, you must obtain a commercial driver's license. You will need to pass the CDL general knowledge test, the passenger knowledge test, school bus knowledge test, and the air brake knowledge test if the vehicle is equipped with air brakes. In addition to the written tests, you must pass the road skills test in a commercial vehicle representative of the type you propose to operate.

If you operate only a school and/or activity bus, you may have commercial license privileges restricted for this purpose and pay only the driver's license fee of \$4.00 per year or \$20.00 for a 5-year license. However, if you intend to operate commercial vehicles other than the school or school activity bus, or if you have a class A CDL or add other endorsement, you will have to pay the fees for the CDL and the additional endorsements.

### Pre-Trip Inspection

Before driving, make sure your bus is safe.

#### Conduct a pre-trip inspection.

- ▶ Follow the inspection method outlined in Section 1: General Knowledge.

#### Also:

- ▶ Make sure all lettering is clean and easy to read.
- ▶ Check the school bus traffic warning lights to make sure they are working.
- ▶ Check the operation of the traffic warning sign (stop arm) and crossing control arm if your bus is equipped with these features.
- ▶ Clean and adjust the mirrors.
- ▶ Check emergency equipment such as flag, flares or reflectors, first aid kit, fire extinguishers.
- ▶ Check all gauges on the instrument panel.
- ▶ Check for exhaust leaks.

#### Do not drive the bus if:

- ▶ the oil or water level is LOW or ADD;

## Section 5: School Buses

- ▶ the turn signals, flashing traffic warning lights or brake lights do not operate;
- ▶ there are problems with the brakes or steering; or, there are noticeable exhaust leaks.

### Operating the Bus Safely

Virginia law requires all school bus drivers to wear safety belts.

Virginia law prohibits the use of hand-held or hands-free cell phones or other wireless devices while operating a school bus. The only exceptions are in an emergency situation or when the vehicle is lawfully parked and for the purposes of dispatching.

School bus drivers may use two-way radio devices authorized by the owner of the school bus.

### Danger Zones and Use of Mirrors

The danger zone is the area on all sides of the bus where children are in the most danger. The danger zones may extend as much as 30 feet from the front bumper with the first 10 feet being the most dangerous, 10 feet from the left and right sides of the bus and 10 feet behind the rear bumper of the bus. In addition, the area to the left of the bus is always considered dangerous because of passing cars.

### Correct Mirror Adjustment

Proper adjustment and use of all mirrors is vital to the safe operation of the school bus in order to observe the danger zone around the bus and look for students, traffic, and other objects in this area. You should always check each mirror before operating the school bus to obtain maximum viewing area. If necessary, have the mirrors adjusted.

### Outside Left and Right Side Flat Mirrors

These mirrors are mounted at the left and right front corners of the bus at the side or front of the windshield. They are used to monitor traffic, check clearances and students on the sides and to the rear of the bus. There is a blind spot immediately below and in front of each mirror and directly in back of the rear bumper. The blind spot behind the bus extends 50 to 150 feet and could extend up to 400 feet depending on the length and width of the bus.

Ensure that the mirrors are properly adjusted so you can see:

- ▶ 200 feet or 4 bus lengths behind the bus.
- ▶ Along the sides of the bus.
- ▶ The rear tires touching the ground.

### Outside Left and Right Side Convex Mirrors

The convex mirrors are located below the outside flat mirrors. They are used to monitor the left and right sides at a wide angle. They provide a view of traffic, clearances, and students at the side of the bus. These mirrors present a view of people and objects that does not accurately reflect their size and distance from the bus.

You should position these mirrors to see:

- ▶ The entire side of the bus up to the mirror mounts.
- ▶ Front of the rear tires touching the ground.
- ▶ At least one traffic lane on either side of the bus.

### Outside Left and Right Side Crossover Mirrors

These mirrors are mounted on both left and right front corners of the bus. They are used to see the front bumper “danger zone” area directly in front of the bus that is not visible by direct vision, and to view the “danger zone” area to the left side and right side of the bus, including the service door and front wheel area. The mirror presents a view of people and objects that does not accurately reflect their size and distance from the bus. The driver must ensure that these mirrors are properly adjusted.

Ensure that the mirrors are properly adjusted so you can see:

- ▶ The entire area in front of the bus from the front bumper at ground level to a point where direct vision is possible. Direct vision and mirror view vision should overlap.
- ▶ The right and left front tires touching the ground.
- ▶ The area from the front of the bus to the service door.
- ▶ These mirrors, along with the convex and flat mirrors, should be viewed in a logical sequence to ensure that a child or object is not in any of the danger zones.

### Overhead Inside Rearview Mirror

This mirror is mounted directly above the windshield on the driver's side area of the bus. This mirror is used to monitor passenger activity inside the bus. It may provide limited visibility directly in back of the bus if the bus is equipped with a glass-bottomed rear emergency door. There is a blind spot area directly behind the driver's seat as well as a large blind spot area that begins at the rear bumper and could extend up to 400 feet or more behind the bus. You must use the exterior side mirrors to monitor traffic that approaches and enters this area.

You should position the mirror to see:

- ▶ The top of the rear window in the top of the mirror.
- ▶ All of the students, including the heads of the students right behind you.

## Loading and Unloading Passengers

- ▶ **Turn on your school bus traffic warning lights.**
  - ▶ You must turn on the warning lights in accordance with state law before you stop to load or unload students.
  - ▶ If the posted speed limit is less than 35 mph, turn on the warning lights at least 100 feet before the stop.
  - ▶ If the posted speed is 35 mph or more, turn on the warning lights at least 200 feet before the stop.
  - ▶ Do not use the warning lights except when loading and unloading passengers.
- ▶ **Extend the warning sign (stop arm) and crossing control arm.**
  - ▶ Extend the warning sign and crossing control arm only when the bus is stopped to load and unload passengers.

### When loading or unloading students:

- ▶ Check your mirrors continuously.
- ▶ Do not use the emergency four-way hazard flashers.
- ▶ Stop in the right lane of the road.
- ▶ On divided highways, five lane roads where the middle lane is used for turning, or heavily traveled roads, unload the students on the side of the road where they live.
- ▶ Stop only when the bus can be seen clearly at a safe distance.
- ▶ Make sure all students are on the bus and seated before moving.
- ▶ Before backing the bus, make sure all students are on the bus and seated.
- ▶ When unloading, make sure all students are clear of the bus before moving. Most injuries occur when the bus is stopped to load or unload students.
- ▶ Never park the bus so that the emergency exit will be blocked while students are on board.
- ▶ Report drivers who illegally pass a bus stopped to load or unload passengers. Make a note of:
  - ▶ the license plate number and state;
  - ▶ the make, type and color of the vehicle; and,
  - ▶ date, time and location of the incident.

## Backing the Bus

- ▶ Do not back the bus unless there is no other safe way to move the vehicle. Drive around the block or make a detour rather than backing the bus.
- ▶ Pick up passengers before backing or turning.
- ▶ Post a lookout on the inside, back of the bus to warn of obstacles, approaching persons or other vehicles.
- ▶ Check your mirrors constantly while backing.

- ▶ Only unload passengers after you have completed the backing maneuver.

## Passing and Turning

- ▶ Avoid passing or driving side-by-side with another bus on the highway.
- ▶ Keep a safe distance between vehicles if you must pass.
- ▶ When turning left, get into the left lane (if there is one) in plenty of time to make the turn safely.

## Following Other Vehicles

- ▶ Always leave at least a bus length between you and the vehicle in front of you.
- ▶ Outside of cities and towns, keep at least 200 feet between you and the vehicle in front of you.

## Railroad Crossings

- ▶ As you approach a railroad crossing, tap your brakes lightly to warn other drivers that the bus is about to stop.
- ▶ Turn on your four-way hazard lights at least 200 feet before a railroad crossing.
- ▶ Come to a full stop at least 15 feet from the nearest rail.
- ▶ Open the entrance door and driver's window.
- ▶ Turn off the warning lights unless you are loading and unloading passengers.
- ▶ Listen and look carefully in both directions.
- ▶ When it is safe to cross, close the entrance door and turn off the four-way hazard lights.
- ▶ Cross the railroad tracks in a gear which allows you to cross the rails completely without changing gears.
- ▶ If the gate comes down as you are starting across the railroad highway crossing, drive through the gate.

## Speed Limits for Buses

- ▶ When traveling on highways where the maximum speed limit is 55 mph or less, you must not exceed 45 mph or the minimum speed limit, if one is posted, whichever is greater.
- ▶ When traveling on interstate or other highways where the maximum speed limit is more than 55 mph, you must not exceed 60 mph.
- ▶ In school, business, and residential areas, you must not exceed the posted speed limit. If no speed limit is posted, drive 25 mph.
- ▶ When traveling on a highway designated as a rural rustic road, you must not exceed the posted speed limit. If no speed limit is posted, you must not exceed 35 mph.

Remember, weather, road and traffic conditions may require you to travel slower than these speed limits. When in doubt, slow down.

## Antilock Braking Systems (ABS)

Your school bus will have a yellow ABS malfunction lamp on the instrument panel if it is equipped with ABS.

### How ABS Helps You

When you brake hard on slippery surfaces in a vehicle without ABS, your wheels may lock up. When your steering wheels lock up, you lose steering control. When your other wheels lock up, you may skid or even spin the vehicle.

ABS helps you avoid wheel lock up and maintain control. You may or may not be able to stop faster with ABS, but you should be able to steer around an obstacle while braking, and avoid skids caused by over braking.

### Braking with ABS

When you drive a vehicle with ABS, you should brake as you always have. In other words:

- ▶ Use only the braking force necessary to stop safely and stay in control.
- ▶ Brake the same way, regardless of whether you have ABS on the bus. However, in emergency braking, do not pump the brakes on a bus with ABS.
- ▶ As you slow down, monitor your bus and back off the brakes (if it is safe to do so) to stay in control.

### Braking if ABS is Not Working

Without ABS, you still have normal brake functions. Drive and brake as you always have.

Vehicles with ABS have yellow malfunction lamps to tell you if something is not working. The yellow ABS malfunction lamp is on the bus's instrument panel. As a system check on newer vehicles, the malfunction lamp comes on at start-up for a bulb check and then goes out quickly. On older systems, the lamp could stay on until you are driving over five mph. If the lamp stays on after the bulb check, or goes on once you are under way, you may have lost ABS control at one or more wheels.

Remember, if your ABS malfunctions, you still have regular brakes. Drive normally, but get the system serviced soon.

## Student Management

### Don't Deal with On-bus Problems When Loading and Unloading

In order to get students to and from school safely and on time, you need to be able to concentrate on the driving task. Loading and unloading requires all your concentration. Don't take your eyes off what is happening outside the bus. If there is a behavior problem on the bus, wait until the students unloading are safely off the bus and have moved away. If necessary, pull the bus over to handle the problem.

### Handling Serious Problems

- ▶ Follow your school's procedures for discipline or refusal of rights to ride the bus.
- ▶ Stop the bus. Park in a safe location off the road, perhaps a parking lot or a driveway.
- ▶ Secure the bus. Take the ignition key with you if you leave your seat.
- ▶ Stand up and speak respectfully to the offender or offenders. Speak in a courteous manner with a firm voice. Remind the offender of the expected behavior. Do not show anger, but do show that you mean business.
- ▶ If a change of seating is needed, request that the student move to a seat near you.
- ▶ Never put a student off the bus except at school or at his or her designated school bus stop. If you feel that the offense is serious enough that you cannot safely drive the bus, call for a school administrator or the police to come and remove the student. Always follow your state or local procedures for requesting assistance.

## Handling Emergencies

### Emergency Drills

Virginia law requires that you hold an emergency exit drill at least once during the first 90 calendar days of the school year or more often if needed. Your local school board or board of education may require more frequent drills.

### Emergency Situations

- ▶ Bus crashes
  - ▶ Do not move the bus until police or school officials arrive.
  - ▶ Check the bus for injured students.
  - ▶ Protect the crash scene by setting out flares or reflectors.

- ▶ Do not leave students unattended. Have a responsible student or passing motorist notify the authorities.
- ▶ Keep students on the bus unless there is extensive damage or danger of further injury or fire.
- ▶ If another vehicle is involved, get the
  - ▶ driver's name, address, phone number, driver's license number, insurance company name and policy number;
  - ▶ vehicle's license plate number and the state and the type of vehicle;
  - ▶ name, address and phone number of witnesses or other drivers involved in the crash.
- ▶ The position of the bus may change and increase the danger.
- ▶ There is imminent danger of collision.
- ▶ There is a need to quickly evacuate because of a hazardous materials spill.

**General Procedures.** Determine if evacuation is in the best interest of safety.

- ▶ Determine the best type of evacuation:
  - ▶ Front, rear or side door evacuation, or some combination of doors.
  - ▶ Roof or window evacuation.
- ▶ Secure the bus by:
  - ▶ Placing the transmission in park, or if there is no shift point, in neutral.
  - ▶ Setting parking brakes.
  - ▶ Shutting off the engine.
  - ▶ Removing the ignition key.
  - ▶ Activating hazard warning lights.
- ▶ If time allows, notify dispatch office of evacuation location, conditions, and type of assistance needed.
- ▶ Dangle radio microphone or telephone out of driver's window for later use, if operable.
- ▶ If no radio, or radio is inoperable, dispatch a passing motorist or are resident to call for help. As a last resort, dispatch two older, responsible students to go for help.
- ▶ Order the evacuation.
- ▶ Evacuate students from the bus
  - ▶ Do not move a student you believe may have suffered a neck or spinal injury unless his or her life is in immediate danger.
  - ▶ Special procedures must be used to move neck spinal injury victims to prevent further injury.
- ▶ Direct a student assistant to lead students to the nearest safe place.
- ▶ Walk through the bus to ensure no students remain on the bus. Retrieve emergency equipment.
- ▶ Join waiting students. Account for all students and check for their safety.
- ▶ Protect the scene. Set out emergency warning devices as necessary and appropriate.
- ▶ Prepare information for emergency responders.

## Break Downs

- ▶ Set out flares or reflectors.
- ▶ Turn on the emergency four-way hazard lights.
- ▶ Keep the students on the bus until other transportation arrives unless there is danger of injury.

## Evacuations

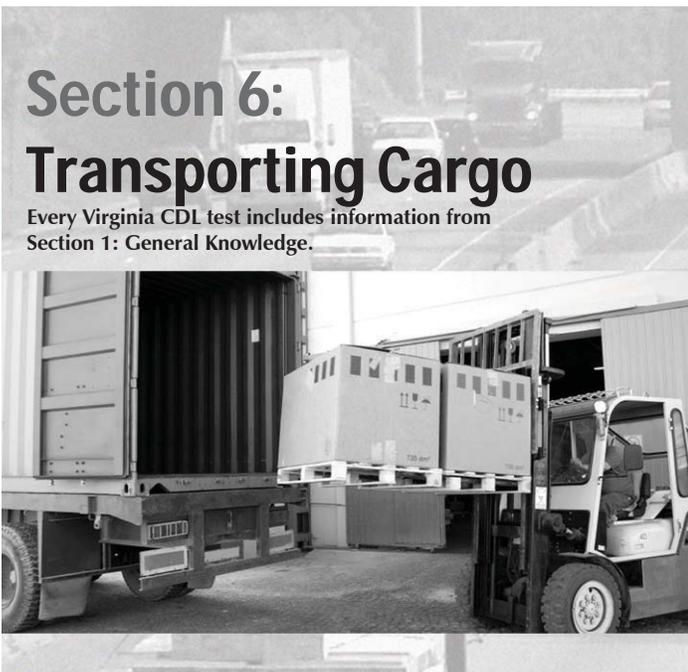
An evacuation situation can happen to anyone, anytime, anywhere. Knowing what to do before, during and after an evacuation can mean the difference between life and death.

**Determine Need to Evacuate the Bus.** The first and most important consideration is for you to recognize the hazard. If time permits, contact your dispatcher to explain the situation before making a decision to evacuate the school bus. The decision to evacuate the bus must be timely. A decision should include consideration of the following conditions:

- ▶ Is there a fire or danger of fire?
- ▶ Is there a smell of raw or leaking fuel?
- ▶ Is there a chance the bus could be hit by other vehicles?
- ▶ Is the bus in the path of a sighted tornado or rising waters?
- ▶ Are there downed power lines?
- ▶ Would removing students expose them to speeding traffic, severe weather, or a dangerous environment?
- ▶ Would moving students complicate injuries?
- ▶ Is there a hazardous materials spill involved? Sometimes, it may be safer to remain on the bus and not come in contact with the material.

**Mandatory Evacuations.** You must evacuate the bus when:

- ▶ The bus is on fire or there is a threat of fire.
- ▶ The bus is stalled on or adjacent to a railroad highway crossing. Steer students away from the track on an angle toward the oncoming train.



**This section tells** you about hauling cargo safely. You must understand basic cargo safety rules to get a CDL.

Cargo that is loaded wrong or that is not secured is a danger to others and you. Loose cargo can:

- ▶ fall from the vehicle and cause a crash
- ▶ hurt or kill you if you stop quickly or crash
- ▶ make it difficult for you to steer the vehicle

Additionally, loose cargo can be damaged by sliding back and forth and can damage the vehicle. You may load and secure the cargo yourself or someone else may load and secure it. In either case, you must:

- ▶ inspect the cargo, unless it is a sealed load or the manner of handling makes inspection impractical.
- ▶ recognize overloads and poorly balanced weight.
- ▶ ensure that the cargo is properly secured.

If you plan to carry hazardous materials that require placards on your vehicle, you must have a hazardous materials endorsement. You must be at least 21 years of age. Section 9 of this manual gives you the information that you need to pass the hazardous materials test.

### Inspecting Cargo

As part of the pre-trip inspection, make sure that the truck is not overloaded. Be sure that the cargo is balanced and secured properly. Inspect the cargo before you begin your trip. Make any adjustments needed. Check the cargo and securing devices as often as necessary during the trip to keep the load secure.

Federal, state and local regulations cover commercial vehicle weight, where you can drive large vehicles and requirements for securing and covering cargo. These regulations vary from place to place. Know the regulations for the areas where you plan to drive.

## Cargo Weight and Balance

### Definitions of Weight

**Gross vehicle weight (GVW)** The total weight of a single vehicle plus the cargo.

**Gross combination weight (GCW)** The total weight of a powered unit (tractor) plus the trailer or trailers plus the cargo.

**Gross vehicle weight rating (GVWR)** The maximum GVW specified by the manufacturer for a single vehicle plus the cargo (maximum scale weight).

**Axle weight** The weight transferred to the ground by one axle or one set of axles.

### Legal Weight Limits

You must keep weights within the legal limits. States have maximum GVWs, GCWs and axle weights. Often, maximum axle weights are set by a formula. This bridge formula governs gross weight independently of axle weight. This helps prevent overloading bridges and roadways. You'll find the maximum weights on the shipping bill.

### Overloading Affects Safety

Overloading a vehicle can affect steering, braking and speed control. Overloaded trucks may gain too much speed on downgrades and the stopping distance increases.

If you are driving in bad weather or in the mountains, it may not be safe to drive at the legal maximum weights. Consider this before you drive.

### Don't Be Top Heavy

Your vehicle's center of gravity affects safe handling. If cargo is piled high or if heavy cargo is loaded on top, the center of gravity will be high. Your vehicle will be more likely to tip over. A high center of gravity is most dangerous on curves or if you swerve to miss a hazard.

Cargo that is piled high can also shift to the side or fall off.

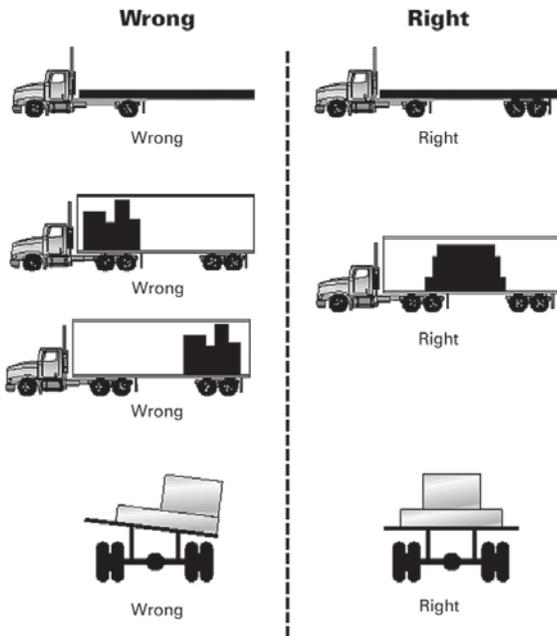
Distribute your cargo so that it is as low as possible. Load the heaviest parts of the cargo on the bottom.

## Balance the Weight

Weight that is poorly balanced will make vehicle handling unsafe. Too much weight on the steering axle will make it difficult to steer. It can also damage the steering axle and tires.

Shifting the weight to the back of the vehicle can make the steering axle weight too light. This makes steering unsafe.

Too little weight on the driving axles can cause poor traction. Drive wheels may spin. During bad weather the truck may not be able to keep going.



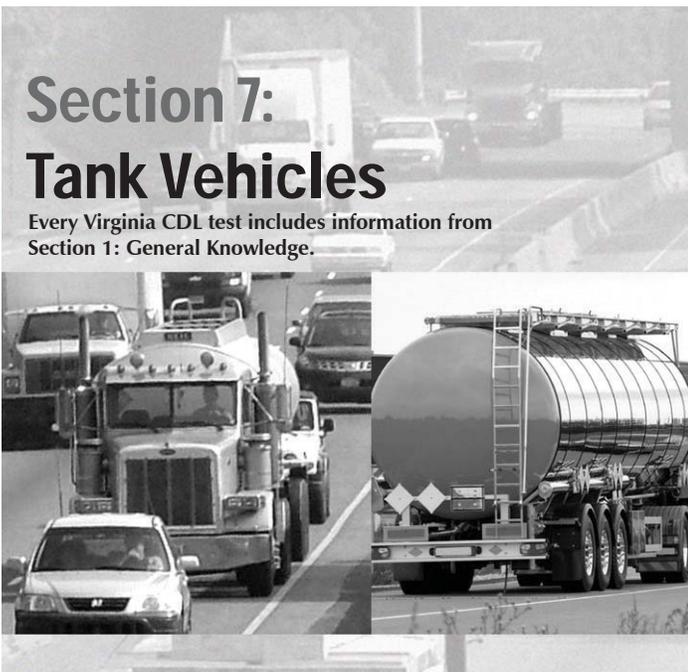
## Securing Cargo

- ▶ **Blocking** is used in the front, back and on the sides of a piece of cargo to keep it from sliding. Blocking is shaped to fit snugly against the cargo. It is secured to the cargo deck to keep the cargo from moving.
- ▶ **Bracing** also prevents cargo movement. Bracing goes from the floor to the upper part of the cargo. It can also go to the walls of the cargo compartment.
- ▶ **Cargo tiedowns** are used on flatbed trailers without sides. The tiedowns keep the cargo from shifting or falling off the vehicle. In closed vans, tiedowns keep the cargo from shifting.
  - ▶ You must use the correct type of tiedowns and correct strength tiedowns. The combined strength of all cargo tiedowns must be strong enough to lift 1 ½ times the weight of the cargo that is tied down. Use chains and tensioning devices (winches, ratchets and clinching components). You must attach the tiedowns to the vehicle correctly using hooks, bolts, rails and rings.

- ▶ Cargo should have at least one tiedown for each 10 linear feet of cargo. No matter how small the cargo, you should use at least two tiedowns to hold it.
- ▶ There are special requirements for securing heavy pieces of metal. Find out what they are if you plan to carry these materials. You find this information in the Code of Federal Regulations.
- ▶ Refer to the Code of Federal Regulations, 49 CFR Part 393.100 for additional load securing requirements.
- ▶ **Header boards** or headache racks protect you from your cargo if you crash or make an emergency stop. Make sure that the header board structure is in good condition. The structure should block the forward movement of any cargo that you are carrying.
- ▶ **Cargo covers** protect other people from spilled cargo and protect the cargo from the weather. Many states require cargo covers for spill protection. Be familiar with the cargo cover laws in the states where you drive.
  - ▶ Use your mirrors to check the cargo covers while you are driving. A flapping cover can tear loose, uncovering the cargo and blocking your view or someone else's view.
- ▶ **Sealed and containerized loads** are generally used for freight that is carried part way by rail or ship. Some containers have their own tiedown devices or locks that attach directly to a special frame. Others must be loaded onto flat bed trailers. These containers must be properly secured just like any other cargo.

## Other Cargo Requiring Special Care

- ▶ **Dry bulk tanks** require special care because they often have a high center of gravity which can cause the load to shift or the trailer to flip over. Be careful when driving around curves and making sharp turns.
- ▶ **Hanging meat** in a refrigerated truck is a very unstable load with a high center of gravity. Be very careful when driving on sharp curves, such as ramps and exit ramps. Drive slowly.
- ▶ **Livestock** can move around in a trailer causing a shift in weight and balance. If you are carrying less than a full load, use false bulkheads to keep the livestock bunched together. Even when bunched together, live stock may lean on curves. This shifts the center of gravity and makes rollover more likely.
- ▶ **Over-length, over-width and/or over-weight loads** require special transit permits. These permits are issued by the Virginia Department of Motor Vehicles. Driving is usually limited to certain times. Special equipment may be necessary, such as signs, flashing lights, flags, etc. Over-sized loads may require a police escort or pilot vehicles with warning signs and flashing lights.



**A tank vehicle** is a vehicle used to carry any liquid or liquid gas in a tank of 1,000 gallons or more. A portable tank is a bulk container that is not permanently attached to the vehicle.

### Inspecting Tank Vehicles

In addition to the pre-trip inspection outlined in Section 1: General Knowledge, you must inspect additional special items found on a tank vehicle. Since tank vehicles come in many types and sizes, check the vehicle's operator's manual to make sure you know how to inspect your tank vehicle. On all tank vehicles, however, leaks are the most important thing to check for. Don't carry liquids or gases in a leaking tank.

When checking your vehicle, be sure to check the following:

- ▶ Check the tank's body or shell for dents and leaks.
- ▶ Check the intake, discharge and cut-off valves. Make sure the valves are in the correct position before loading, unloading or moving the vehicle.
- ▶ Check the pipes, connections and hoses for leaks, especially around joints.
- ▶ Check manhole covers and vents. Make sure the covers have gaskets and that they close correctly. Keep the vents clear so that they work correctly.
- ▶ Check special purpose equipment. If your vehicle has the following equipment, be sure it works:
  - ▶ vapor recovery kits
  - ▶ grounding and bonding cables
  - ▶ emergency shut-off systems
  - ▶ built-in fire extinguisher

- ▶ Check the emergency equipment required for your vehicle. Find out what equipment you are required to carry and make sure you have it and know how it works.

### Driving Tank Vehicles

Hauling liquids in tanks requires special skills because of the vehicle's high center of gravity and the movement of the liquid.

- ▶ **Tank vehicles have a high center of gravity.** Because much of the vehicle's weight is carried high off the road, this makes the vehicle top-heavy and easy to roll over. Tankers carrying liquids are particularly easy to roll over. Tests have shown that tankers can turn over at the speed limits posted for curves. Take curves and on-ramp/off-ramp curves well below the posted speeds.
- ▶ **Watch out for liquid surge.** Liquid surge results from the movement of liquid in partially filled tanks. For example, when you stop, the liquid will surge back and forth. When the wave hits the end of the tank, it tends to push the truck in the direction that the wave is moving. If the truck is on a slippery surface such as ice, the wave can shove the stopped truck out into the intersection. When driving a tanker carrying liquid, you must be familiar with the vehicle's handling.

Some tankers may have bulkheads or baffles to help control the liquid surge. However, unbaffled tanks, also known as smooth bore tanks, have nothing inside to slow down the flow of the liquid. Therefore, the forward and back surge can be very strong. Unbaffled tanks are usually those used to carry food products, such as milk. Sanitation regulations forbid the use of baffles because it is difficult to clean the inside of the tank. Therefore, be very cautious when driving smooth bore tanks. Start and stop slowly and smoothly.

- ▶ **Watch out for side-to-side surge.** Baffled liquid tanks have bulkheads with holes that let the liquid flow between the smaller tanks. The baffles help control the forward/backward liquid surge; however, the liquid can still surge side-to-side. This can cause the vehicle to roll over.
- ▶ **Distribute the weight evenly when loading your vehicle.** Some liquid tanks are divided into several smaller tanks by bulkheads. When loading and unloading the smaller tanks, pay attention to the weight distribution. Don't put too much weight on the front or rear of the vehicle.
- ▶ **Never load a cargo tank totally full.** Liquids expand as they warm. This is called outage. You must leave room for the liquid to expand. Different liquids expand by different amounts and require different amounts of outage. You must know the outage requirement for the liquids that you haul.

- ▶ **Know how full to load your vehicle.** A full tank of dense liquid, such as some acids, may exceed legal weight limits. Therefore, you may only partially fill tanks with heavy liquids. The amount of liquid that you can load into a tank depends on:
  - ▶ the amount that the liquid will expand during transit;
  - ▶ the weight of the liquid; and,
  - ▶ the legal weight limits.
- ▶ **Drive smoothly.** Because your tank vehicle has a high center of gravity and because of liquid surge, you must start, slow down and stop smoothly. You must also make smooth turns. Otherwise, your vehicle could roll over.
- ▶ **Use controlled or stab braking.** If you must stop quickly to avoid a crash, use controlled or stab braking. Remember, if you steer quickly while braking, your vehicle could roll over.

## Safe Driving Rules

- ▶ **Slow down before curves.** Then, accelerate slightly through the curve. The posted speed for a curve may be too fast for a tank vehicle. Stay below the posted speed.
- ▶ **Maintain a safe stopping distance between you and the vehicle ahead.** Remember, wet roads double the normal stopping distance. Empty tank vehicles may take longer to stop than loaded ones.
- ▶ **Don't over-steer, over-accelerate or over-brake.** This could cause your vehicle to skid or roll over. If your drive wheels or trailer wheels begin to skid, your vehicle may jackknife. If your vehicle starts to skid, take immediate action to restore traction to the wheels.

## Section 8: Transporting Passengers

Every Virginia CDL test includes information from Section 1: General Knowledge.



**You must have** a commercial driver's license if you plan to drive a vehicle designed to carry 16 or more passengers including the driver. You must also have a passenger endorsement on your CDL. To get the endorsement, you must pass:

- ▶ the written general knowledge exam;
- ▶ the written passenger bus exam;
- ▶ the written air brakes exam if your vehicle is equipped with air brakes;
- ▶ the skills test required for the class of vehicle that you plan to drive.

Note: If you hold a CDL with a Passenger endorsement and are required to be registered with the Virginia State Police Sex Offenders and Crimes Against Children registry, you are prohibited from operating a commercial motor vehicle to transport children to or from activities sponsored by a school or by a child day care facility licensed, regulated, or approved by the Virginia Department of Social Services. Your CDL will display a Q restriction.

## Pre-trip Inspection

Before driving your bus, make sure it is safe.

- ▶ **Review the inspection report made by the previous driver.** Sign the previous driver's report only if the defects reported earlier have been certified as repaired or certified as not needing repair. By signing this report, you certify that the defects reported earlier have been fixed.
- ▶ **Conduct a pre-trip inspection.** Follow the inspection method outlined in Section 1: General Knowledge.