Curriculum Scope and Sequence Modules for Driver Education in Virginia

Module Nine

Virginia Driver Responsibilities: Vehicle Functions

- **Vehicle Functions/Malfunctions**
- **Anti-Lock Braking Systems**
- **Vehicle Performance**
- **Highway Transportation System Agencies**

Virginia Department of Education
in cooperation with the
Virginia Department of Motor Vehicles

Table of Contents

Standards of Learning Addressed in This Module 1

Introduction 2

Topic 1—Vehicle Functions/Malfunctions 3
Lesson 1 4
Lesson 2 6
Lesson 3 10
Lesson 4 14

Topic 2—Anti-Lock Braking Systems 17
Lesson 1 18

Topic 3—Vehicle Performance 25
Lesson 1 26

Topic 4—Highway Transportation System Agencies 35
Lesson 1 36

Worksheets 39
Simulation 47
Assessment 49

Standards of Learning Addressed In This Module

DE.16 The student will identify and describe the performance characteristics of other road users and apply problem-solving skills to minimize risks when sharing the roadway with
a) pedestrians and animals;
b) pedalcycles and motorcycles;
c) tractor-trailers, trucks, and construction vehicles;
d) sport utility vehicles, recreation vehicles, and trailers;
e) emergency vehicles;
f) funeral processions;
g) passenger and school buses;
h) farm machinery and horse drawn vehicles.

DE.17 The student will compare vehicle-braking systems and explain proper braking techniques for various weather and roadway conditions. Key concepts/skills include
a) small and large vehicle conventional brake systems;
b) two- and four-wheel anti-lock brake systems (ABS).

DE.18 The student will analyze how preventive maintenance reduces the possibility of vehicle failures and recognize the warning signs that indicate the need for maintenance, repair, or replacement. Key concepts/skills include
a) vehicle warning devices;
b) lights and signals;
c) steering and suspension systems;
d) tires and braking systems;
e) fuel and ignition electronics.

Module Nine Introduction

Module Nine - Driver Responsibilities: Vehicle Functions
The driver will gain information about vehicle system functions and malfunctions, recognize when ABS engages, respond to vehicle malfunctions, respect other users, and understand the role of agencies that manage the highway system.

Topic 1—Vehicle Functions/Malfunctions
The student will understand how the steering, suspension, traction control, fuel, electrical, and brake systems function.

Topic 2—Anti-Lock Braking Systems
The student will understand the proper use of ABS technology.

Topic 3—Vehicle Performance
The student will understand vehicle performance characteristics and potential conflicts with other motorized and non-motorized roadway users.

Topic 4—Highway Transportation System Agencies
The student will understand that a consortium of federal, state, and local systems function together to provide a safe and lawful driving community.

Minimum Time Frames **Module Nine–2 Hours**	
Classroom Instruction	Recommended Minutes
Topic 1 — Vehicle Functions/Malfunctions	25
Topic 2 — Anti-Lock Braking Systems	50
Topic 3 — Vehicle Performance	40
Topic 4 — Highway Transportation System Agencies	20
Supplement—Parent Orientation	55
In-Car Instruction (Option 1)	
Behind-the-Wheel Instruction/Break	30
Observation	30
Laboratory Multiphase (Option 2)	
Behind-the-Wheel Instruction/Break	30
Observation	30
Simulation	30
Parental Involvement	60

Module Nine
Topic 1—Vehicle Functions/Malfunctions

25 Minutes Instructional Time
Prerequisites: Successful Completion of Modules 1 to 8

Instructor Activities	Time Frame
Review Module Nine, Topic 1 Lesson Plans Prior to Lesson	
Review Driver Education Vehicle's Owner's Manual	
Show Transparencies	20-25 minutes
T-9.1 "Dashboard Warning Symbols"	(3-4 minutes)
T-9.2 "Dashboard Warning Symbols"	(3-4 minutes)
T-9.3 "Vehicle Failures"	(3-4 minutes)
T-9.4 "Vehicle Systems"	(3-4 minutes)
T-9.5 "Vehicle Systems"	(3-4 minutes)
T-9.6 "Vehicle Systems"	(3-4 minutes)
Distribute and Review Student Worksheets W-9.1 "Procedures for Vehicle Malfunctions"	5-10 minutes
Review Module Assessments Prior to Lesson MA-9.1 "Module Nine Assessment"	
Additional Resources (Media and/or Text) "Drive Right" Ch. 13 "Handbook Plus" Ch. 14 "How To Drive" Ch. 11 "License To Drive" Ch. 16, 17 "Responsible Driving" Ch. 14"	

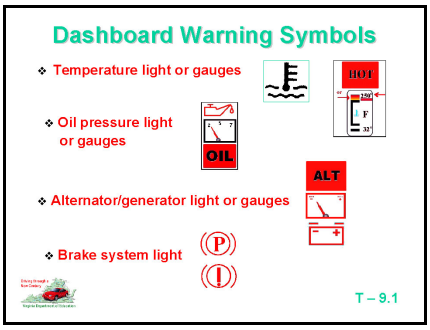
Knowledge and Skills

The student is expected to:

- recognize dashboard warning symbols and know what causes them to activate.
- describe what to do if a light activates.

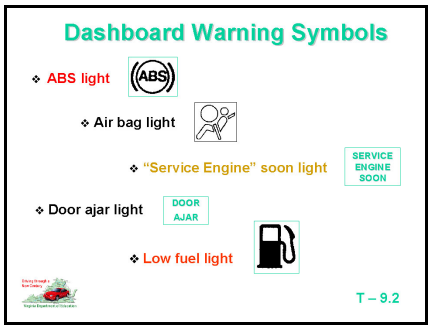
Activities & Resources

Show Transparency T-9.1 “Dashboard Warning Symbols” and discuss the various alert lights that may activate when starting the car, and the warning lights that may activate while driving. Discuss what to do if a light activates.



T-9.1
Dashboard Warning Symbols

Show Transparency T-9.2 “Dashboard Warning Symbols” and continue discussing the various alert lights that may activate during starting and the warning lights that may activate while driving. Discuss what to do if a light activates.



T-9.2
Dashboard Warning Symbols

Vehicle Dashboard Functions

It is essential to know what the warning lights and gauges on the instrument panel mean and where they are located. Ask students about alert vs. warning lights. Encourage them to become familiar with their vehicle's warning lights and gauges by reading the owner's manual, as this will help prevent them from being caught off-guard should a problem arise.

Alert Lights and Warning Symbols

- **Temperature light or gauge—**This light/gauge warns you when the coolant in the engine is too hot or too low. If it comes on, pull off the road when safe and get professional help. Caution: never attempt to remove the radiator cap when the engine is hot. The pressure and hot steam may cause severe upper torso and facial burns.

- **Oil pressure warning light or gauge—**This light/gauge warns you when the oil is not circulating at the proper pressure or there is not enough oil. This light/gauge does not tell you the amount of oil in the engine. It is recommended that you not drive too many miles under this condition.

- **Alternator/Generator warning light or gauge—**Your vehicle's electrical system is in trouble if this light comes on or the gauge shows "discharge" while the engine is running.
  - Discharge occurs when the alternator is not generating enough electricity to charge the battery.
  - Be aware that if this happens the engine must use electricity stored in the battery.
  - Turn off as many electrical devices as possible (i.e., the radio, heater/AC, etc.).
  - Caution: Have this checked without delay. If the battery is drained, the car can shut off without further warning.

- **Brake system warning light**—This warning light serves two purposes:
  - To show the parking brake is set before moving the vehicle.
  - To alert you that part or all of the braking system is not working properly or, in some vehicles, the brake fluid is too low. If the brake system is not working properly, brake gradually to a stop, have the vehicle towed, and have the problem corrected.

- **Anti-lock Braking System (ABS) light—**Alert light illuminates prior to start; warning light after start.

- **Air bag warning light—**Alert light illuminates prior to start; warning light after start.

- **Service engine soon light—**Warning light illuminates prior to or after start.

- **Door ajar light—**Warning light illuminates prior to or after start.

- **Low fuel warning light—**Warning light illuminates prior to or after start.

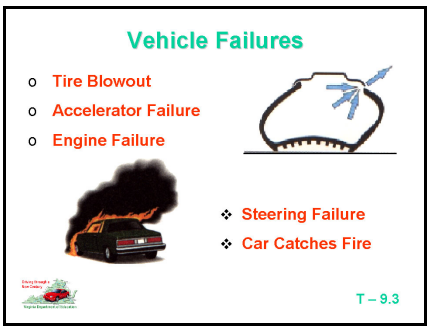
Knowledge and Skills

The student is expected to describe preventive measures and appropriate responses for sudden tire deflation, accelerator problems, engine failure, steering failure, and vehicle fire.

Activities & Resources

Show Transparency T-9.3 "Vehicle Failures" to discuss each action or procedure used when responding to driving emergencies.

- Blowout
- Accelerator problems
- Engine failure
- Steering failure
- Car fire



T-9.3
Vehicle Failures

Distribute Worksheet W-9.1 "Procedures for Vehicle Malfunctions" and have students fill it out as the procedures for handling vehicle failures are described.

Worksheet

Tire failure

All tires wear out gradually through hard braking and/or acceleration. They need periodic balancing and alignment. Look for wear bars appearing across the tires as a sign they need replacing.

A tire blowout is a rapid deflation of air from the tire. If a front tire blows out, vehicle will pull sharply in the direction of the blowout. If a rear tire blows out, vehicle will wobble and shake and pull slightly in the direction of the blowout. If a blowout occurs, follow these steps:

- Grip the steering wheel firmly.
- Take foot off the accelerator.
- DO NOT BRAKE.
- Allow the vehicle to slow on its own, or brake gently if necessary.
- Check traffic around you.
- Turn on emergency flashers.
- Drive to a protected location and pull off the roadway.
- Have the tire replaced.

Accelerator Failure

Accelerator failure could be caused by either a broken spring or the pedal getting stuck in the down position. In either case:

- Shift to Neutral (the engine may race but no harm done).
- Search for an escape path.
- Steer smoothly and brake gently.
- Pull off the roadway.
- Turn off the vehicle.
- Have the pedal repaired at a service center before driving again.

Engine Failure

Engine failure could happen when the engine quits running completely, becomes flooded, or overheats. If the engine just shuts off while driving:

- Shift to Neutral.
- Look for an escape path.
- DO NOT BRAKE hard.
- Pull off the roadway (brake gently but with more pressure on the pedal).
- Stop; try to restart the engine.
- If unsuccessful, raise hood and turn on emergency flashers.
- Wait for help.

Engine Becomes Flooded—There Will Usually Be a Strong Odor of Gasoline

- Push the accelerator pedal to the floor and hold it there.
- Turn the key for up to five seconds.
- If it doesn't start, wait several minutes and try again.
- Once started, release the accelerator pedal.

The Engine Overheats While Driving

- If the air conditioner is on, turn it off.
- Turn on the heater to draw heat off the engine.
- If stopped, shift to "neutral" and press the accelerator pedal gently.
- If these fail, move to a safe location off the roadway.

- Do not open the radiator cap.
- Seek help.

Total Steering Failure—A Serious Emergency
- Communicate to others by using the horn and emergency flashers.
- Stop as quickly as possible using the parking brake. DO NOT depress the brake pedal as the vehicle could swerve sharply.
- Shift to a lower gear.
- Call for assistance.

Power Steering Failure
The vehicle can still be steered, but it will require much more effort on the driver's part.

The Car Catches on Fire
- Steer the vehicle out of traffic and away from buildings and people.
- Everyone must leave the vehicle immediately and move away.
- If the engine is on fire, do not open the hood, call the fire department.
- If the passenger compartment is on fire, use a fire extinguisher, or call the fire department.

Brake Failure
Total brake failure rarely happens on newer vehicles because of cross matching brakes on dual master cylinders. The warning light will usually give warning if one of the dual cylinders malfunctions. If it does occur on an older vehicle, the driver is usually braking for a stop. Pump the brake pedal quickly. After three or four pumps the driver will know if the brakes are going to hold. This action may build up enough brake pressure to steer the vehicle off the highway and stop safely. If this doesn't work:
- downshift to a lower gear. This uses the braking power of the engine to slow the vehicle. Find an escape route—a safe exit from the highway.
- activate the hazard lights to warn other drivers of a problem.
- apply the parking brake gradually. You can quickly release the parking brake if the vehicle begins to skid, and reapply as needed. Select a safe path while the vehicle slows down.

If these steps do not stop the vehicle,
- look for an uphill slope.
- rub wheels against a curb.
- scrape against guardrails.

Should a collision be unavoidable, steer for a sideswipe rather then colliding head-on into something solid.

Power Brake Failure
- Power brake failure is usually the loss of power that helps you brake.
- Braking power stops if the engine stops.
- However, the power brake will function normally for one more application of the pedal.
- Apply the brake.
- Modulate pressure without releasing brake.
- If the brake pedal is released, the driver will have to press harder on the brake pedal to stop.
- The vehicle will stop.

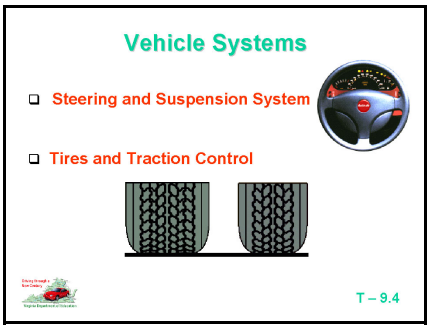
Notes

Knowledge and Skills

The student is expected to explain operation and maintenance of the steering, suspension, and traction control systems.

Activities & Resources

Show Transparency T-9.4 "Vehicle Systems" to briefly discuss vehicle systems used when driving a vehicle.



T-9.4
Vehicle Systems

Steering
- Rack and Pinion provides quicker turning radius with less input.
- Some are less than three turns from steering lock to steering lock.

Suspension
- Independent suspension
- McPherson struts

Tires
- Quality
- Radial design with firmer sidewalls
- Tread blocks and sipes to move water

Traction Control
- Electronic devices
- Active handling capabilities (motion sensors)

Support Information

Steering and Suspension

Steering System—controls the position of the front wheels in order to permit the driver to change the direction of the vehicle. Most cars today have power steering, a hydraulic pump powered by a belt connected to the engine that facilitates steering.

Basic Components of the Steering Wheel System
- Steering wheel—driver control that controls the position of the front wheels; may be adjustable (i.e. tilt steering wheel).
- Steering column—connects the steering wheel to the steering gear box. This is collapsible on impact to protect the driver.
- Steering gearbox—converts the rotary motion of the wheel into linear motion of the steering linkage.
- Power steering—hydraulic pump impelled by a belt connected to the engine that facilitates steering. (Most vehicles today have power steering.)

Support Information

General Steering Information

- Avoid turning the steering wheel when the vehicle is not moving; this causes wear on the steering system.
- Never force the steering at the limit of travel; back off slightly and the wheels will still be fully turned. Forcing to limit of travel causes early failure.
- Avoid deep potholes, curbs, and any other sudden or hard impacts that may cause damage to the steering components. Have the steering aligned at least once a year and after any serious impacts.
- Periodically inspect the belt at the power steering pump and check power steering fluid. (Consult the owner's manual for exact locations.)
- Steering problems often develop gradually rather than suddenly. Any steering problem is serious and should be repaired immediately.

Common Indications of Problems

- Play or excess movement in the steering wheel
- Steering difficulty, even though the tires are properly inflated
- Shimmying, wobbling, shaking, or pulling to one side under normal driving conditions
- Squealing sounds when making turns

Note: *Keep hands in the steering position of between the 9 and 3 o'clock and the 7 and 5 o'clock position to avoid injury from an air bag depending on the steering wheel openings. Injuries from the airbag include serious hand, arm, head, face, or eye injuries.*

Suspension System

Includes a series of rods, bars, springs, and other components. This system keeps the wheels and tires pointed in the direction of the steer. The suspension system:

- supports the weight of the vehicle.
- absorbs the shocks caused by road irregularities.
- provides flexibility while ensuring vehicle stability and drivability.
- supports the weight of the vehicle and flex to absorb road shocks.

If uneven tire wear is noticed, there may be a problem with the suspension system. Have this checked where the vehicle is serviced. Check the owner's manual for the recommended intervals for servicing or replacing the vehicle's shocks, struts, and joints. The steering and suspension will not break down without warning. Following the recommended service intervals in the owner's manual will permit early diagnosis and repair.

Basic Components

- Springs
- Leaf in the rear
- Coil front and sometimes rear
- Torsion bars
- McPherson Strut—A suspension unit that combines the shock and spring in one component.

Shock Absorbers

One installed at each wheel to control the oscillating action of the springs to minimize movement and stabilize the wheel contact with the road. Stabilizer bars (sway bars) are added to the front and sometimes the rear suspension to minimize body roll (lean or sway) on turns and bumps.

General Shock Information

- If the vehicle bounces more than usual, have shocks checked where the vehicle is serviced.
- If the vehicle does not appear to be level (when unloaded), have the springs checked for sag, wear and/or breakage where the vehicle is serviced.
- If the tire wear is uneven, there may be a problem with the suspension system. Have this checked where the vehicle is serviced.
- Check the owner's manual for the recommended intervals for servicing or replacing the vehicle's shocks, struts, and joints.
- The steering and suspension will not break down without warning.
- Following the recommended service intervals in the owner's manual will permit early diagnosis and repair.

Tires

Tires have two functions:

- They are air-filled cushions that absorb most of the shocks caused by road hazards. The tires flex, or give, as they meet these irregularities. This reduces the effect of the shocks on the vehicle and the passengers.
- Second, the tires grip the road to provide traction. This enables the driver to accelerate, brake, and steer the vehicle. This reduces the effect of the shocks on the vehicle and the passengers.

Basic Tire Information

- Ply—layers of material (cords impregnated with rubber) under the tread. Each ply strengthens the tire and gives it shape.
- There are two basic tire types:
  - **Bias ply—**plies are criss-crossed. This makes the casing strong in all directions. However, these tires wear more rapidly and provide less traction.
  - **Radial ply—**plies are parallel and perpendicular to the tread. Belts (usually steel) are then attached in the same position as the tread, which is then applied to the sidewall and results in more flexibility.
- Greater traction—the actual gripping power between the tires and the roadway surface. Traction provides improved tread mileage and improved fuel economy.
- Information about the tire's construction, size, recommended inflation levels, and carrying capacity is clearly marked on the sidewall of the tire.
- New tires usually have a paper label attached with additional information.
- Maintain the manufacturer's recommended air pressure in the tires at all times.
- Keep a reliable tire gauge in the vehicle and use it regularly. Maintaining proper air pressure in the tire will yield maximum fuel efficiency and tire mileage. Too little air pressure can make handling the vehicle more difficult. Underinflated tires will not get as much mileage either, and will need to be replaced sooner. *Caution: The risk of a blowout with underinflated tires is greater.*

- Always check the tires for wear whenever the vehicle is serviced. If abnormal wear is noticed, have a service technician correct the problem.

Tire Quality and Grading
All tires sold in the United States are rated on the Uniform Tire Quality Grading System. This can be read on the sidewall of the tire. Tires are rated by:

- Traction—measured by the ability to stop a car in straight-ahead motion on a wet surface. A tire graded A has the best traction performance, B grading is an above average rating, and C grading indicates the tire meets government standards.

- Temperature—indicates the tire's ability to withstand heat. A tire graded A is the most heat-resistant and less likely to suffer a blowout under the same conditions as tires with grades of B or C.

The higher the treadwear rating, the greater the mileage. A tire with a treadwear rating of 150 is expected to last 50 percent longer than one graded at 100.

Keep safety in mind when new tires are needed. Compare and decide which type of tire offers the best value for the kind of driving done. Check the owner's manual for recommendations on tires for the vehicle.

Traction—The Actual Gripping Power Between the Tires and the Roadway Surface
- The more traction there is, the greater the gripping power.
- Friction is the force that keeps each tire from sliding on the road.
- The friction created by the tire on the road is traction.
- Traction makes it possible for the vehicle to grip the road so the driver can change speed and direction.

Two things are necessary to maintain ideal levels of traction:
- Vehicle must be in good condition.
- Road must be smooth, paved, level, and clean.

Vehicle Condition
- As a vehicle ages, it must be maintained in order to perform correctly.
- If tires, shock absorbers, or steering system parts are allowed to wear, traction and control will be reduced.
- Good shock absorbers are very important for maintaining traction.
- Worn shock absorbers will limit vehicle control; have them replaced as soon as possible.
- Worn or improperly inflated tires also will limit control. Check tire pressure and tread frequently, and replace tires as needed.

Knowledge and Skills

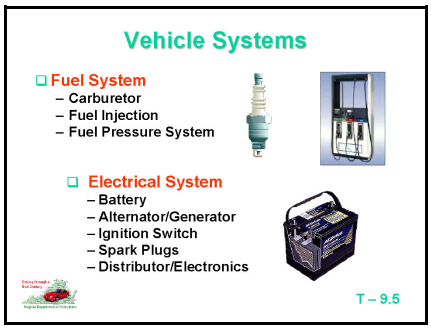
The student is expected to explain the operation and maintenance of fuel, electrical, and brake systems.

Activities & Resources

Show Transparency T-9.5 "Vehicle Systems" to briefly discuss fuel and electrical systems.

Fuel System
- Carburetor
- Fuel injection
- Fuel pressure system

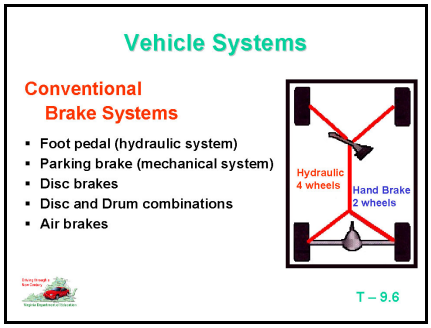
Electrical System
- Battery
- Alternator
- Ignition
- Spark plugs
- Distributor/electronics



T-9.5
Vehicle Systems

Show Transparency T-9.6 "Vehicle Systems" to briefly discuss brake systems.

- Hydraulics
- Mechanical
- Disc brakes
- Air brakes



T-9.6
Vehicle Systems

The Fuel System

The automotive fuel system is designed to provide the correct amount of fuel and air to the engine under all operating conditions and power demands. Many vehicles today use a fuel injection system (replacing the carburetor) to deliver the fuel under pressure into the combustion chambers or into the air flow just as it enters each individual cylinder. This maximizes power and economy.

Basic Components of the Fuel System

- Fuel tank—a reservoir for fuel. A tank device controls the fuel gauge to inform the driver of the fuel available.
- Fuel lines—tubes that connect the tank to the carburetor or injection system.
- Carburetor—mixes the fuel and air and supplies it to the cylinders. The gas pedal controls the carburetor.
- Fuel filter—removes dirt and other contaminants from the fuel. Replace as recommended in owner's manual.
- Fuel pump—electrical or mechanical device that forces fuel from the tank to the carburetor.
- Air filter—removes dirt and dust particles from air entering the engine. Replace at each tune-up.
- Choke—restricts air flow and increases idle speed (when cold).
- Turbo—turbine to increase the air entering the cylinders.

To keep the vehicle's fuel system in good shape, follow these simple tips:

- Keep fuel level above a quarter of a tank.
- Keep condensation out of the fuel lines.
- Avoid fouling (if fuel injection system) or clogging (carburetor) the system with contaminants.
- Do not run out of gas.
- Follow regular maintenance schedules and instructions in the owner's manual.

The Ignition System

The ignition system sets off combustion in the engine's cylinders by converting the 12-volt current to high voltage surges. The electrical system is involved in the ignition process and provides the electrical power needed to operate the vehicle's lights, controls, and accessories. The ignition system consists of the ignition switch, distributor assembly, ignition coil, spark plugs, wiring, and battery.

The Electrical System

- **The Charging System—**produces electrical power while the engine is running to operate all the electrical components and recharge the battery. This consists of a drive belt, alternator, voltage regulator, wiring, and battery.
- **The Starting System—**permits the driver to turn the ignition switch to activate an electric motor, Solenoid switch, wiring, and battery.
- **The Accessory Circuits—**power the lights, safety systems, and accessories. This system includes the fuse box, wiring, and any electrically powered equipment.

Other Components

- **The Fuse Box**—protects the electrical equipment. Refer to the owner's manual for location in the vehicle. Keep spare fuses in vehicle at all times.
- **Ignition Coil—**transforms the 12-volt current to a surge of current of many thousands of volts.
- **Spark Plugs—**produce spark to ignite the air-fuel mixture.
- **Battery—**stores energy in chemical form so it can supply the electricity to start the engine.
- **Distributor—**controls the production and distribution of the surges to the spark plugs.
- **Starter—**an electrical motor that cranks the engine (turns the flywheel) during starting.
- **Alternator—**is driven by the belt, charges the battery, and operates electrical component.

Overview of Braking Systems

The brake system permits the driver to slow or stop the rotation of the tires. The friction of the tires against the road surface will then slow and/or stop the vehicle. Modern vehicles are equipped with two braking systems: a dual hydraulic brake system and a mechanical brake system (parking or emergency brake).

Good brakes are essential for the safe operation of a vehicle. The life expectancy and performance of your brakes depends on how they are used and maintained. Braking distance is the distance the vehicle travels once the brakes are applied. Experience and skill in braking, the kinetic energy of the vehicle, the mechanical condition of the vehicle, and road conditions all come into play. Other factors that affect braking distances are roadway surface, hills, and loads.

Basic Components of Brake System

- **Disc Brakes—**superior brakes that utilize a pinching action on a metal disc to slow or stop tire rotation of the tire. Disc brakes are usually on the front wheels. The front brakes do 70% of the braking. Disc brakes are available as an option for all four wheels.
- **Drum Brakes—**brake shoes push outward on a rotating drum. Because they are enclosed, they retain heat.
- **Dual Master Cylinder—**the brake pedal applies pressure on two pistons that pressurize the brake fluid. The fluid transmits this pressure to each wheel where it activates the disc or drum brake mechanism. A reservoir (sometimes two) supplies extra fluid when needed. The dual systems operate independently in case one should fail.
- **Brake Lines—**double-walled steel tubes full of brake fluid that conduct the hydraulic pressure.
- **Power Brake—**an engine-activated booster unit that reduces the effort required to apply the hydraulic brakes. Will operate one more time if the engine should stop functioning.
- **Parking Brake—**a lever or foot pedal that mechanically (cables and levers) activates the rear brakes only (most vehicles). Can be used for parking and if the hydraulic brakes fail.
- **Indicator Light—**comes on if one of the dual hydraulic brake systems should fail or, in some vehicles, if the brake fluid is low. If this occurs, have a service technician check the problem.

Braking distance is the distance a vehicle travels once the brakes are applied. A driver's experience and skill in braking, the kinetic energy of the vehicle, the mechanical condition of the vehicle, and road conditions all come into play. What does this mean?

- A vehicle going 20 mph can stop within 20 feet.
- A vehicle going 40 mph takes 80 feet to stop.
- A vehicle going 60 mph stops at 180 feet.

Notice the vehicles in the last two examples increased speed by 20 mph each and how much further they traveled in the braking distance. Other factors that affect braking distances:

- **Vehicle condition**—a poorly maintained vehicle takes longer to stop.
- **Roadway surface**—rain, snow, ice, dirt, wet leaves, and gravel reduce road traction and increase stopping distance.
- **Hills**—braking distance increases when driving downhill.
- **Loads**—heavy loads increase your braking distance.

Module Nine
Topic 2—Anti-Lock Braking Systems

50 Minutes Instructional Time
Prerequisites: Successful Completion of Modules 1 to 8

Instructor Activities	Time Frame
Review Module Nine, Topic 2 Lesson Plans Prior to Lesson	
Show Transparencies	40-50 minutes
T-9.7 "Vehicle Systems"	(6-9 minutes)
T-9.8 "ABS Development"	(6-9 minutes)
T-9.9 "Critical Traction Needs"	(6-9 minutes)
T-9.10 "ABS Advantages"	(6-9 minutes)
T-9.11 "With ABS...Do"	(6-9 minutes)
T-9.12 "With ABS... Do Not"	(6-9 minutes)
Distribute and Review Student Worksheets	10-15 minutes
W-9.2 "ABS Pretest"	
W-9.3 "ABS Concerns and Issues"	
W-9.4 "ABS Post Test"	
Review Module Assessments Prior to Lesson	
MA-9.1, "Module Nine Assessment"	
Additional Resources (Media and/or Text)	
Video: "Stomp, Stay, and Steer," (Continental TEVES)	
Video: "ABS Safety" (ABS Educational Alliance, (919) 406-8811)	
Video: "Benefits of Four-Wheel ABS" (ABS Educational Alliance)	
"Drive Right" Ch. 13	
"How to Drive" Ch. 11	
"Handbook Plus," Ch. 14	
"License to Drive," Ch. 16, 17	
"Responsible Driving" Ch. 14	

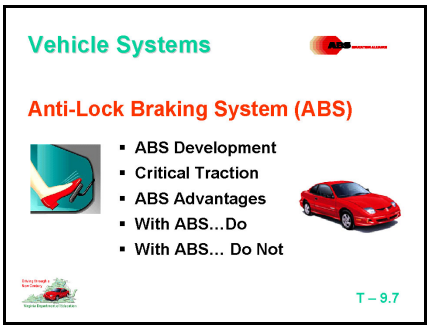
Knowledge and Skills

The student is expected to understand proper use of ABS technology.

Activities & Resources

Show Transparency T-9.7 “Vehicle Systems” to briefly discuss the components of the anti-lock braking systems used in vehicles.

- Development of ABS
- Provides critical traction
- Advantages
- How to Use ABS
- Factors in improper use of ABS



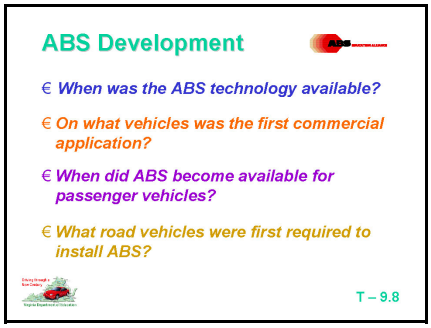
T-9.7
Vehicle Systems

Distribute Worksheet W-9.2 “ABS Pretest” to provide a basis for discussion of the ABS technology on new vehicles.

Worksheet

Show Transparency T-9.8 “ABS Development” to discuss the background and development of the anti-lock braking systems used in vehicles.

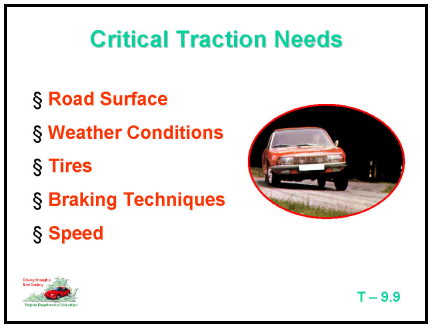
- Availability
- Commercial application
- Passenger vehicles
- Required installation



T-9.8
ABS Development

Show Transparency T-9.9 “Critical Traction Needs” to discuss the critical traction needs of a vehicle.

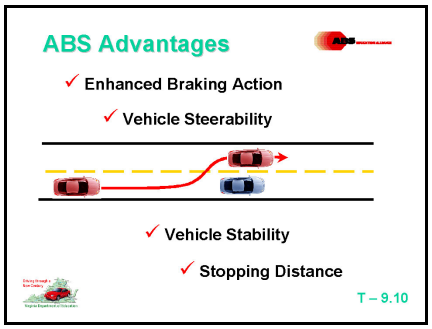
- Road surface
- Weather conditions
- Tires
- Techniques
- Speed



T-9.9
Critical Traction Needs

Show Transparency T-9.10 “ABS Advantages” to discuss the advantages of ABS.

- Enhanced braking action
- Steerability
- Stability
- Stopping Distance



T-9.10
ABS Advantages

If available, show one of three recommended videos, “Stomp, Stay, and Steer,” “ABS Safety,” or “Benefits of Four-wheel Anti-lock Braking Systems” to demonstrate the significance of enhanced vehicle stability, steerability, and reduced stopping distance.

- Poor driving and braking techniques
- Advantages of four-wheel ABS
- Technology explanation
- Examples of the technology at work

Discuss the issues presented in Worksheet W-9.3 “ABS Concerns and Issues” to identify student knowledge of concerns presented by the ABS industry regarding incorrect use of the technology. Hand out the pamphlet entitled “America Brakes for Safety” (ABS Education Alliance) to aid in answering the questions on the student worksheet. (If time permits, this may be completed as a class activity or used as a homework assignment with a follow up discussion.)

Worksheet

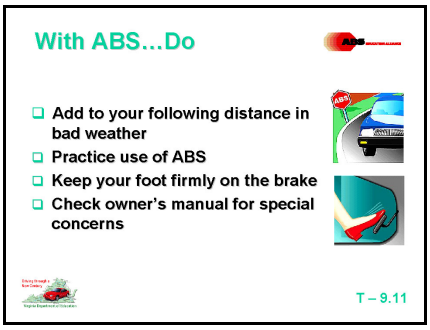
- The ABS Definition
- What is the difference?
- What is idea of 4-wheel ABS?
- How is system defeated?
- What are the sensations?
- Effect of road surfaces?
- What is 2-wheel ABS?
- How do you know?
- Four things you can do

Distribute Worksheet W-9.3 “ABS Concerns and Issues” and the ABS Coalition pamphlet, “America Brakes for Safety,” to assess student knowledge of ABS industry concerns regarding incorrect use of the technology.

Worksheet

Show Transparency T-9.11 “With ABS...Do” to discuss the critical actions of the driver using ABS in a vehicle.

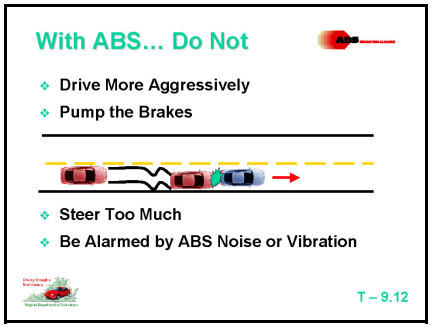
- Add to following distance
- Practice…practice...use of system
- Keep foot on brake
- Owner’s manual for concerns



T-9.11
With ABS... Do

Show Transparency T-9.12 “With ABS... Do Not” to discuss what the driver should not do when using ABS to stop a vehicle.

- Drive more aggressively
- Pump brakes
- Steer too much
- Be alarmed by noise and vibration



T-9.12
With ABS... Do Not

Use Worksheet W-9.4 “ABS Post Test” as a lesson assessment or part of the Module 9 test as required by the local school entity.

Worksheet

Encourage students to share this information with their parents and review their vehicle owner’s manual for any specific ABS or traction control concerns.

Overview of ABS (ABS Curriculum)

Maintaining control of your vehicle is a key to safe driving. The traction between your rolling tires and the road surface will impact the amount of control you have in a given situation. Braking—whether slowing for a turn or braking for a stop—can cause a car to lose rolling traction. This can affect stopping distance and steering control. Anti-lock brake system (ABS) technology has become available to maintain rolling traction, offering skid-free stopping and steering control.

ABS allows the driver to steer his/her vehicle out of potentially damaging situations. The anti-lock brake system is engaged only under potentially dangerous conditions and engages when it detects impending wheel lock. ABS is not engaged under normal braking conditions, and it will not impair normal braking actions. The following information is intended for 4-wheel ABS except where noted otherwise.

Introduction

The instructor should uses the pretest to provide a basis for novice driver entry knowledge of this topic area. Show Transparency T-9.8 to provide background information for ABS development. Use the following questions to initiate discussion about the development of an anti-lock brake system:

- *When was the technology available?*
  An anti-lock brake system, which prevents wheel lock-up during braking, was first patented for passenger car application in the 1930s.

- *On what type of vehicle was the first application of ABS technology used?*
  ABS was first introduced in the 1930s for use on aircraft.

- *When did ABS become readily available for passenger vehicles?*
  Interest in developing ABS for production automobiles emerged at about the same time as that for aviation. Several suppliers became interested in ABS, but interest waned and research was discontinued for several years. In the 1980s, interest was renewed as many vehicle safety technologies were developed for use in passenger vehicles.

- *What road vehicles were first required users of ABS technology?*
  ABS regulations for heavy-duty trucks were first introduced in the United States [1975-76] to reduce crashes due to traction loss. This technology advancement allowed for fewer jackknifing situations due to brake traction losses. The mandate, although revoked, has been reinstated in early 1997.

Traction

When drivers use improper braking, steering, or acceleration techniques, a vehicle can lose traction. Use Transparency T-9.9 to review the conditions that contribute to increasing or decreasing a stopping distance. In other parts of the curriculum, students should have discussed road surface, weather conditions, tires, braking techniques, and speed as potential problem areas.

Now it is time to consider braking as a potential to increase or decrease stopping distance based on braking principles and techniques. There are several appropriate techniques to brake a modern automobile. Drivers must understand that locking the brakes is dangerous, because when wheels stop rolling, tires lose traction, stopping distance may increase, and steering ability is lost.

ABS Advantages

On most roadway surfaces, ABS controls the brakes better than driver *pumping* or *jabbing* techniques. Use Transparency T-9.10 to identify the four advantages of ABS technology.

Enhanced Braking Action—With the advent of caliper-disc brake technology in the late 1960s, drivers were discouraged from using pumping brake actions. Instead, they were encouraged to use squeeze braking techniques, similar to the process used hand brake on a bicycle, to slow the vehicle. Transparency T-9.10 may be used to illustrate the ABS advantages.

Due to the difficulty in applying the squeeze braking techniques, drivers tended to lock the wheels, causing the tires to skid. ABS was developed to assist driver braking actions when impending wheel lock-up could occur. Advances in computer and sensory technology allowed ABS to become a practical feature. In some reduced traction situations when wheel lock-up occurred, drivers were trained to use jab-braking actions to enhance steerability and reduce stopping distance. ABS allows this braking action to occur in a more efficient manner by providing the jabbing action automatically while the driver maintains steady brake pressure.

Vehicle Steerability—Steerability refers to the ability to move the vehicle where the driver wants it to go. With rolling traction, a driver is able to steer the car to the right or left in a lane change or make a smooth adjustment when entering a curve. In each of these driving situations, sudden steering actions can cause a sudden shift in vehicle balance and traction loss. This lack of steerability may take the vehicle off the normal traveled section of the roadway.

Under driver-panic braking conditions where limited steering action is required, ABS technology will enhance driver control capabilities. ABS technology is designed to maintain rolling traction and steering. The rolling action may produce longer stopping distances on some surfaces, such as freshly fallen snow or loose gravel. The ABS steering advantage outweighs any braking disadvantage on these surfaces. Evasive steering techniques are designed to allow the driver to steer the vehicle clear of danger.

By maintaining a speed reduction without wheel lock-up, ABS increases steerability of the vehicle. The driver should use just enough steering movement to guide the vehicle to a clear space on the roadway. It is important to emphasize maintaining constant firm pressure on the brake pedal while looking for an open lane steering option.

ABS Video
Instructors may use any of three videos entitled “Stomp, Stay, and Steer,” “America Brakes for Safety,” or “Benefits of Four-wheel Anti-lock Braking Systems” to demonstrate the significance of enhanced vehicle stability, steerability, and reduced stopping distance. The video should provide examples of poor driving and braking techniques and follow up with the advantages of four-wheel ABS. The technology will be explained and examples of the technology at work will be displayed. The videos will mention the increased ability to stop the car on most surfaces, but the primary issue is the increased vehicle stability and the ability to steer the vehicle out of harm’s way. *Contact the ABS Coalition or Continental TEVES for updated ABS and traction control videos.*

ABS Concerns
Use Worksheet W-9.4 to identify student knowledge of concerns presented by the ABS industry regarding incorrect use of the technology. Hand out the pamphlet entitled “America Brakes for Safety,” sponsored by the ABS Education Alliance to aid in answering the questions on the student worksheet. (If time permits, this may be completed as a class activity or used as a homework assignment with a follow up discussion.)

ABS Issues
A discussion of ABS issues should follow the worksheet completion and include the following items:

- *What does the abbreviation "ABS" stand for?*
  The abbreviation stands for Anti-lock Brake System

- *What is the difference between ABS and conventional automobile brakes?*
  Conventional brakes allow wheels to be locked by the driver and produce a loss of rolling traction. ABS engages when a wheel speed sensor detects impending wheel lock-up, allowing the vehicle to be steered while helping maintain vehicle stability.

- *What is the idea behind 4-wheel anti-lock brakes?*
  4-wheel ABS is designed to prevent skidding and maintain limited steering control during emergency braking.

- *Name two ways that the anti-lock brake system can be deactivated by the driver.*
  By removing the hard pressure from the brake pedal or by pumping the brakes.

- *What sensations will a driver feel when ABS engages?*
  Brakes may feel harder to push, have a vibration, and noises may occur.

- *What effect does road surface have on stopping distance with ABS?*
  Stopping distance may be longer on some surfaces, such as freshly fallen snow or loose gravel, but the ability to steer the vehicle remains.

- *What is the difference using 2-wheel ABS?*
  2-wheel ABS, found only on light trucks, is designed to eliminate rear wheel skid, which may produce a loss of vehicle stability such as a sudden movement to the right or left. The front wheels may still lock up. The driver must recognize that although the vehicle has 2-wheel ABS on the rear wheels, he/she must use conventional braking techniques with this 2-wheel anti-lock brake system.

- *How do you know that your vehicle is equipped with ABS?*
  There may be a marking on the vehicle, but ABS-equipped cars have a dashboard alert system that lights briefly at start-up.

- *List four things one should do with ABS.*
  Add to your following time or distance interval in poor weather as with conventional brakes, practice using ABS, keep your foot firmly on brake, and check the owner's manual for special concerns.

- *List four things one should not do with ABS.*
  Don't drive more aggressively, don't pump the brakes, don't forget to steer after checking for clearance, and don't be alarmed by noise and vibration which may occur.

ABS Summary
The keys to proper use of the ABS technology are to recognize how the vehicle is equipped, recognize when ABS is functioning, and perform techniques of firm braking and limited steering. Knowing these key factors and elements will allow the driver to take full advantage of this braking technology. The instructor should emphasize that ABS technology does not affect the normal operation of the conventional braking system in any manner. The vehicle's brakes will feel and operate like a conventional system until any impending wheel lock occurs to activate the ABS system.

Module Nine
Topic 3—Vehicle Performance

40 Minutes Instructional Time
Prerequisites: Successful Completion of Modules 1 to 8

Instructor Activities	Time Frame
Review Module Nine, Topic 3 Lesson Plans Prior to Lesson	
Show Transparencies	20-25 minutes
T-9.13 “Vehicle Performance”	(9-12 minutes)
T-9.14 “Vehicle Performance”	(9-12 minutes)
T-9.15 “Bicyclist Responsibilities”	(2-3 minutes)
T-9.16 “Sharing Roadway with Bicyclists”	(2-3 minutes)
T-9.17 “Bicycle Safety Issues”	(2-3 minutes)
T-9.18 “Sharing Roadway with Trucks”	(2-3 minutes)
T-9.19 “Sharing Roadway with Motorcyclists”	(2-3 minutes)
Distribute and Review Student Worksheets	5-10 minutes
W-9.5 “Vehicle Performance Characteristics”	
Review Module Assessments Prior to Lesson	
MA-9.1 “Module Nine Assessment”	
Additional Resources (Media and/or Text)	
Video: “Semi-Conscious: Driving in the Real World” (AAA)	
Video: “Don’t Hang Out in the No-Zone” (Virginia Trucking Association, (804) 355-5371)	
Video: “Sharing the Roadway with Trucks” (NTSI—Ontario Trucking Association, (416) 249-7401)	
“Drive Right” Ch. 13	
“Handbook Plus” Ch. 14	
“How To Drive” Ch. 11	
“License To Drive” Ch. 16, 17	
“Responsible Driving” Ch. 14	

Vehicle Performance

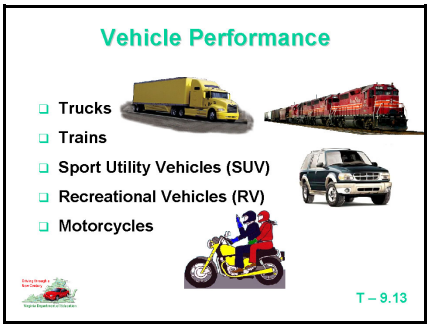
Knowledge and Skills

The student is expected to list and describe appropriate rules and strategies for sharing the roadway with other vehicles.

Activities & Resources

Show Transparency T-9.13 "Vehicle Performance" to discuss the characteristics of these other motorized and non-motorized users of the transportation system.

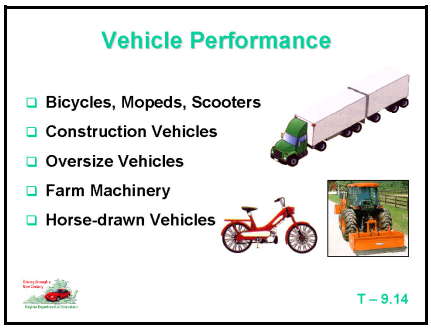
- Trucks
- Trains
- Sport utility vehicles
- Recreation vehicles
- Motorcycles



T-9.13 Vehicle Performance

Show Transparency T-9.14 "Vehicle Performance" to discuss the characteristics of other motorized and non-motorized users of the transportation system.

- Bicycles, mopeds, and scooters
- Construction vehicles
- Oversize vehicles
- Farm machinery
- Horse-drawn vehicles



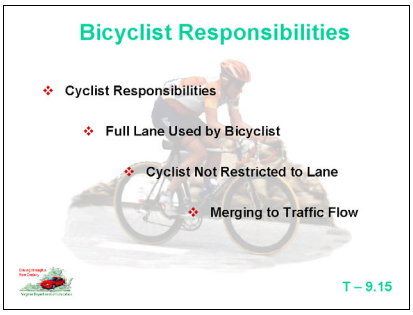
T-9.14 Vehicle Performance

Have students complete Worksheet W-9.5 "Vehicle Performance Characteristics," as you discuss the characteristics of other motorized and non-motorized users of the transportation system.

Worksheet

Show Transparency T-9.15 "Bicyclist Responsibilities." Discuss sharing the roadway with bicycles.

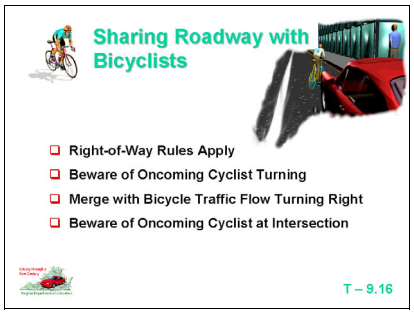
- Cyclist responsibilities
- Full lane use by bicyclist
- Cyclist not restricted to lane
- Merging to traffic flow



T-9.15 Bicyclist Responsibilities

Show Transparency T-9.16 “Sharing Roadway with Bicyclists.” Discuss motorist responsibilities with bicycles.

- Beware of oncoming cyclist when turning left
- Merge with bicycle traffic flow when turning right
- Beware of oncoming cyclist at intersection
- Yield right-of-way



T-9.16
Sharing Roadway with Bicyclists

Show Transparency T-9.17 “Bicycle Safety Issues.” Discuss bicycle safety and laws. Cyclists must:

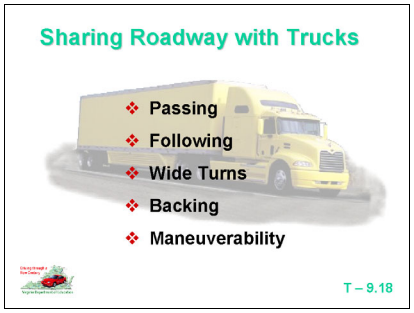
- Obey traffic laws
- Follow safety guidelines
- Use caution in wet weather
- Beware of common motorist errors.

T-9.17
Bicycle Safety Issues

Show video “Sharing the Roadway with Trucks” from (NTSI) to support information provided in the Virginia Driver’s Manual.

Show Transparency T-9.18“ Sharing Roadway with Trucks.” Discuss motorist responsibilities with trucks and larger vehicles.

- Passing
- Following
- Wide turns
- Backing
- Maneuverability

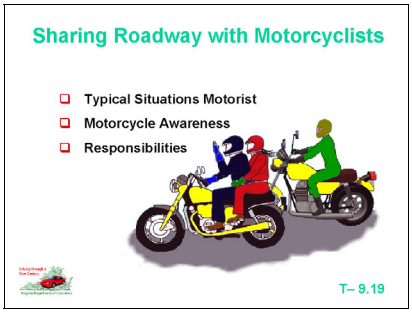


T-9.18 Sharing Roadway with Trucks

Show Transparency T-9.19 "Sharing Roadway with Motorcyclists." Discuss motorist responsibilities with trucks and larger vehicles.

- Motorcycle awareness
- Typical situations
- Motorist responsibilities

Use the Motorcycle Safety Resource Guide as a resource for this topic. The guide is available at no cost from DMV, (804) 367-6211



T-9.19 Sharing Roadway with Motorcyclists

Support Information

Other Motorized and Non-Motorized Users of the Transportation System

Vehicles of different sizes and power handle differently. Small vehicles like motorcycles are light and can accelerate quickly. Large trucks and recreational vehicles take lots of power just to accelerate to highway speeds. They also take a long distance to stop. A driver must be aware of these differences.

Trucks

Trucks help transport nearly everything we eat, wear, and use in our daily lives. They are an essential part of our national economy. Keep in mind that truck drivers often face the problem of tight scheduling and drive over long periods of time. This may lead to fatigue and/or loss of sleep.
To schedule a No Zone presentation call the Virginia Trucking Association at (804) 355-5371.

Passing a Truck

When passing a truck, first check to your front and rear and move into the passing lane only if it is clear and you are in a legal passing zone. Let the truck driver know you are passing by blinking your headlights, especially at night. The driver will make it easier for you by staying to the far side of the lane. When you meet a truck coming from the opposite direction, keep as far as possible to the side to avoid a sideswipe accident and to reduce the wind turbulence between the two vehicles. Remember that the turbulence pushes the vehicles apart.

Following a Truck

Drivers of large trucks sit high above the road and have an excellent view of the roadway ahead. Their view to the sides and to the rear is often restricted. There are large blind spots around every large truck called **no zones.** No zones are where truck drivers cannot see other vehicles and where most collisions occur. These no zones are in front beside the truck, to the sides of the truck, and to the rear of every large truck. Be careful not to drive in these no zones.

A driver in the no zone is at risk because the truck driver cannot see a vehicle in that area. When following a large truck, increase following distance to allow clear sight distance ahead. Stay far enough back so the side view mirrors of the truck can be seen. If the side view mirrors cannot be seen, the truck driver cannot see a following vehicle.

Tractor-trailers take longer to stop than a car traveling at the same speed. The average passenger car traveling at 55 mph can stop in approximately 140 feet, which is about three-fourths the length of a football field.

When you follow a truck at night, always dim your headlights. If you are stopped behind a truck on an upgrade, leave space in case the truck drifts slightly back when it starts to move.

Right Turns
Pay close attention to truck turn signals. Trucks make wide right turns and sometimes must leave an open space to the right just before the turn. Always check a truck's turn signal before beginning a pass. Not being alert to this can lead to being caught in a right turn squeeze, which can result in vehicle damage. Always keep out of the open space of a tractor-trailer making a right turn.

Backing Accidents
Never try to cross behind a truck that is preparing to back up. Often, when a truck driver is preparing to back the truck from a roadway into a loading area, there is no choice but to temporarily block the roadway.

Maneuverability
Trucks are designed to carry many products to and from towns and cities; they are not designed to be as maneuverable as cars. Trucks have longer stopping and accelerating distances, a wider turning radius, and weigh more.

Trains
Many railroad fatalities occur each year because drivers ignore crossing signals or drive around the end of crossing gates. Most railroad fatalities occur at the 188,000 crossings in America without signals or gates. The major cause of mishaps at railroad crossings is inattention. Drivers who cross the same tracks frequently may forget to look both ways.

Speed, impatience, intoxication, and poor judgment add to the problem. Remember: trains take at least ONE MILE to stop (in some cases, two miles). Follow these countermeasures for safe crossing:

- Never take familiar crossings for granted or assume no train is coming.
- Identify all warning signs, signals, and protecting devices.
- Never stop on railroad tracks.
- Before you cross the tracks, look and listen for approaching trains.
- Do not rely solely on lights and/or sounds—make sure the way is clear before crossing.
- Be alert after dark at crossings that are not protected by gates or flashing lights. Too frequently, people drive into the sides of trains at such crossings.

Sport Utility Vehicles
Sports Utility Vehicles are very popular vehicles in America. They are usually large four-wheel drive family vehicles, with a big enough motor to go fast (equaling poor gas mileage). Sport utility vehicles have a higher center of gravity and are susceptible to rollovers when making sharp turns at high speeds. They also are heavy, and this gives the driver added protection in a collision.

Motorcycles
Motorcycles are small vehicles that accelerate quickly. Danger exists because the motorcyclist is exposed and is offered no protection should a collision occur. To stop a motorcycle, the motorcyclist must operate separate brakes for front and rear wheels. A motorcyclist must coordinate the hand throttle, hand clutch, and front gearshift lever to accelerate smoothly. Unlike four-wheel vehicles, a motorcycle might have difficulty remaining upright when stationary or in motion. When near a motorcyclist, increase following distance. When being followed by a motorcycle, check the rear-view mirror often. Be aware of following motorcyclists and avoid making sudden stops. A motorcyclist cannot cope with adverse weather conditions as well as a four-wheel vehicle can. Remember this and increase the space around motorcyclists in bad weather.

Why Don't Drivers See Motorcyclists? There are several reasons why drivers may not see the motorcyclist coming: Motorists tend to look for other cars, not for motorcyclists. The profile of a motorcycle is much smaller than the profile of larger vehicles. Motorcycle riding requires frequent lane movements to adjust to changing road conditions.

What are the Situations When Motorcycle-Related Accidents are Most Likely to Occur? Accidents are most likely to occur in these high-risk situations:

- **Left Turns—**The most common accident between cars and motorcyclists is at an intersection when the automobile driver is making a left turn in front of a motorcycle.

- **Car's Blind Spot—**Cyclists riding alongside a lane of cars are often out of the view of the driver. An unsuspecting driver may collide with a motorcyclist as the driver tries to change lanes.

- **Hazardous Road Conditions—**Motorcyclists have to be much more concerned about road obstructions such as potholes and fallen tree limbs. Railroad tracks may be minor problems for drivers, but a motorcyclist may have to slow down or change lanes to avoid these obstacles.

- **Weather Conditions—**When the road surface is wet or icy, motorcyclists' braking and handling abilities are impaired.

- **Strong Winds—**A strong gust of wind can move a motorcycle across an entire lane if the rider isn't prepared for it. Wind gusts from large trucks in the other lane can be a real hazard.

- **Large Vehicles—**A large vehicle such as a van, bus, or truck can block a motorcycle from a driver's view.

Bicycles

Bicycles are treated as vehicles in this state. Motorists must yield the right-of-way to cyclists at intersections when passing and when turning. Avoid making right turns in front of a cyclist traveling on the shoulder and yield to a cyclist preparing to make a left turn. Bicycles are legally entitled to use the road. On roads where the speed limit exceeds 50 mph, bicycles must use the shoulder except where prohibited.

When following a cyclist, slow down upon approaching him/her. Avoid the use of the horn, as loud noises can surprise the bicycle operator, causing an accident. Do not follow closely. Bicycles can stop and maneuver quickly. Be prepared for a cyclist to swerve to avoid a road hazard. Young cyclists are likely to make surprising changes in direction. When passing a cyclist, wait until it is safe and allow adequate clearance. Return to the proper lane when the bicyclist can be seen clearly in the rearview mirror.

- Do not use horn.
- Do not attempt to share the lane with the cyclist.
- Reduce speed.
- Follow the bicycle and wait for a safe opportunity to pass.

Bicycle Rules that Motorists Should Know

A bicycle is a vehicle and any person riding a bicycle has all of the rights and responsibilities as a driver of a vehicle. Bicyclists are required to ride as far right in the lane as possible only when the lane can be safely shared by a car and a bicycle, side by side. Bicyclists are not restricted to the right lane of traffic.

One-way, multi-laned streets are one example. Another instance is when the bicyclist is changing lanes to make a left turn. The bicyclist should follow the same path any other vehicle would take traveling the same direction. Motorists should merge with bicycle traffic when preparing for a right-hand turn. Avoid turning directly across the path of bicycle traffic.

Common Motorists Mistakes
The most common car-bicycle collision is caused by a motorist turning left in front of oncoming bicycle traffic. The second most common is a motorist turning right across the path of the bicycle traffic. The third most common is a motorist pulling away from a stop sign and failing to yield the right-of-way to bicycle cross traffic.

Rules for Cyclists
- A bicyclist should always obey all traffic laws, signs, and signals.
- Never ride opposite the flow of traffic.
- Stop at all stop signs and stop (red) lights.
- On a one-way roadway with two or more marked traffic lanes, a cyclist may ride near the left curb or edge of the roadway.
- Persons riding two abreast shall not impede the normal and reasonable flow of traffic on the roadway.
- A person riding a bicycle shall not ride other than upon or astride a permanent and regular seat.
- No bicycle shall be used to carry more than one person at one time, or the number for which it is designed and equipped.
- No person riding a bicycle shall attach the same or himself to any streetcar or vehicle upon a roadway.
- No person operating a bicycle shall carry any package, bundle, or article which prevents the driver from keeping at least one hand upon the handlebars.
- Bicyclists may ride on shoulders.
- Bicyclists may signal a right-hand turn using either the left arm pointing up or the right arm pointing horizontally.
- Every bicycle shall be equipped with a brake which will enable the operator to make the braked wheels skid on dry, level, clean pavement.
- Every bicycle in use at nighttime shall be equipped with a lamp in front and a red reflector on the rear.
- Hearing-impaired bicycle riders may display a safety flag.
- Bicyclists should wear an approved bicycle helmet.
- When riding on pedestrian facilities, reduce speed and exercise caution.
- Do not weave in and out of parked cars.
- Move off the street to stop, park, or make repairs to your bicycle.
- A bicyclist should select a route according to the person's own bicycling skills and experience.
- Bicycles should be equipped with a mirror.

Mopeds and Motor Scooters
A moped is a two-wheeled vehicle that can be driven with either a motor or pedal. Its name comes from motor-driven bicycle and pedal-driven bicycle. Like a bicycle, a moped can be pedaled and can be stopped with a hard brake. Like a motorcycle, a moped is powered by an engine and controlled by a hand throttle.

A motor scooter is a low powered two-wheeled vehicle. It is more powerful than a moped. A motor scooter is similar to a motorcycle, though most motor scooters require no shifting.

Construction Vehicles

These are found at or near construction sites. They are very large and loud. Proceed with caution around them. Many construction vehicles move slowly starting out, and, because of the heavy loads they haul, acceleration takes longer. Remember the following with regard to sharing the road with construction vehicles:

- Do not tailgate.
- Driver may not see you in his side mirrors.
- Keep a safe distance between your vehicle and any construction vehicle(s).

If a construction vehicle is behind you, remember the following:

- Keep checking the rear view mirror.
- Do not stop quickly unless absolutely necessary.
- Keep in mind that construction vehicles need a lot of braking distance.

Various traffic control devices are used in road construction and maintenance work areas to direct drivers and pedestrians safely through the work site and to provide for the safety of highway workers.

The Most Commonly Used Controls

- Standard signs
- Electronic variable message signs
- Cones
- Drums
- Barricades
- Flashing arrow panels
- Flaggers

Speed limits may be reduced in work areas. The law doubles the fines for speed violators in work zones. The maximum penalty for violating speed limits in work zones is $250.

Oversized Vehicles

Be prepared to share the road with a number of special purpose vehicles. Snow plows can be expected in winter months. When mobile homes are being transported, they are often preceded and followed by vehicles that carry a “Wide Load” sign. Use extra caution when meeting or passing such vehicles. Allow extra space to increase sight distance. Use caution when passing.

Farm Machinery

In rural areas, large, slow-moving farm machinery should be expected. Virginia law does not require farm machinery to be licensed. The machinery is allowed to cross or be driven on roads to get to the fields or back to the farm. Farm machinery and vehicles which travel at 25 mph or less must display a slow moving vehicle emblem when using a public highway. This emblem is an orange triangle surrounded on each side by a strip of red. Be prepared to adjust speed or position when this sign is seen. Pass with caution, and remember the operator of the farm machinery cannot hear other vehicles.

Horse-Drawn Vehicles

When encountering horse-drawn vehicles, adjust speed. The horse-drawn vehicle should display a slow-moving vehicle emblem on the rear. Pass with caution. While passing, do not use horn and do not *rev* the engine because this may scare the horse and cause an accident.

(Excerpt from Costech Technologies and Marlene Weber Enterprises Driver Education Textbook)

Recreational Vehicles and Trailers

- Recreational vehicles and trailers accelerate and stop more slowly than cars and require more room for turning.
- Visibility is a major problem with recreational vehicles. Remember that the closer you are as you approach a recreational vehicle, the more it will block your field of vision.

Drivers of recreational vehicles can lose sight of you because their blind spots are much larger than those of cars.

When you approach a vehicle towing a trailer, be sure to consider the following:

- Watch for any sway or possible hazards, such as crosswinds or slippery curves.
- Be aware that sudden braking might cause the trailer to jackknife.
- Use extreme caution while passing a trailer and the towing vehicle. It may take you a half-mile of clear roadway to pass safely.

Slow-Moving Vehicle Symbol

Recognize this symbol? It identifies slow-moving vehicles (25 mph or less) and it can save your life. Watch for it by day and by night.

By day –
During daylight hours, you will see the fluorescent triangle in the center of the symbol. This triangle is visible for at least one-fifth of a mile.

By night –
At night, the reflective red border of the symbol will glow in the headlights of an approaching vehicle.

(Excerpt from Costech Technologies and Marlene Weber Enterprises Driver Education Textbook)

Log Haul Vehicle

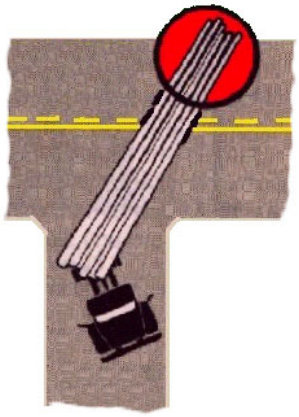
Safety Suggestions

- When a log haul truck is turning from a side road onto the highway, reduce your speed. Due to the weight of the vehicle, its acceleration will be slow.

- Do not follow a log haul truck too closely. You should increase your following distance to at least four seconds.

- Log haul trucks are very long so you will need a clear view of the road ahead and a greater distance to pass.

- If a log haul truck is heading toward you, especially on a gravel road, be ready to pull to the right as far as possible.



Never pass a log haul truck that is turning. A danger zone exists behind this vehicle. The danger zone is basically the overhang from the tail end of the truck and may be as long as **27 feet.** When these vehicles are making a turn, they can block all the lanes of a road.

Snowplows

These uniquely designed vehicles operate in a vast range of weather conditions during winter months. While working, they may create a snow cloud which will make it difficult for other drivers to see them.

Here are some things to remember when approaching snowplows:

- Snowplows are equipped with flashing amber lights to make them more visible.

- Maintain a safe following distance behind a snowplow. This will not only give you more time to react to the unexpected, but may also help you avoid rock damage from the sanding unit of the snowplow.

- Before you pass a snowplow, be sure you can see far enough ahead, and that passing is permitted.

But why bother passing? Snowplow drivers are instructed to pull over approximately every five miles to allow vehicles to pass.

Module Nine
Topic 4—Highway Transportation System Agencies

20 Minutes Instructional Time
Prerequisites: Minimum Age for Entry into Program

Instructor Activities	Time Frame
Review Module Nine, Topic 4 Lesson Plans Prior to Lesson	
Show Transparencies T-9.20 “HTS Agencies” T-9.21 “HTS Agencies”	15-20 minutes (8-10 minutes) (8-10 minutes)
Review Student Assessments Prior to Lesson MA-9.1 “Module Nine Assessment”	

Highway Transportation System Agencies

Knowledge and Skills

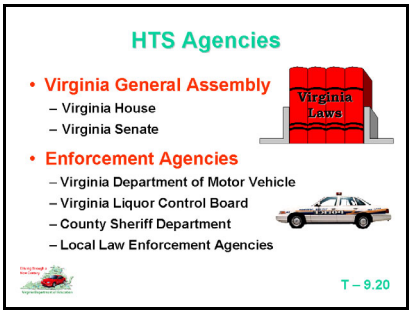
The student is expected to describe how numerous agencies and individuals contribute to the function and management of the Highway Transportation System.

Activities & Resources

Show Transparency T-9.20 "HTS Agencies" to discuss lawmaking and judicial systems.

General Assembly
Virginia House and Senate
http://www.state.va.us

Virginia Judicial System
(www.courts.state.va.us)



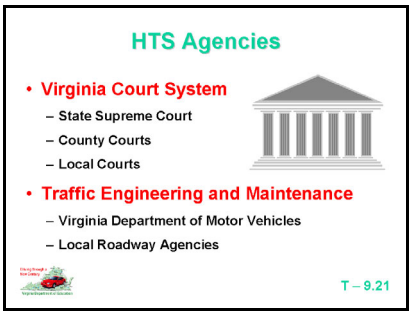
T-9.20
HTS Agencies

Show Transparency T-9.21 "HTS Agencies" to discuss engineering, education, and enforcement systems.

Traffic Engineering and Maintenance
Virginia VDOT Engineering and Maintenance
(www.vdot.state.va.us)

Education
- VASAP http://www.vasap.state.va.us
- Driver improvement clinics
- Public, non-public, and commercial schools http://www.penk12.va.us

Enforcement
- State and local law enforcement http://www.vsp.state.va.us
- Virginia Department of Motor Vehicles http://www.dmv.state.va.us
- Virginia Alcoholic Beverage Control Board http://www.abc.state.va.us



T-9.21
HTS Agencies

Support Information

Agencies Involved in the Highway Transportation System

Many federal, state, and local government agencies help regulate the HTS. The federal government has established the National Highway Safety Act with a set of traffic safety guidelines. Federal, state, and local governments in turn enforce these national guidelines.

- Laws are passed to amend the Code of Virginia.
- Enforcement agencies help to assure that laws are obeyed.
- The Department of Motor Vehicles assures that driver and vehicle standards are met.
- Courts decide whether drivers charged with violating the laws are guilty or innocent.
- Highway traffic engineers plan, build, and maintain the complex system of roadways.

Virginia Courts—http://www.courts.state.va.us

- Supreme Court of Virginia
- Court of Appeals of Virginia
- Circuit Courts
- General District Courts
- Juvenile and Domestic Relations District Courts

Notes

Curriculum Scope and Sequence Modules for Driver Education in Virginia

Module Nine

Worksheets

W-9.1 Procedures for Vehicle Malfunctions
W-9.2 ABS Pretest
W-9.3 ABS Concerns and Issues
W-9.4 ABS Post Test
W-9.5 Vehicle Performance Characteristics

Simulation

SLS-9.1 Simulation Laboratory Session

Assessment

MA-9.1 Procedures for Vehicle Malfunctions

Virginia Department of Education
in cooperation with the
Virginia Department of Motor Vehicles

Worksheet W-9.1

Procedures for Vehicle Malfunctions

Tire Blowout

1.

2.

3.

4.

5.

6.

7.

8.

Accelerator Failure

1.

2.

3.

4.

5.

6.

Steering Failure

1.

2.

3.

4.

Car Fire

1.

2.

3.

4.

5.

Engine Failure

1.

2.

3.

4.

5.

6.

7.

Worksheet W-9.2

ABS Pre Test

Part One Directions. Circle the correct letter on the test sheet. (4 points each)

1. As road conditions worsen, so does your control over which driving input?
   A. Braking B. Steering
   C. Accelerating D. All of the above

2. How do you recognize that ABS is activated when using the brake?
   A. An immediate stop B. Tire and wheel lock-up
   C. Very hard pedal pressure D. Vibration and changes in pedal pressure

3. You are driving in the right lane of an icy, two-way, four-lane street when you see that a car in your lane is stopped for a stop sign. Your car is equipped with ABS, so you should_____.
   A. shift to a lower gear
   B. brake soft, clear traffic, and steer to the right
   C. brake hard, clear traffic, and steer to the open space
   D. steer into a snowbank to the right.

4. You are driving in the right lane of an icy, two-way, four-lane street when you see that a car in your lane is stopped for a stop sign. Your car is not equipped with ABS, so you should_____.
   A. shift to a lower gear, clear right lane, brake softly
   B. brake softly, clear lane, and steer to the open space
   C. brake hard, clear lane, steer to the left, and maintain brake pressure
   D. brake hard, clear lane, and steer into a snowbank to the right

5. If you must stop quickly on a slippery street surface, you should _____.
   A. apply soft braking pressure to engage ABS B. apply firm, steady pressure with ABS engaged
   C. apply jabbing brake with ABS engaged D. not engage ABS

Part Two Directions: Please place the correct answer on the back of this sheet. (8 points each)

6. What does the abbreviation "ABS" stand for?

7. What is the difference between ABS and conventional automobile brakes?

8. What is the idea behind 4-wheel anti-lock brakes?

9. Name two ways that the anti-lock brake system can be deactivated by the driver.

10. What sensations will a driver feel when ABS engages?

11. What effect does road surface have on stopping distance with ABS?

12. What is the difference using 2-wheel ABS?

13. How do you know that your vehicle is equipped with ABS?

14. List four things one should do with ABS.

15. List four things one should not do with ABS.

Worksheet W-9.3

ABS Concerns and Issues

Name:_____

Class Activity

Answer the following questions to the best of your ability using the "America Brakes for Safety" illustrated pamphlet provided by the ABS Education Alliance.

1. What does the abbreviation "ABS" stand for?

2. What is the difference between ABS and conventional automobile brakes?

3. What is the idea behind 4-wheel anti-lock brakes?

4. Name two ways that the anti-lock brake system can be deactivated by the driver.

5. What sensations will a driver feel when ABS engages?

6. What effect does road surface have on stopping distance with ABS?

7. What is the difference using 2-wheel ABS?

8. How do you know that your vehicle is equipped with ABS?

9. List four things one should do with ABS.

10. List four things one should **not** do with ABS.

Worksheet W-9.4

ABS Post Test

Part One Directions. Circle the correct letter on the test sheet. (4 points each)

1. As road conditions worsen, so does your control over which driving input?
   A. Braking B. Steering
   C. Accelerating D. All of the above

2. How do you recognize that ABS is activated when using the brake?
   A. An immediate stop B. Tire and wheel lock-up
   C. Very hard pedal pressure D. Vibration and changes in pedal pressure

3. You are driving in the right lane of an icy, two-way, four-lane street when you see a car in your lane is stopped for a stop sign. Your car is equipped with ABS, so you should _____.
   A. shift to a lower gear
   B. brake soft, clear traffic, and steer to the right
   C. brake hard, clear traffic, and steer to the open space
   D. steer into a snowbank to the right

4. You are driving in the right lane of an icy, two-way, four-lane street when you see a car in your lane is stopped for a stop sign. Your car is not equipped with ABS, so you should _____.
   A. shift to a lower gear, clear right lane, brake softly
   B. brake softly, clear lane, and steer to the open space
   C. brake hard, clear lane, steer to the left, and maintain brake pressure
   D. brake hard, clear lane, and steer into a snowbank to the right

5. If you must stop quickly on a slippery street surface, you should _____.
   A. apply soft braking pressure to engage ABS B. apply firm, steady pressure with ABS engaged
   C. apply jabbing brake with ABS engaged D. not engage ABS

Part Two Directions: Please place the correct answer on the back of this sheet. (8 points each)

6. What does the abbreviation "ABS" stand for?

7. What is the difference between ABS and conventional automobile brakes?

8. What is the idea behind 4-wheel anti-lock brakes?

9. Name two ways that the anti-lock brake system can be deactivated by the driver.

10. What sensations will a driver feel when ABS engages?

11. What effect does road surface have on stopping distance with ABS?

12. What is the difference using 2-wheel ABS?

13. How do you know that your vehicle is equipped with ABS?

14. List four things one should do with ABS.

15. List four things one should not do with ABS.

Worksheets W-9.2 and W-9.4
ABS Pre Post Test Answer Sheet

Part One: Directions. Please place the correct letter on the answer sheet provided.

1. D.
2. D.
3. C.
4. B.
5. B.

Part Two: Directions. Please place the correct answer on the answer sheet provided.

6. The abbreviation stands for Anti-lock Brake System (see Outside Cover, Pamphlet).

7. Conventional brakes allow wheels to be locked by the driver and produce a loss of rolling traction. ABS engages when a wheel speed sensor detects impending wheel lock-up, allowing the vehicle to be steered while helping maintain vehicle stability (see Inside Column 4, Pamphlet).

8. 4-wheel ABS is designed to prevent skidding and maintain limited steering control during emergency braking (see Cover, Pamphlet).

9. By removing the hard pressure from the brake pedal or by pumping the brakes (see Inside Column 1, Pamphlet).

10. Brakes may feel harder to push, have a vibration, and noises may occur (see Inside Column 1, Pamphlet).

11. Stopping distance may be longer on some surfaces, such as freshly fallen snow or loose gravel, but the ability to steer the vehicle remains (see Inside Column 1-2, Pamphlet).

12. 2-wheel ABS, found only on light trucks, is designed to eliminate rear wheel skid which may produce a loss of vehicle stability such as a sudden movement to the right or left. The front wheels may still lock-up. The driver must recognize that although the vehicle has 2-wheel ABS on the rear wheels, he/she must use conventional braking techniques with this 2-wheel anti-lock brake system (see Inside Column 4, Pamphlet).

13. There may be a marking on the vehicle, but ABS-equipped cars have a dashboard alert system that lights briefly at start-up (see Inside Column 1-2, Pamphlet).

14. Add to your following time or distance interval in poor weather as with conventional brakes, practice using ABS, keep your foot firmly on brake, and check the owner's manual for special concerns (see Inside Column 2, Pamphlet).

15. Don't drive more aggressively, don't pump the brakes, don't forget to steer after checking for clearance, and don't be alarmed by noise and vibration which may occur (see Inside Column 3, Pamphlet).

Worksheet W-9.5

Vehicle Performance Characteristics

Trucks

Trains

Sport Utility Vehicles

Recreational Vehicles

Motorcycles

Bicycles, Mopeds, Scooters

Construction Vehicles

Oversize Vehicles

Farm Machinery

Horse-drawn Vehicles

SLS-9.1

Simulation Laboratory Session

Suggested Titles: **"Evasive Action Skills" (DORON Video or Laserdisc)**
"Crash Avoidance II" (DORON Video or Laserdisc)
"Avoiding Collisions" (SSI Safe Driver Training Series)
"Testing Driver Performance II" (SSI Safe Driver Training Series)

Learning Goals: **The student demonstrates comprehension of speed control and vehicle positioning in lane, which will increase the ability to position vehicle for moderate risk vehicle maneuvers.**

Performance: **Performances are based on the simulation video used for this section. In each situation, the student will demonstrate correct positioning for vehicle control.**

Assessment: **Instructor records assessment of speed, positioning, and techniques on the district on-street records form. Student assessment of simulation activities may also be added to the student portfolio.**

Instructor Activities	Student Driver Activities	Materials Needed and Notes

Notes

Module Assessment MA-9.1
Module Nine Assessment

Please do not write on the test. Select the best answer and place the appropriate letter (A, B, C, D) on the answer sheet provided.

1. When you want to do preventive maintenance on your car, the best source of information is _____.

   A. the auto parts shop
   B. a friendly mechanic
   C. your vehicle owner's manual
   D. the local auto club

2. If your car's temperature light comes on while driving, you should _____.

   A. pull over safely, open the hood and radiator cap and check the problem
   B. pull over safely, open the hood, and let the vehicle cool before checking anything
   C. pull over safely, open the hood, and check the oil level
   D. pull over safely, open the hood, and check the transmission fluid

3. If the left front tire blows out while you are driving, _____.

   A. the vehicle will pull sharply to the right
   B. the vehicle will pull sharply to the left
   C. the vehicle will wobble slightly to the right
   D. the vehicle will wobble slightly to the left

4. If any tire blows out while you are driving, what should you NOT do?

   A. Grip the steering wheel firmly.
   B. Take your foot off the gas pedal.
   C. Allow the vehicle to slow gradually and safely.
   D. Brake hard.

5. If the gas pedal becomes stuck in the "down" position and you are increasing speed, what is the first thing you should do to control the vehicle speed?

   A. Grip the steering wheel firmly.
   B. Shift to "neutral" gear.
   C. Brake hard.
   D. Pull quickly off the roadway.

6. If you are making a turn and your engine shuts off in the middle of the intersection, the first thing you should do is _____.

   A. stop in the intersection and restart the vehicle
   B. shift to "neutral," complete the turn, then pull off and restart the engine
   C. pull over immediately and stop
   D. look for a service center to help restart the vehicle

7. If you have total steering failure while driving, you should _____.

   A. stop as quickly as possible using the parking brake correctly
   B. stop as quickly as possible using the brake pedal
   C. stop as quickly as possible by scraping tires against the curb
   D. stop as quickly as possible by hitting small trees and bushes

8. If your vehicle has power steering and it fails or quits working while driving _____.

   A. drive to the nearest service center for repairs
   B. drive to the local auto club and report it
   C. your vehicle cannot be steered, so park it
   D. your vehicle can still be steered, with much effort, to a safe stopping point

9. Which driving habit listed will help reduce the possibility of steering system problems?

   A. Avoid hitting curbs or deep potholes on the road.
   B. Avoid turning the steering wheel beyond its limits.
   C. Inspect the power steering fluid level and fill when low.
   D. A, B, and C are all good habits to reduce steering system problems.

10. Your vehicle bounces a lot when you drive. You notice the tires are wearing unevenly. Your vehicle appears to be leaning to one side when it is parked. These are all signs of _____.

    A. a suspension system problem
    B. an electrical system problem
    C. an exhaust system problem
    D. a braking system problem

11. Tire inflation is important to both safety and tire wear. What is the proper amount of air to have in a tire?

    A. 10 pounds below the manufacturer's recommended pressure on the side of the tire.
    B. 10 pounds above the manufacturer's recommended pressure on the side of the tire.
    C. At the manufacturer's recommended pressure on the side of the tire.
    D. At 50 p.s.i., no matter what the manufacturer recommends.

12. Most new vehicles are equipped with anti-lock brakes (ABS). When these brakes are working properly _____.

    A. they vibrate when you push hard on the pedal
    B. they allow you to steer while braking hard
    C. both A and B are correct
    D. neither A nor B are correct

13. Parts of the electrical system that need to be checked regularly and replaced on occasion are _____.

    A. the fuel filter and gas cap
    B. the muffler and exhaust pipe
    C. the brake shoes and brake drums or discs
    D. the battery and spark plugs

14. When should you have a "tune-up" completed on your vehicle?

    A. When the car owner's manual recommends it.
    B. Every 10,000 miles.
    C. When the oil becomes dirty.
    D. When the transmission fluid is low.

15. When should you use parking lights on your vehicle?

    A. At night when driving a short distance
    B. When driving on a bright, sunny day
    C. On a rainy day when visibility is low
    D. When parked next to the roadway for a short period of time

16. You are coming to an intersection. You see a tractor-trailer coming to the intersection from the left and starting to turn right. What should you expect from the tractor-trailer?

    A. It will not interfere with your path of travel.
    B. It will turn wide and use part of your lane to complete its turn.
    C. It will stop and let you pass.
    D. It will speed up and turn quickly.

17. The driver of a large truck or tractor-trailer rig will have the most difficulty seeing _____.

    A. ahead of his rig
    B. overhead clearance signs approaching at bridges
    C. to the sides and rear of his vehicle
    D. down into passing vehicles

18. When following a large truck or tractor-trailer, _____.

    A. increase your following distance
    B. stay behind at all times for protection
    C. drive in the driver's blind spots
    D. keep the truck ahead to block the wind

19. Where do most train/car collisions occur?

    A. At crossings that have warning signals and gates
    B. At crossings with no warning signals or gates
    C. At the train station in the city
    D. At the busiest time of day for commuters

20. Which of these characteristics is true about motorcycles and their riders?

    A. They offer the rider little or no protection in a crash.
    B. They speed up and can stop quickly.
    C. They are sometimes difficult to see in traffic.
    D. A, B and C are all correct.

21. When you are driving and following a motorcycle, you should _____.

    A. pass the motorcyclist the first chance you have
    B. increase your following distance
    C. wave at the motorcyclist to get his/her attention
    D. blow your horn so they can move out of the way

22. When passing someone riding a bicycle ahead of you, _____.

    A. blow your horn to pass them
    B. get close to them and make them move over
    C. slow your speed and increase the space between you and the bicyclist
    D. have them move to the sidewalk to ride

23. If the bicycle rider near you is a child, _____.

    A. expect them to know Virginia's bicycle laws
    B. expect them to be in total control of the bicycle
    C. expect them to know all of the safety rules when riding
    D. expect anything could happen and adjust your driving

24. Construction zones on roadways are set up _____.

    A. to protect the workers and help traffic move through smoothly
    B. to speed up construction
    C. so car drivers can see the construction taking place
    D. to impede and slow the flow of traffic

25. Construction vehicles around construction zones _____.

    A. have the right of way
    B. are usually large and slow moving
    C. are there to create problems for the car driver
    D. cannot be seen when driving through the zone

26. When approaching and driving through a construction zone, you should _____.

    A. get through quickly to avoid dust
    B. slow your speed and adjust your vehicle's position
    C. watch the construction taking place
    D. turn on the radio to drown out the noise

27. If you break a traffic law in a construction zone in Virginia, _____.

    A. the judge will forgive you because of the delay
    B. there will be no record of it on your driving record
    C. fines will be double what they are for breaking laws in other areas
    D. fines are the same amount as any other traffic violation

28. If you approach an oversized vehicle marked with a "Wide Load" sign, you should _____.

    A. make it move to the edge of the road
    B. speed up to get around it
    C. flash your lights to warn other drivers
    D. slow your speed and increase the distance you are from it

29. Farm machinery and horse-drawn carriages are marked in the rear with a special “Slow-Moving Vehicle” sign. What should you do when you approach one of these vehicles?

    A. Increase speed to get around it quickly.
    B. Slow down and pass it quickly.
    C. Slow down and pass when safe and legal to do so.
    D. Slow down and blow your horn.

30. Which of the following agencies has NOTHING to do with highway safety in Virginia?

    A. Virginia State Police
    B. Virginia Legislature
    C. Virginia Education Agency
    D. Virginia Veterans’ Administration

31. How do you recognize that ABS is activated when using the brake?
    A. An immediate stop
    B. Tire and wheel lock-up
    C. Very hard pedal pressure
    D. Vibration and changes in pedal pressure

32. You are driving in the right lane of an icy, two-way, four-lane street when you see that a car in your lane is stopped for a stop sign. Your car is equipped with ABS, so you should _____.
    A. shift to a lower gear
    B. brake soft, clear traffic, and steer to the right
    C. brake hard, clear traffic, and steer to the open space
    D. steer into a snowbank to the right

33. You are driving in the right lane of an icy, two-way, four-lane street when you see that a car in your lane is stopped for a stop sign. Your car is not equipped with ABS, so you should _____.
    A. shift to a lower gear, clear right lane, brake softly
    B. brake softly, clear lane, and steer to the open space
    C. brake hard, clear lane, steer to the left, and maintain brake pressure
    D. brake hard, clear lane, and steer into a snowbank to the right

34. If you must stop quickly on a slippery street surface, you should apply _____.
    A. soft braking pressure to engage ABS
    B. firm, steady pressure with ABS engaged
    C. jabbing brake with ABS engaged
    D. do not engage ABS

35. What does the abbreviation "ABS" stand for?

36. What is the difference between ABS and conventional automobile brakes?

37. What is the idea behind 4-wheel anti-lock brakes?

38. Name two ways that the anti-lock brake system can be deactivated by the driver.

39. What sensations will a driver feel when ABS engages?

40. What effect does road surface have on stopping distance with ABS?

Module Assessment MA-9.1
Answer Sheet

Module 9 Answer Sheet

Name: _____ Date:_____ Score_____

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____
22. _____
23. _____
24. _____
25. _____
26. _____
27. _____
28. _____
29. _____
30. _____
31. _____
32. _____
33. _____
34. _____
35. _____
36. _____
37. _____
38. _____
39. _____
40. _____

Module Assessment MA-9.1

Answer Key

1. C
2. B
3. B
4. D
5. B
6. B
7. A
8. D
9. D
10. A
11. C
12. C
13. D
14. A
15. D
16. B
17. C
18. A
19. B
20. D
21. B
22. C
23. D
24. A
25. B
26. B
27. C
28. D
29. C
30. D
31. D
32. C
33. B
34. B
35. THE ABBREVIATION STANDS FOR ANTI-LOCK BRAKE SYSTEM.
36. CONVENTIONAL BRAKES ALLOW WHEELS TO BE LOCKED BY THE DRIVER AND PRODUCE A LOSS OF ROLLING TRACTION. ABS ENGAGES WHEN A HEEL SPEED SENSOR DETECTS IMPENDING WHEEL LOCK-UP, ALLOWING THE VEHICLE TO BE STEERED WHILE HELPING MAINTAIN VEHICLE STABILITY.
37. 4-WHEEL ABS IS DESIGNED TO PREVENT SKIDDING AND MAINTAIN LIMITED STEERING CONTROL DURING EMERGENCY BRAKING.
38. BY REMOVING THE HARD PRESSURE FROM THE BRAKE PEDAL OR BY PUMPING THE BRAKES.
39. BRAKES MAY FEEL HARDER TO PUSH, HAVE A VIBRATION, AND NOISES MAY OCCUR.
40. STOPPING DISTANCE MAY BE LONGER ON SOME SURFACES, SUCH AS FRESHLY FALLEN SNOW OR LOOSE GRAVEL, BUT THE ABILITY TO STEER THE VEHICLE REMAINS.