

# Curriculum Scope and Sequence Modules for Driver Education in Virginia

## Module Two

### Virginia Driver Responsibilities: Preparing to Operate a Vehicle

- Driver Preparation Procedures
- Identifying Vehicle Control Devices
- Operating Vehicle Control Devices
- Vehicle Balance Considerations
- Standard Vehicle Reference Points

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

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## Standards of Learning Addressed In This Module

- DE.2 The student will demonstrate an understanding of basic vehicle operating procedures. Key concepts/skills include
- pre-driving procedures;
  - starting procedures (automatic and manual transmissions);
  - vehicle information, warning, and control devices;
  - vehicle securing procedures.
- DE.3 The student will recognize the effects of momentum, gravity, and inertia on vehicle control and balance, and the relationship between kinetic energy and force of impact. Key concepts/skills include
- seating and hand position;
  - steering, braking, and acceleration;
  - compensating for shifts in vehicle load (from side to side, front to rear, and rear to front) that affect vehicle performance;
  - types of collisions — head-on, near-frontal, broadside, rear-end, rollover, sideswipe.
- DE.4 The student will demonstrate the ability to manage visibility, time, and space to avoid conflicts and reduce driving risks. Key concepts/skills include
- synthesizing information visually from the driving environment, using a space-management process;
  - applying following-interval concepts;
  - selecting gap and judging distance;
  - estimating passing-time and space needs.
- DE.7 The student will demonstrate the ability to communicate presence and intentions with other highway transportation users. Key concepts/skills include
- vehicle position and driver action;
  - vehicle communication devices.
- DE.15 The student will identify and evaluate emergency response strategies to reduce the severity of or avoid a collision in high-risk driving situations. Key concepts/skills include
- evasive maneuvers, using brake and steering combinations;
  - off-road recovery;
  - front and rear traction control.
- 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
- vehicle warning devices;
  - lights and signals;
  - steering and suspension systems;
  - tires and braking systems;
  - fuel and ignition electronics.

## Module Two Introduction

### **Module Two—Virginia Driver Responsibilities: Preparing to Operate a Vehicle**

The student will recognize the necessity of making routine vehicle checks and adjustments prior to and after entering the vehicle; appropriately identify and respond to alert symbols, warning symbols, vehicle control devices, and safety devices; understand and control vehicle balance and vehicle operating space; and appropriately apply the techniques of vehicle reference points to establish roadway position and vehicle placement.

#### **Topic 1—Driver Preparation Procedures**

The student will utilize basic procedures and readiness techniques to enter, start, and secure the vehicle, and perform basic vehicle maintenance checks.

#### **Topic 2—Identifying Vehicle Control Devices**

The student will recognize and understand the function and operation of each vehicular alert or warning symbol, control device, information device, and comfort system.

#### **Topic 3—Operating Vehicle Control Devices**

The student will demonstrate proper steering, braking, and acceleration techniques, and be able to operate the vehicular systems and devices while seated in the driver's seat.

#### **Topic 4—Vehicle Balance Considerations**

The student will recognize the effects of steering, braking, and acceleration on the balance of a vehicle, and will demonstrate vehicular control utilizing vehicle balance techniques.

#### **Topic 5—Standard Vehicle Reference Points**

The student will utilize standard vehicle reference points to determine and execute lane placement, stopping position, and turning maneuvers.

<b>Minimum Time Frames</b>	
<b>Module Two—3 Hours</b>	
Classroom Instruction	Recommended Minutes
Topic 1 — Driver Preparation Procedures	20
Topic 2 — Identifying Vehicle Control Devices	30
Topic 3 — Operating Vehicle Control Devices	50
Topic 4 — Vehicle Balance Considerations	25
Topic 5 — Standard Vehicle Reference Points	30
Supplement—Parent Participation Activities	55
In-Car Instruction (Option 1)	
Behind-the-Wheel Instruction/Break	50
Observation	50
Laboratory Multiphase (Option 2)	
Behind-the-Wheel Instruction/Break	40
Observation	80
Simulation	120
Parental Involvement	60

**Module Two**  
**Topic 1—Driver Preparation Procedures**

**20 Minutes Instructional Time**  
**Prerequisites: Qualifies for Valid Learner's Permit**

Instructor Activities	Time Frame
<p><b>Review Module Two, Topic 1 Lesson Plans Prior to Lesson</b></p> <p><b>Show Transparencies</b>            T-2.1 "Pre-Drive Tasks"            T-2.2 "Pre-Drive Tasks"            T-2.3 "Pre-Drive Tasks"            T-2.4 "Under the Hood Checks"            T-2.5 "Driver Readiness Tasks"            T-2.6 "Driver Readiness Tasks"            T-2.7 "Starting Tasks"            T-2.8 "Starting Tasks"            T-2.9 "Securing Tasks"            T-2.10 "Securing Tasks"</p> <p><b>Distribute and Review Student Worksheets</b>            W-2.1 "Driver Preparations"            W-2.2 "Under the Hood Checks"</p> <p><b>Review Module Assessments Prior to Lesson</b>            MA-2.1 "Module Two Assessment"</p> <p><b>Additional Resources (Media and/or Text)</b>            Video: "Teaching Your Teens To Drive." (AAA)            "Owners Manual" for the driver education vehicle            "Drive Right"            "Empower Yourself with Zone Control Driving"            "Handbook Plus"            "How to Drive"            "License To Drive"            "Responsible Driving"</p>	<p>20 minutes (2-3 minutes) (2-3 minutes) (2-3 minutes) (2-5 minutes) (2-3 minutes) (2-3 minutes) (2-3 minutes) (2-3 minutes) (2-3 minutes) (2-3 minutes) (1-2 minutes)</p> <p>10 minutes</p>

# Driver Preparation Procedures

## Knowledge and Skills

The student is expected to describe and demonstrate pre-drive tasks.

## Activities & Resources

Distribute Worksheet W-2.1 "Driver Preparations" to students for completion during this section.



Show Transparencies T-2.1, T-2.2, and T-2.3 "Pre-Drive Tasks" to discuss pre-drive checks around the vehicle.

- Check around outside of vehicle.
- Check for small children and pets.
- Store valuables in the trunk.
- Approach driver's door from front.
- Approach door from rear in parking lot.
- Check vehicle and traffic flow.
- Unlock door and enter quickly.

**Pre-Drive Tasks**

- ✓ Check around the outside of the vehicle for broken glass (windows, lights), body damage, condition of tires, fluid leaks, direction front tires are turned (which way will vehicle move when placed in gear?), or debris on the ground that could interfere with movement.
- ✓ Check for small children or pets near vehicle.

T-2.1

T-2.1 Pre-Drive Tasks

**Pre-Drive Tasks**

- ✓ Store valuables in trunk of vehicle
  - Books and book bags have less chance of slipping off seats
  - The vehicle is a classroom with no room for
    - food, candy and sodas
    - homework and inattention in the rear
- ✓ When parked at the curb
  - Approach from front of car
  - Increase awareness of oncoming traffic
  - Approach driver's door with key in hand

T-2.2

T-2.2 Pre-Drive Tasks

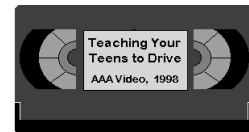
**Pre-Drive Tasks**

- ✓ When parked in parking lot
  - Approach from rear of car
  - Increase awareness of person and objects in area
  - Driver's door with key in hand
- ✓ Unlock Doors
- ✓ Check traffic flow
- ✓ Enter the vehicle

T-2.3

T-2.3 Pre-Drive Tasks

“Teaching Your Teens To Drive” (AAA) provides a video, student guide, and parent guide that have three lesson segments devoted to driver preparation, starting, and moving the vehicle. This resource adds to the information presented in this segment.



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## Support Information

### Driver Preparation

The driver preparation section involves all the tasks that lead up to putting the car in motion and securing the vehicle. The topics will review pre-drive, driver readiness, starting, and securing tasks. The novice driver will be introduced to the preventive maintenance responsibilities associated with using a vehicle. The driver will review the meaning of vehicle controls and their locations. Appropriate uses of each are described in this support information. The module concludes with a discussion of targeting skills and the relationship of the vehicle operating space to standard vehicle reference points. A mirroring technique is introduced that will eliminate mirror blind spots and reduce night glare in the side view mirrors. Module Two, Topic 1 starts with pre-drive tasks and concludes with developing standard reference points. This topic prepares the novice driver for the first in-car lesson.

### Reviewing Pre-Drive Inspection

The driver will become familiar with the specific tasks related to approaching the vehicle in a safe manner. The tasks are not listed in order of importance. The student will develop a preferred sequence or procedure on Worksheet W-2.1 with the guidance of the instructor.

### On Approach to Vehicle

- Check outside of vehicle.
- Check for small children and pets.
- Check for obvious fluid leakage. Identify the source of any leaking fluids (coolant, air conditioner condensation, brake, motor oil, transmission fluid).
- Check for tire inflation, position, and damage.
- Check for obvious physical damage to body or glass.
- Approach driver's door from front when parked at curb.
- Approach from rear when parked in a parking lot.

### On Arrival to Vehicle

- Store all valuables in trunk or secure on floor of vehicle.
- Look into vehicle and check traffic flow.
- Unlock doors to enter vehicle.
- Enter vehicle with key in hand.
- Place key at appropriate location (dash/console). Storage of key on dashboard will prevent start-up before pre-start procedures are completed.
- Sit directly behind the steering wheel and allow for comfortable access to brake pedal and accelerator, which is the greatest distance from the driver, while keeping heel of foot on floorboard.
- Adjust head restraints. To minimize neck injury, level head restraint directly across from top of ear. Recognize that a lowered head restraint may cause injury in a crash and encourages whiplash.
- Fasten seat and shoulder restraints. Prevent yourself from being thrown about or out of the vehicle by adjusting seat and shoulder restraints snugly across hips and chest.
- Adjust mirrors to gain maximum field of vision and sight distance from rear and side view mirrors, and to reduce or eliminate mirror blind spot.
- Set or check parking brake.
- Lock the handle device. Locked doors are not “dead locked,” and may fly open in a crash.

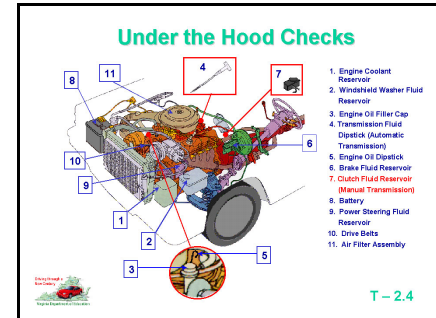
## Driver Preparation Procedures

## Knowledge and Skills

The student is expected to summarize basic vehicle maintenance checks outlined in the owner's manual.

## Activities &amp; Resources

Show Transparency T-2.4 "Under the Hood Checks" to discuss basic maintenance self-checks under the hood.



T-2.4  
Under the Hood Checks

Distribute Worksheet W-2.2 "Under the Hood Checks" to students for completion during this section.

Worksheet

Each driver should have an idea of his/her responsibility for vehicle maintenance. The owner's manual of any vehicle will provide information about periodic maintenance. Emphasize the need for periodic maintenance to be completed by qualified service personnel. Many vehicles can be driven 100,000 miles before the first scheduled engine tune-up. For instance, Ford and General Motor Companies' maintenance schedules for most of the 1999 passenger cars, minivans, light trucks, sport utilities, vans, and 4x4s extend over 150,000 miles. However, it is important to remember that certain items require service on a more frequent schedule.

Provide students with some background information about basic maintenance requirements. The vehicle owner's manual is the recommended resource for maintenance information. Ask the students to bring copies of family vehicle owner's manual to class for comparison of information provided.



## Support Information

**Weekly Self-Checks—Tire Pressure, Tire Wear, and Damage**

- Maximum pressure listed on tire side-wall
- Vehicle manufacturer's pressure recommendation for smooth ride
- Tire tread wear, damage, or bars showing
- Cuffing (uneven wear on inside or outside tread areas)
- Bald spots, bald center, or worn side treads
- Cuts, stones, metal fragments, or other damage

**Weekly Self-Checks—Vehicle Safety, Communication Devices, and Accessories**

- Headlights, tail lights, and turn signals
- Emergency lights and markers
- Emergency kit
- Windshield wiper blades, operation, and washer fluid
- Heating, ventilation, and air conditioner systems (HVAC)
- Safety warning lamps (brake, ABS, air bag, safety belt) for operation

**Regular (1-2 Months) Self-Checks**

- Function of all interior and exterior lights
- Engine oil level, brake fluid level, and engine coolant level
- Lap/shoulder belts and seat latches for wear and function

**Self-Check (Twice Per Year)**

- Air pressure in spare tire
- Power steering fluid level
- Parking brake for proper operation
- Hinges, latches, door weather strips, and outside locks (check and lubricate)
- Body and door drain holes (check and clean)
- Cooling system coolant strength
- Battery connections (clean if necessary)
- Transmission fluid level

**Professional Service Every 3,000-5,000 Miles**

- Oil change/filter replacement
- Tire rotation/balance

**Professional Service Every 15,000 Miles**

- Automatic transmission fluid level
- Brake pads/shoes/rotors/drums, brake lines, hoses, and parking brake system
- Engine cooling system
- Steering linkage, suspension and, if equipped, drive shaft and ball joints
- Cabin air filter replacement, if equipped

**Professional Service Every 30,000 Miles**

- Exhaust system and heat shield
- Engine air filter and fuel filter replacement
- Accessory drive belts
- Automatic transmission/transaxle service, if equipped

***Check owner's manual for vehicle maintenance recommendations.***

# Driver Preparation Procedures

## Knowledge and Skills

The student is expected to:

- describe and demonstrate driver readiness tasks.
- describe and demonstrate vehicle starting tasks.

## Activities & Resources

Show Transparencies T-2.5 and T-2.6 “Driver Readiness Tasks” to discuss driver seating position, restraints, and mirror adjustments made prior to starting a motor vehicle. Encourage students to list the procedures on Worksheet W-2.1.

**Driver Readiness Tasks**

- ✓ **Security**
  - Check passengers for safe entry
  - Lock doors
  - Place key in appropriate location
- ✓ **Seating Position**
  - Adjust for driver foot pedal and dead pedal position
  - Adjust for driver steering wheel reach and hand position
  - Adjust for driver visual needs

T-2.5

T-2.5 Driver Readiness Tasks

**Driver Readiness Tasks**

- ✓ **Restraints**
  - Safety belt adjustment and appropriate air bag position
  - Head restraint position (rear and side protection)
- ✓ **Mirrors**
  - Rear view mirror settings (200 feet to rear)
  - Side view mirror settings (15 degrees out will gain side views)
  - May be adjusted to view sides rather than rear view
  - Rear view needed when inside mirror view is blocked to rear

T-2.6

T-2.6 Driver Readiness Tasks



Show Transparency T-2.7 “Starting Tasks” to discuss driver tasks necessary to start a motor vehicle. Encourage students to list the procedures on Worksheet W-2.1.

**Starting Tasks**

- ✓ Check/set parking brake
- ✓ Foot on service brake
- ✓ Key in ignition and unlock
- ✓ Shifter to park/neutral

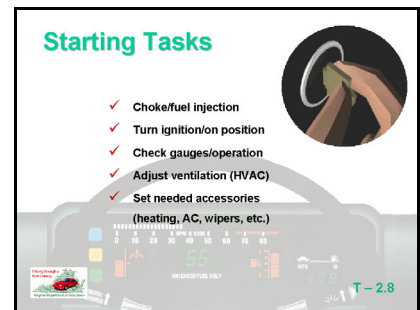
T-2.7

T-2.7 Starting Tasks



Show Transparency T-2.8 “Starting Tasks” to continue discussing driver tasks needed to start a motor vehicle, and guide students in listing the procedures on Worksheet W-2.1.

It is recommended that the owner’s manual for the driver education vehicle be used as supplemental text in this session. The owner’s manual often has starting and securing procedures as an integral part of the ‘getting to know your vehicle’ section.



T-2.8 Starting Tasks

[Worksheet](#)

## Support Information

### Driver Readiness Tasks (Recommended for Use In-Car)

#### Security Needs

- Entry checks
- Locking doors

#### Seating Position

- Feet position
- Arm position
- Hand position
- Visual needs (chin above steering wheel)

#### Active Restraints

- Safety belts
- Head restraints

#### Mirror Settings

- Rear mirror setting position
- Side mirror setting to reduce mirror blind zone and glare elimination (BGE)

### Starting Tasks (Recommended for Use In-Car)

- Check parking brake.
- Place foot on brake.
- Put key in ignition.
- Place shift selector in “Park” or “Neutral.”
- Check for fuel injection or automatic choke.
- Turn key to “on” position.
- Check alert lights and gauges.
- Turn key to start engine.
- Adjust heating, ventilation, and air conditioning (HVAC).
- Set accessories (headlights or daylight running lights are recommended).
- Check for warning lights and gauges.

## Starting Procedure Information and Sample Questions

### Parking Brake

If parking brake is firmly set, will the vehicle move? What wheel(s) does this brake control? How do you release the parking brake? Should parking brakes be used year-round?

### Foot on Service Brake

Prevents vehicle from moving before you are ready. Keeps driver from using the accelerator pedal when starting the engine.

### Key in Ignition

Which key enters the ignition? Which side of key is up? What is the other key for? How do keys differ with various makes of vehicles?

### Gear Selection (Park/Neutral)

Most automatic transmission vehicles will not start in any gear except park or neutral. Where are these gears located on the selector indicator? How does park differ from neutral? When would neutral be used instead of park?

### Fuel Injection/Choke

Most new vehicles are fuel-injected. Owner's Manual or EFI markings indicate fuel injection. The choke on older vehicles controls the fuel-air mixture entering the carburetor to facilitate burn.

### Ignition to Start

A key is necessary to unlock steering control and start vehicle. Note position of start switch and watch engine information light for indication that the engine is on. Be careful not to hold key longer than a few seconds. The owner's manual provides guidelines for timing of start.

### Gauge Check

Gauges provide certain information concerning the mechanical condition of the vehicle and warn of any unusual vehicle problems.

### Accessories Needed

Turn on or adjust any needed accessories (i.e., ventilation system, daylight running lights, night headlights, wipers, defrosters, radio, or other devices). Daylight running lights are becoming standard equipment on General Motors vehicles. Studies indicate that crashes are reduced when vehicles are more visible. (*Headlight use on driver education vehicles is recommended due to the school divisions' responsibility for providing a higher level of care for their students' safety.*)

# Notes

Driver Preparation Procedures

Knowledge and Skills

The student is expected to describe and demonstrate vehicle securing tasks.

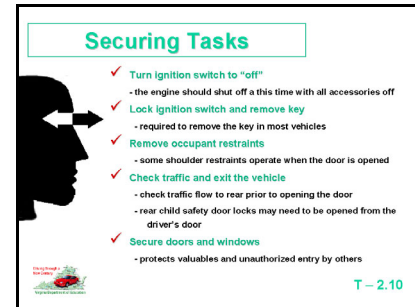
Activities & Resources

Show Transparencies T-2.9 and T-2.10 “Securing Tasks” to discuss driver tasks needed to secure a motor vehicle, and guide students in listing the procedures on Worksheet W-2.1.

- Stop in a legal, secure parking space.
- Set parking brake.
- Place shift selector in (P)ark.
- Turn off any accessories used.
- Turn ignition switch to “off.”
- “Lock” ignition and remove key.
- Remove occupant restraints.
- Check traffic prior to exiting vehicle.
- Secure doors and windows.



T-2.9 Securing Tasks



T-2.10 Securing Tasks



Teaching Your Teens To Drive” (AAA) provides a video, student guide, and parent guide that have three lesson segments devoted to driver preparation, starting, and moving the vehicle. This resource adds to the information presented in this segment.



**Module Two**  
**Topic 2—Identifying Vehicle Control Devices**

**30 Minutes Instructional Time**  
**Prerequisites: Qualifies for Virginia Learner's Permit**

Instructor Activities	Time Frame
<p><b>Review Module Two, Topic 2 Lesson Plans Prior to Lesson</b></p> <p><b>Show Transparencies</b>            T-2.11 "Alert/Warning Symbols and Controls"            T-2.12 "Alert/Warning Symbols and Controls"            T-2.13 "Control, Information, Comfort, and Safety Devices"            T-2.14 "Control, Information, Comfort, and Safety Devices"            T-2.15 "Control, Information, Comfort, and Safety Devices"            T-2.16 "Control, Information, Comfort, and Safety Devices"            T-2.17 "Control, Information, Comfort, and Safety Devices"</p> <p><b>Distribute and Review Student Worksheets</b>            W-2.3 "Control and Information Devices"            W-2.4 "Control, Information, Comfort, and Safety Devices"            W-2.5 "Family Vehicle Instrument Panel"</p> <p><b>Review Module Assessments Prior to Lesson</b>            W-2.3 "Control and Information Devices"            W-2.4 "Control, Information, Comfort, and Safety Devices"            W-2.5 "Family Vehicle Instrument Panel"            W-2.6 "Family Vehicle Equipment"            MA-2.1 " Module Two Assessment"</p> <p><b>Additional Resources (Media and/or Text)</b>            Video: "Teaching Your Teens To Drive." (AAA)            "Owner's Manual" for the driver education vehicle            "Drive Right"            "Empower Yourself with Zone Control Driving"            "Handbook Plus"            "How to Drive"            "License To Drive"            "Responsible Driving"</p>	<p>30 minutes            (2-5 minutes)            (2-5 minutes)            (2-5 minutes)            (2-5 minutes)            (2-5 minutes)            (2-5 minutes)            (2-5 minutes)</p> <p>10-15 minutes</p>

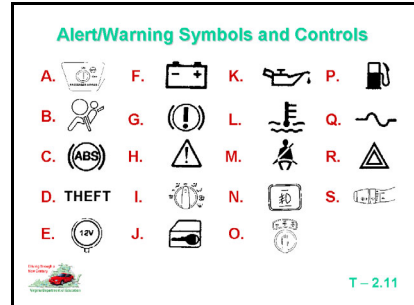
Identifying Vehicle Control Devices

Knowledge and Skills

The student is expected to recognize each vehicular alert or warning symbol and explain the symbol's function and operation.

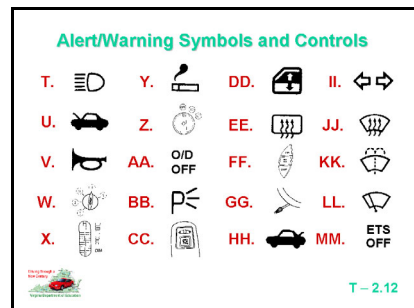
Activities & Resources

Show Transparency T-2.11 "Alert/ Warning Symbols and Controls" to discuss the alert and warning symbols found in motor vehicles. Provide information on vehicular control, convenience, safety, and communication devices, with attention to their safe and proper use.



T-2.11 Alert/Warning Symbols and Controls

Show Transparency T-2.12 "Alert/Warning Symbols and Controls" to continue discussing the alert and warning symbols.



T-2.12 Alert/Warning Symbols and Controls

Use Worksheet W-2.3 "Control and Information Devices" during classroom discussion to illustrate the various operational controls.



Provide W-2.5 "Family Vehicle Instrument Panel" for use as a parent involvement activity. Use the vehicle owner's manual to compare the control and information devices and symbols on the dashboard with the ones illustrated on the worksheet.



Note: W-2.5 may be used as a Topic 3 assessment tool, which gives students a longer time period to complete the exercise.



“Teaching Your Teens To Drive” (AAA) provides a video, student guide, and parent guide that have three lesson segments devoted to driver preparation, starting, and moving the vehicle. This resource adds to the information presented in this segment.



## Support Information

### Purpose of Lesson

- Assist students in recognizing the symbols used to identify the operation, safety, communication, and control devices found in motor vehicles.
- Assist students in correctly responding to and operating the various safety, communication, and control devices found in motor vehicles.

### Transparency Answers

- |  |                                      |
|--|--------------------------------------|
| A. Air Bag On/Off Switch               | B. Air Bag Activation                |
| C. Antilock Brake System Activation    | D. Theft Deterrent System Activation |
| E. 12 Volt Extension Outlet            | F. Battery Warning Light             |
| G. Brake Warning Light                 | H. Safety Alert Symbol               |
| I. Vent and Air Flow Control           | J. Door Locks                        |
| K. Low Oil Pressure Warning Light      | L. Temperature Indicator             |
| M. Seat Belt Reminder                  | N. Fog Lamps                         |
| O. Drive Wheel Selector                | P. Fuel Indicator                    |
| Q. Fuse / Fuse Box                     | R. Emergency Flashers                |
| S. Turn Signal/Wipers Stalk            | T. Headlights/High Beam Indicator    |
| U. Hood Release                        | V. Horn                              |
| W. Fan Speed Indicator                 | X. Interior Light Adjustment         |
| Y. Lighter Indicator                   | Z. Exterior Lights                   |
| AA. Overdrive On/Off switch            | BB. Parking Lamp Indicator           |
| CC. Adjust Left/Right Side Mirror      | DD. Power Window Controls            |
| EE. Rear Defroster Indicator           | FF. Cruise Control Device            |
| GG. Steering Wheel Height Adjustment   | HH. Trunk Release                    |
| II. Left/Right Signal Indicator        | JJ. Front Windshield Defroster       |
| KK. Windshield Washer                  | LL. Windshield Wipers                |
| MM. Electronic Traction System Control |                                      |

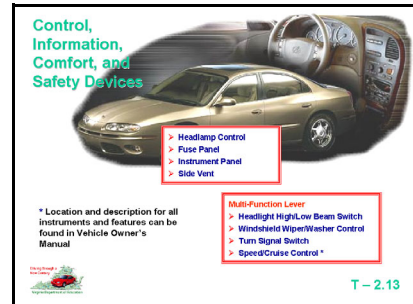
Identifying Vehicle Control Devices

Knowledge and Skills

The student is expected to identify the location and function of the various control, information, comfort, and safety devices.

Activities & Resources

Show Transparencies T-2.13, T-2.14, T-2.15, T-2.16, and T-2.17 “Control, Information, Comfort, and Safety Devices” to identify the location and function of the various control, information, comfort, and safety devices. The switches, dials, gauges, and levers confronted by a driver are identified.



T-2.13 Control, Information, Comfort, and Safety Devices

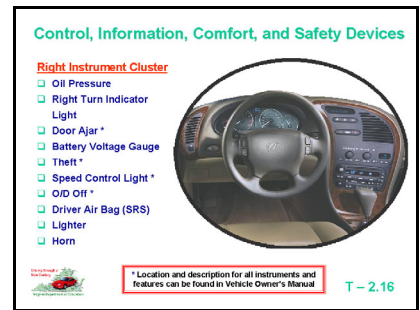


T-2.14 Control, Information, Comfort, and Safety Devices



T-2.15 Control, Information, Comfort, and Safety Devices

Continue showing transparencies to identify the location and function of the various control, information, comfort, and safety devices.



T-2.16 Control, Information, Comfort, and Safety Devices



T-2.17 Control, Information, Comfort, and Safety Devices

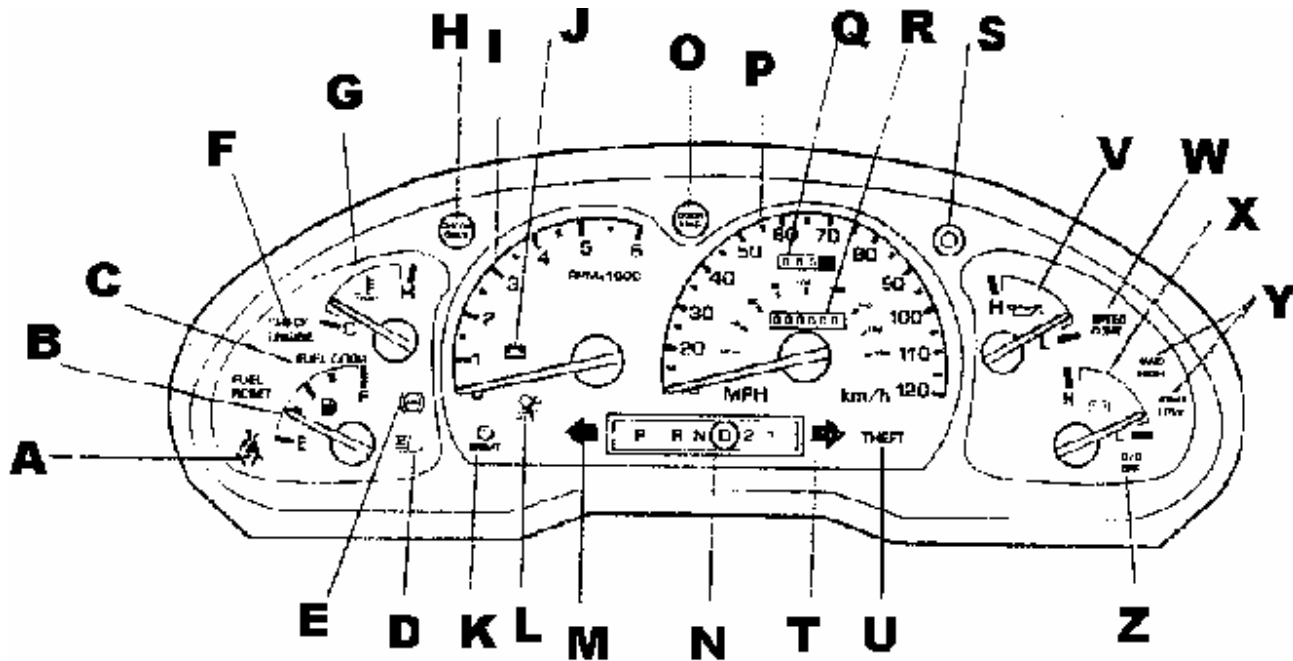
Collect Worksheet W-2.3 “Control and Information Devices,” Worksheet W-2.4 “Control, Information, Comfort, and Safety Devices,” and Worksheet W-2.5 “Family Vehicle Instrument Panel,” and use as assessment tools for this session.

Worksheet

Worksheet

Worksheet

Support Information



- A. Safety Belt
- B. Fuel Gauge
- C. Fuel Door
- D. Headlight Beam Indicator
- E. Anti-lock Brake System
- F. Check Engine Light
- G. Temperature Gauge
- H. Check Gauge
- I. Tachometer
- J. Battery Warning Light
- K. Brake
- L. Airbag
- M. Left Turn Indicator

- N. Gear Selection Indicator
- O. Door Ajar
- P. Speedometer MPH/km/h
- Q. Trip Odometer
- R. Odometer
- S. Trip Odometer Reset
- T. Right Turn Indicator
- U. Theft
- V. Oil Pressure Gauge
- W. Speed/Cruise Control
- X. Battery Voltage Gauge
- Y. 4WD High/Low
- Z. Overdrive On/Off

**Module Two**  
**Topic 3—Operating Vehicle Control Devices**

**50 Minutes Instructional Time**  
**Prerequisites: Qualifies for Virginia Learner's Permit**

Instructor Activities	Time Frame
<p><b>Review Module Two, Topic 3 Lesson Plans Prior to Lesson</b></p> <p><b>Show Transparencies</b>            T-2.18 "Operating Vehicle Control Devices"            T-2.19 "Operating Vehicle Control Devices"            T-2.20 "Operating Vehicle Control Devices"            T-2.21 "Safety, Communication, Comfort, and Convenience Devices"            T-2.22 "Safety, Communication, Comfort, and Convenience Devices"            T-2.23 "Safety, Communication, Comfort, and Convenience Devices"</p> <p><b>Distribute and Review Student Worksheets</b>            W-2.6 "Family Vehicle Equipment"</p> <p><b>Review Module Assessments Prior to Lesson</b>            W-2.5 "Family Vehicle Instrument Panel"            W-2.6 "Family Vehicle Equipment"            MA-2.1 "Module Two Assessment"</p> <p><b>Additional Resources (Media and/or Text)</b>            Video: "Teaching Your Teens To Drive." (AAA)            "Owner's Manual" for the driver education vehicle            "Drive Right"            "Empower Yourself with Zone Control Driving"            "Handbook Plus"            "How to Drive"            "License To Drive"            "Responsible Driving"</p>	<p>50 minutes            (5-8 minutes)            (5-8 minutes)            (5-8 minutes)            (5-8 minutes)            (5-8 minutes)            (5-8 minutes)</p> <p>5 minutes</p>

Operating Vehicle Control Devices

Knowledge and Skills

The student is expected to:

- position the steering wheel and driver’s seat to allow for the operation of the vehicular controls.
- explain the function and operation of the steering wheel, accelerator, brake pedal, gear selection lever, parking brake, cruise/speed control, and ignition switch.


Activities & Resources

Show Transparency T-2.18, T-2.19, and T-2.20 “Operating Vehicle Control Devices” to discuss the operation of control devices.

- Steering position
- Steering wheel movement
- Adjusting wheel height and angle
- Accelerator pedal use
- Brake pedal use
- Gear selector lever
- Location and use of parking brake
- Cruise and speed control
- Ignition switch

**Operating Vehicle Control Devices**

- > Maintaining Steering Control
  - Adjusting Information, Comfort, or Control Devices
- > Always Turn Steering Wheel in Direction of Desired Movement
  - Moving forward
  - Moving backward
- > Adjustment of Steering Wheel Height and / or Angle
  - Airbag deployment
  - Hand position
  - Wheel movement




T – 2.18

T-2.18 Operating Vehicle Control Devices

**Operating Vehicle Control Devices**

- > Accelerator Pedal
  - Used to stabilize, increase, and decrease speed
  - The Driver can
    - cover accelerator, progressive acceleration, thrust acceleration, lift-off accelerator
- > Brake Pedal
  - Used to stabilize, decrease, and increase speed
  - The driver can
    - cover brake, trail brake, controlled squeeze braking threshold brake, lock brake, ABS, jab (slab) brake, lift-off brake




T – 2.19

T-2.19 Operating Vehicle Control Devices

**Operating Vehicle Control Devices**

- > Gear Selector Lever –
  - Transmission Type and Location
  - (Overdrive and (D)rive gear use
- > Parking Brake – Emphasis on Parking
  - Owners Manual requests use before placing into (P)ark
- > Cruise / Speed Control – Why and How
  - Purpose of cruise control
  - Danger of cruise control
- > Ignition Switch - Location and Functions



T – 2.20

T-2.20 Operating Vehicle Control Devices

“Teaching Your Teens To Drive” (AAA) provides a video, student guide, and parent guide that have three lesson segments devoted to driver preparation, starting, and moving the vehicle. This resource adds to the information presented in this segment.



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## Support Information

### Vehicle Control Devices

Controls perform the same function in each vehicle. However, location and characteristics not only vary from one type of vehicle to another, but also between vehicles of the same make and model. It is critical to remember that when operating any vehicle control, comfort, or communication device the driver's attention must not be diverted from the path of travel for more than an instant. The following provides general information about each of the vehicle control devices:

**Steering**—The steering wheel is always turned in the direction the driver wants the vehicle to move, whether moving forward or in reverse. However, the amount of steering input and energy needed will vary according to the type of steering, number of turns lock to lock, power assist, and speed of travel. Target the path of travel before starting to steer. It is wise to have the vehicle in motion when using the steering wheel. Regardless of whether the driver's hands grip the wheel in a balanced position on the upper or lower half of the wheel, before one hand releases the wheel to adjust any information, comfort, or control device, the hand not performing the action should be moved to the 7-8 or 4-5 o'clock position, depending on steering wheel opening. The driver should not place one hand at the top of the wheel when moving forward due to air bag injury potential and lack of balanced steering control.

**Steering Wheel Adjustment**—The angle of the steering wheel is controlled by a lever located on the left or right side of the steering column in some vehicles. Other vehicles permit the driver to change the angle of the steering wheel by adjusting the steering column. An adjustment lever located on the bottom side of the steering column, near the firewall, permits the driver to raise or lower the steering column to achieve a better steering wheel angle.

**Gear Selector Lever**—In a vehicle with an automatic transmission, the gear selector lever is located either on the steering column or on a console located between the front seats. In a vehicle with a manual transmission, the shifting lever is located on the center console, on the floor to the right of the driver, or, in older vehicles, on the right side of the steering column. Most vehicles have a lock release button to prevent misshifting.

P—Parking, engine starting, and key removal  
R—Reverse  
N—Neutral  
D—Normal driving (O/D overdrive on/off switch)  
2—Stronger engine braking  
L—Maximum engine braking

In most vehicles, the brake pedal must be depressed to shift gears. The overdrive switch is for selecting either three-speed or four-speed transmission operation.

**Parking Brake**—The parking brake is sometimes mistakenly referred to as an emergency brake. The purpose of the parking brake is to hold a vehicle in place when it is parked and to protect the transaxle, constant velocity joints, or transmission. *Many new vehicle owner manuals indicate that it is important to set the brake before putting the gear shifter in (P)ark.* Driver education students should be taught to follow this procedure. The parking brake may be either a foot-operated pedal located to the far left side of the driver's position or a hand-operated lever located to the right of the steering column or to the right of the driver on the floor or center console. To set a foot-operated parking brake, push down firmly on the pedal. Depending on the vehicle, one of two methods is used to release the brake. In some vehicles, the pedal is pushed down until a click is heard, then the pedal is released. In other vehicles, the brake release lever is located above the foot pedal on the underside of the dashboard. To set a floor or console mounted parking brake, simply pull back firmly on the lever. To release the brake, press down the button located on the top of the lever with the thumb and lower the lever.

**Cruise/Speed Control**—This device allows a driver to select and travel at a set speed without having to keep a foot on the accelerator or the brake. The controls are located either on the steering wheel or a stem on the left side of the steering column. The control options include on/off, set/accelerate, and coast. Cruise control allows you to cruise at speeds over 25 mph.

**Ignition Switch**—This switch locks the steering wheel and shifting lever, and enables the driver to start and turn off the engine or use the accessories. The ignition is located on the right side of the steering column near the dashboard or in the dashboard.

**Engine Immobilizer System**—This is a theft prevention system. The engine will start only when the electronic code in the key's transponder chip corresponds to the registered ID code for the vehicle. The system is set automatically when the key is removed from the ignition switch. An indicator light will flash to show that the system is set.

**Accelerator Pedal**—This foot-operated pedal is suspended from the firewall on the right side of the driver's position. Speed is controlled by adjusting even pressure on the pedal. Some vehicles have electronic adjustments for the foot pedals. Extensions are available to meet special needs of the driver in reaching the pedal with the foot in a proper position.

**Brake Pedal**—This pedal is located to the left of the accelerator. The driver slows the vehicle by applying a squeezing pressure on the pedal with the heel of the foot on the floor. How much and how rapidly the vehicle slows is determined by how much pressure the driver applies to the brake pedal and the friction between the tires and road surface. Brake pedal extensions are available for short-statured drivers, which allow them to sit at least 10" away from the airbag.



# Notes

Operating Vehicle Control Devices

Knowledge and Skills

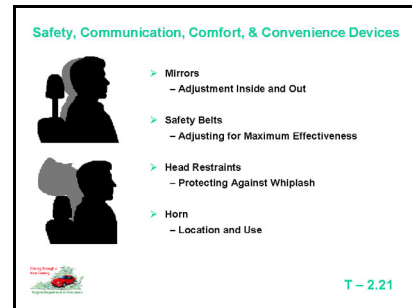
The student is expected to explain the function and operation of the mirrors, safety belts, head restraints, horn, turn signal, door locks, hazard flashers, windshield wipers/washer, headlights, hood release, trunk release, heater/ventilation/air conditioner, and seat adjustment controls.

Activities & Resources

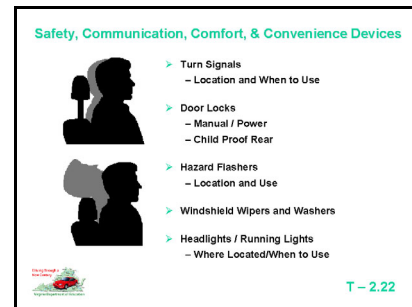
Show Transparency T-2.21, T-2.22, and T-2.23 “Safety, Communication, and Convenience Devices” to discuss the operation of safety, communication, and convenience control devices.

- Rear view and side view mirrors
- Safety belts
- Head restraints
- Horn location and use
- Turn signal and lane changer device
- Door locks
- Hazard flashers
- Windshield wipers and washer
- Headlight and daylight running lights
- Hood release
- Trunk release
- Heater, ventilation, and air conditioner (HVAC)
- Seat adjustment controls

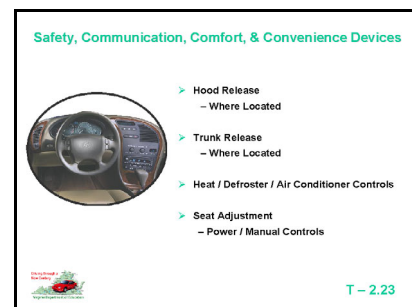
Provide Worksheet W-2.6 “Family Vehicle Equipment” to reinforce this topic area.



T-2.21 Safety, Communication, Comfort, and Convenience Devices



T-2.22 Safety, Communication, Comfort, and Convenience Devices



T-2.23 Safety, Communication, Comfort, and Convenience Devices



## Support Information

**Mirrors**—Adjust the mirrors, inside and outside. For vehicles equipped with remote controlled outside mirrors, these controls may be located on the left side of the dash, the driver's side arm rest, or center console. However, no matter how the mirrors are adjusted, there are areas that cannot be seen and require drivers to turn their heads to check prior to making a move to the left or right.

The Blindzone and Glare Elimination (BGE) technique promoted by George Platzer (1996), an automotive safety engineer and member of the Society of Automotive Engineers (SAE), may be used to train new drivers. The inside rear view mirror becomes the primary mirror, and the left and right side view mirrors become directed to side view use only. The driver can move his head toward the window to see the right and left sides of the vehicle when pulling from the curb. The BGE setting allows the driver to have two useful views in the side mirror, and the in-car instructor can use the right side mirror view as a rear view mirror. For more information go to the Society for Automotive Engineers' website at <http://www.sae.org>.

Inside rearview mirrors have a night driving position to reduce headlight glare.

**Safety Belts**—While safety belts protect occupants in a crash, they serve an equally important role of keeping the driver firmly in place behind the steering wheel, allowing better control of the vehicle. For maximum protection, the safety belt should be positioned under jackets, coats, sweaters etc., as low on the hips or thighs as possible. After fastening the belt, grasp the shoulder belt and pull upward to take up the slack in the belt across hips. Make sure that all passengers do the same.

**Head Restraint**—All new vehicles are equipped with head restraints to help reduce whiplash injuries if the vehicle is struck from the rear. Some vehicles are equipped with head restraints that can be adjusted up or down to position the restraint behind the middle of the occupant's head. Drivers should be sure that the restraint is adjusted to a position above the ear level to avoid serious neck injury in a rear collision. Some vehicles are equipped with head restraints that are built into the top of the seat and cannot be adjusted.

**Horn**—The horn is generally operated by pressing a button located on a steering wheel cross bar or on the pad on the lower half of the steering wheel above or below the air bag cover. It is usually marked with the horn symbol to indicate the location.

**Turn Signal Lever**—The turn signal lever has two uses. Located on the left side of the steering column, the lever is moved up to signal a movement to the right and down for a movement to the left. While the signal will cancel after a turn, the driver may have to cancel the signal manually after a slight turn. The signal is used to indicate a lane change by moving the lever halfway up or down with the thumb hooked on the steering wheel. The signal begins to work as the halfway point is reached and can be manually held in this position or locked prior to a lane change. Manually holding in position allows the driver to easily release the lever prior to the movement so that a signal to turn will not be confused with the lane change or merge.

**Door Locks**—In vehicles equipped with manual locks, each door has its own locking device. An additional master control is usually located on the driver side arm rest in vehicles with electric door locks. Child safe rear door locks are an option.

Wireless remote controls not only lock and unlock doors, they often have a panic switch. When the panic switch is pushed, the horn blows and the exterior lights flash to attract attention and summon help in case of emergency.

**Hazard Flasher**—The purpose of the hazard flashers is to warn other drivers of a problem and to increase their awareness of the presence of your vehicle. The switch for the lights is usually located on the top or right side of the steering column or on the dash. When operated, both front and rear turn signal lights flash.

**Vehicle Lights**—Some vehicles are equipped with daylight running lights, which may operate the headlights without having the taillights on. It is recommended by the National Highway Traffic Safety Administration (NHTSA) to use the headlights whenever the vehicle is moving, especially when not equipped with the daylight running lights. The light switch is often located on a steering stalk or on the dash panel to the left and is often a multi-purpose switch for parking lights, headlights, high beam, or low beam. A panel switch is often used to adjust the brightness of the dash panel lights and interior lights.

Automatic light control sensors are available on some vehicles and turn headlights on or off depending on the darkness of the surroundings.

Front fog lights are an option on some vehicles and come on only when headlights are on low beam.

**Windshield Wipers and Washers**—This control is frequently located on the turn signal lever. Two switches are often involved, one that controls the speed of the wipers and a second that controls the washer fluid.

**Hood Release**—This lever is usually located on the left side of the driver's compartment under the instrument panel. In some vehicles it is located under or just to the right of the steering column. To open the hood, a second latch located under the hood of the vehicle must be released.

**Trunk Release**—An option in some vehicles is to have a trunk release lever located on the floor just to the left of the driver's seat. In other vehicles, the release mechanism is a button located in the glove box, or is a feature included on a keyless entry remote control mechanism.

**Heater, Ventilation, and Air Conditioner**—These control switches are located in a duster on the instrument panel. Some vehicles have a separate switch located on the instrument panel that operates a rear window defroster.

**Seat Adjustment Controls**—If manually controlled, the adjustment lever to move the seat forward or back is typically located at the lower front or right side of the driver's seat. A second lever or knob located on the left side of the seat in some vehicles allows the driver to change the angle of the seat back. In vehicles with electric power seats, the controls are usually located on the lower left side of the driver's seat or in a control cluster located on the side door panel.

**Power Windows**—Work when the ignition switch is in the "on" position. Some vehicles have an automatic operation feature for the driver's side window. The window will open all the way when pushed down. A wireless remote is an option.

**Window Lock Switch**—Push in the window lock switch and passengers' windows can not be operated.

#### **Other Features**

- Outside and inside temperature indicators
- Average vehicle speed
- Average fuel consumption
- Instantaneous fuel consumption
- Driving time
- Power outlets for accessories
- Garage door opener
- GPS—Global positioning systems

**Module Two**  
**Topic 4—Vehicle Balance Considerations**

**25 Minutes Instructional Time**  
**Prerequisites: Qualifies for Virginia Learner's Permit**

Instructor Activities	Time Frame
<p><b>Review Module Two, Topic 4 Lesson Plans Prior to Lesson</b></p> <p><b>Show Transparencies</b>            T-2.24 "Controlling Vehicle Balance"            T-2.25 "Controlling Vehicle Balance"            T-2.26 "Controlling Vehicle Balance"            T-2.27 "Vehicle Control"            T-2.28 "Vehicle Control"            T-2.29 "Vehicle Control"            T-2.30 "Vehicle Control"            T-2.31 "Vehicle Control"</p> <p><b>Distribute and Review Student Worksheets</b>            W-2.7 "Vehicle Balance Basics"</p> <p><b>Review Module Assessments Prior to Lesson</b>            W-2.7 "Vehicle Balance Basics"            MA-2.1 "Module Two Assessment"</p> <p><b>Additional Resources (Media and/or Text)</b>            "In Control: Technical Aspects of a Vehicle "            Video: "In Control: America's Driving Reference " (J.B. Heimann Productions, Instructional Video, 2219 C Street, Lincoln, NE 68502; (800)228-0164)            Video: "Teaching Your Teens to Drive" (AAA)            "Teaching Your Teens to Drive" Parent/Teen Handbook            "Drive To Survive"            "Survival Behind the Wheel"            "How to Drive"            "Handbook Plus"            "Going Faster"            "Bondurant Behind the Wheel"</p>	<p>25 minutes (3-5 minutes) (3-5 minutes) (3-5 minutes) (3-5 minutes) (3-5 minutes) (3-5 minutes) (3-5 minutes) (3-5 minutes)</p> <p>10 minutes</p>

Vehicle Balance Considerations

Knowledge and Skills

The student is expected to:

- define and explain vehicle balance.
- describe how seating position affects the ability to control vehicle balance.
- describe how steering, braking, and acceleration each affect vehicle balance and list ways to compensate to maintain vehicle balance under the forces of these conditions.

Activities & Resources

Show Transparency T-2.24 “Controlling Vehicle Balance” to discuss vehicle balance concepts and how balance is affected by driver seating position, steering input, acceleration, and brake application.

**Controlling Vehicle Balance**

- Vehicle Balance (Roll, Pitch, and Yaw)
  - Roll: vehicle moves side to side
  - Pitch: vehicle moves forward or backward
  - Yaw: vehicle moves left or right
  - Specific amount of weight or down force on each tire patch
  - Best balance is at rest with no movement
  - Based on weight/suspension/tire pressure
- Vehicle Movement
  - Creates Changes to vehicle balance
  - Due to suspension and pressure changes

T – 2.24

T-2.24  
Controlling Vehicle Balance

Provide Worksheet W-2.7 “Vehicle Balance Basics” as a Topic 4 assessment tool and classroom activity.



Use Transparency T-2.25 “Controlling Vehicle Balance” to continue discussing vehicle balance concepts.

- Steering wheel balance
- Changes in steering ratios
- Precision steering, braking, and acceleration

**Controlling Vehicle Balance**

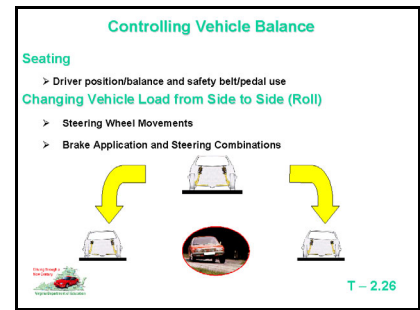
- Maintaining Vehicle Balance
  - Steering Wheel Balance
    - Smaller steering wheel
    - Rack and pinion steering
  - Precise Steering, Braking, and Accelerator Input
    - Less steering movement
    - Squeeze brakes
    - Smooth acceleration/deceleration
  - Changes in Steering Ratios, 1980’s to Date

T – 2.25

T-2.25  
Controlling Vehicle Balance

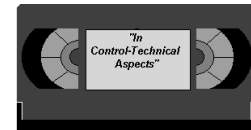
Show Transparency T-2.26 “Controlling Vehicle Balance” to continue discussing vehicle balance concepts.

- A balanced driver seating position
- Vehicle changing balance from side to side (roll)



T-2.26 Controlling Vehicle Balance

Optional Resource “In Control: Vehicle Technical Aspects” (J.B. Heimann Production) provides information from Sam Posey and Sandy Stevens about seating position, aspects of pitch, roll, vehicle understeer, vehicle over-steer, and antilock brakes. It supplements the information presented in this segment.



## Support Information

### Vehicle Balance

The most neglected area of traffic safety education is the area of vehicle balance instruction. Few instructors adequately teach the importance of using kinesthetic senses when driving an automobile. However, a driver uses the feeling of motion consistently to judge acceleration, deceleration, and the loss of traction. The only other sense used more to safely operate a vehicle is vision. Vehicle balance refers to the distribution of the weight of the vehicle on the tires as they meet the ground. This downforce of the tire patch to the roadway is affected by tire pressure and the suspension geometry. The ideal tire patch size and balance for a vehicle is only reached when the vehicle is motionless. As soon as motion occurs, changes to the vehicle balance or weight on the tire patches changes. A transfer of weight from one point of the vehicle to another is caused by acceleration, deceleration, cornering, or a combination of these actions. If there is no acceleration or deceleration, the vehicle is traveling at a constant speed or stopped, the suspension is set on center and the steering and traction condition is considered to be in balance.

### Requirements for Maintaining Vehicle Balance

- Balance maintained through precise steering movements, smooth and progressive acceleration, and controlled brake application
- Body position which allows the feet, legs, arms and hands to maintain a stable seat position and maximize vehicle movement feedback (kinesthetic feedback)

Maintaining vehicle balance results from the driver’s reaction to the vehicle’s suspension changes and center of weight transfers. Basically, the weight of a vehicle can be concentrated on one of three points on the chassis based on speed changes—the front of the chassis (over the front tire patches), the rear of the chassis (over the rear tire patches), the center of the chassis (distributed equally over the front and rear tire patches); or can be concentrated on one of two points on the chassis based on steering or surface changes—to the right of center (right two tire patches), or the left of center (left two tire patches). The magnitude of these weight changes and the driver’s ability to maintain control of the vehicle is influenced by the rate of acceleration, brake application pressure, steering input, surface traction, or combinations of these factors.

Students must understand that when driving newer model cars, the distance the steering wheel must be moved to perform most maneuvers is substantially less than was required with most cars during the 1980s and many models in the early 1990s. The number of steering wheel turns, lock to lock, has in most cases been reduced from four to five turns to two to three turns. The lock to lock configuration reduction is a result of smaller steering wheel sizes and rack and pinion steering geometry changes. Without appropriate adjustment on the part of drivers, steering too quickly in combination with sudden brake application appears to have become a problem, particularly in the occurrence of single vehicle, run-off-roadway crashes.

As a result of the off-road crash potential, the use of hand-over-hand steering is no longer recommended and, instead, hand-to-hand steering is recommended. Hand-over-hand is still recommended, however, in slow movement activities when vision is limited, such as perpendicular parking, or very fast action movements, such as traction loss recovery. Since drivers operate different types of vehicles, it becomes critical to teach more than one steering technique to new drivers.

**Seating Position**—In order to establish vehicle balance and improve ability to see, drivers should sit in a comfortable, erect position squarely behind the steering wheel. Adjust seat height so that the top of the steering wheel is in line with the top of the shoulders. The top of the wheel should never be more than one inch higher than the top of the shoulders. (In vehicles without power seats and/or adjustable steering columns or tilt steering wheels, some drivers will need to use a wedge-shaped driver's cushion.) Proper distance from the steering wheel can be determined by extending the arm straight forward and adjusting the position of the seat, forward or backward, until the top of the steering wheel is in line with the wrist joint.

Drivers under five feet five inches in height or with short legs may need to use brake and accelerator pedal extensions to comfortably reach and operate the pedals and maintain a distance of 10 inches between their body and the steering wheel to reduce the chance of injury in the event of air bag inflation.

### **Changing Vehicle Balance from Side to Side (Roll)**

Sudden steering, acceleration, or braking inputs can affect vehicle balance from side to side (vehicle roll).

- **Steering Movements**—Weight or center of mass shifts to left or right side of vehicle depending on speed, traction, and amount of steering input. Occupants may or may not feel forward lifting movement from the corner of the vehicle opposite the direction of the turn.
- **Brake and Steering Combinations**—Depending on degree of steering and brake input, braking may improve traction, such as in trail braking through a turn, when performed at an appropriate speed. However, applying the brakes when cornering at too high a speed has little effect relative to slowing the vehicle, but may have a very noticeable effect of producing traction loss due to severe weight shift to the front tire on the inside of the curve.

### **Changing Vehicle Balance from Front to Rear (Pitch)**

Sudden steering, acceleration, or braking inputs can affect vehicle balance from front to rear. When acceleration is applied, weight or center of mass is transferred toward the rear of the vehicle. If acceleration is sudden and hard, there is a noticeable drop of the rear of the vehicle and occupants feel rearward weight thrust.

- **Releasing Brake**—Simply releasing pressure from the brake pedal results in a shift of weight to the rear.
- **Covering Accelerator**—The purpose of covering the accelerator is to provide a smooth transition from brake release to progressive acceleration. It is similar to trail braking in that speed and vehicle balance are maintained prior to braking.



- **Light Accelerator Pressure**—The purpose of light accelerator pressure is to maintain weight balance while maintaining slow forward motion or reducing speed gradually with minimal weight shift.
- **Progressive Accelerator Pressure**—Firm, steady acceleration will increase speed and gradually shift balance of vehicle to the rear suspension. This action eases steering control and improves rear wheel traction moving out of a turn or curve.
- **Thrust Accelerator Pressure**—A firm push or thrust of accelerator used to shift more weight to the rear wheels for traction, or to cause a shift to a lower gear in a vehicle with an automatic transmission to increase the rate of acceleration. This process is sometimes needed when passing or changing lanes in higher speed traffic situations.

### Changing Vehicle Load from Rear to Front (Pitch)

Sudden steering, acceleration, or braking inputs can affect vehicle balance from rear to front. When brakes are applied, weight or center of mass is transferred to the front of the vehicle. If braking is hard, there is a noticeable drop of the hood and rise of the rear of the vehicle and occupants feel forward movement. The most efficient way to slow or stop your vehicle is to brake while traveling in a straight line. This allows the braking force to have an evenly distributed effect on all four wheels.

The ability to apply the correct pressure to the brake pedal is learned through experience and practice. However, each vehicle has a somewhat different “feel” with which a driver must become familiar. Apply too little pressure and the vehicle will not stop at the desired spot or within the distance available. Apply too much pressure and the brakes may lock up, and traction and directional control may be lost.

The key to good braking technique is to stabilize the foot and control brake pressure with the forces of the ankle and toes rather than thigh muscles. To facilitate this action place the heel of the foot on the floor in front of the brake pedal in such a manner that the foot forward of the ball makes contact with the pedal. This position better enables drivers to use the toes to make fine adjustments to pedal pressure and to pivot the foot more smoothly back and forth between the brake and accelerator. This also allows the driver to rest the right side of the foot against the center console or center hump for better control of speed while their foot is on the accelerator.

- **Releasing Accelerator**—Simply releasing pressure on the accelerator results in a shift of weight to the front. The affect on the reduction in speed tends to be more noticeable in vehicles with rear wheel drive than in front wheel drive vehicles equipped with transaxles.
- **Cover Brake**—The purpose of covering the brake is to provide a smooth transition from acceleration to braking. It is similar to trail braking in that speed and vehicle balance are maintained prior to braking.
- **Controlled Braking (Squeeze On)**—Braking is done with sufficient brake pressure needed to slow the vehicle, while maintaining balance to avoid traction loss to front or rear wheels. Remember that directional control (steering) becomes more difficult when using hard brake application.
- **Threshold Braking**—Threshold braking is used to maximize the braking effect of the vehicle, lifting (unloading) the rear suspension, and lowering (loading) the front suspension, to provide maximum traction to the front tires for braking just short of lock up. If lock up does occur, steering control is regained by releasing brake pressure very slightly (2-3 degrees). As with controlled braking, control of the brake pedal is best maintained if the heel is on the floor.
- **Trail Braking (Squeeze Off)**—Trail braking is used to maintain speed and balance of the vehicle when steering is required prior to turning at an intersection or in a curve. This technique is often used in combination with or at the end of controlled or threshold braking.

Vehicle Balance Considerations

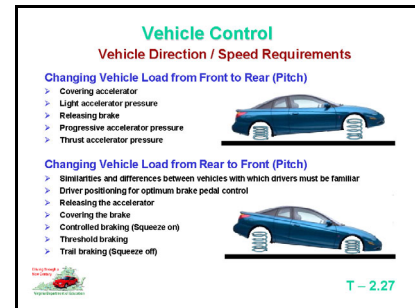
Knowledge and Skills

The student is expected to:

- describe how changes in vehicle balance from side to side, front to rear, and rear to front affect vehicle balance.
- describe the correct hand positions and steering techniques recommended when performing driving maneuvers.

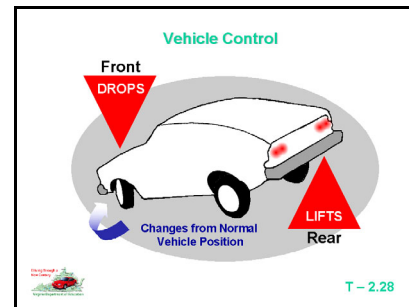
Activities & Resources

Use Transparency T-2.27 “Vehicle Control” to illustrate and discuss how sudden steering or improper combinations of braking and steering affects vehicle balance at any speed.



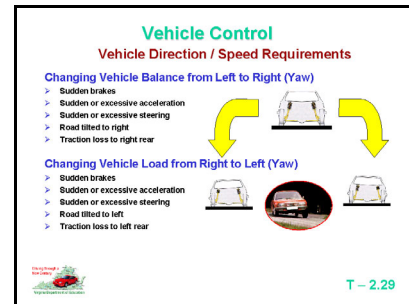
T-2.27 Vehicle Control

Show Transparency T-2.28 “Vehicle Control” to discuss load transfer during braking, cornering, and steering at dangerously high speeds or while using an improper combination of braking and steering.



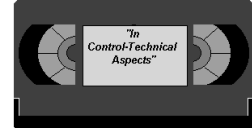
T-2.28 Vehicle Control

Show Transparency T-2.29 “Vehicle Control” to discuss load transfer during rear end swings to the right or left, resulting in a yaw (spinning) condition.

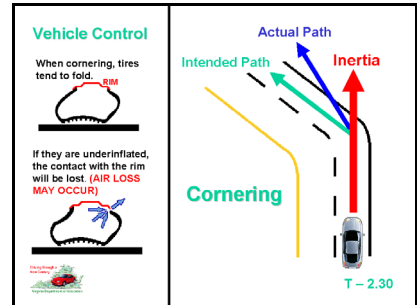


T-2.29 Vehicle Control

“In Control: Vehicle Technical Aspects” (J.B. Heimann Production) provides information from Sam Posey and Sandy Stevens about seating position, aspects of pitch, roll, vehicle understeer, vehicle oversteer, and antilock brakes. It supplements the information presented in this segment.

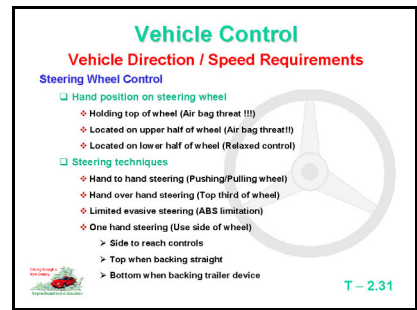


Show Transparency T-2.30 “Vehicle Control” to discuss load transfer during braking, cornering, and steering at dangerously high speeds or using an improper combination of braking and steering.



T-2.30 Vehicle Control

Show Transparency T-2.31 “Vehicle Control” to discuss using the steering wheel in a smooth and precise manner.



T-2.31 Vehicle Control

Collect Worksheet W-2.7 “Vehicle Balance Basics” as an assessment tool for this topic area. Additional evaluation and assessment questions concerning this topic are located in the Module Assessment MA-2.1 “Module Two Assessment.”



## Support Information

**Steering Wheel Control**

Due to changes in steering ratios and effort needed to turn the wheel, recommendations relative to hand position on the steering wheel have become more flexible. In order to maximize vehicle control, normal steering control involves the balance of the steering wheel to avoid sudden movements and minimize steering wheel reversals.

- **Hand Position**—Placing the hands at shoulder height (the left hand between 9 and 10 o'clock and the right hand between 2 and 3 o'clock allows for balanced shoulder strength to control the wheel). Placing the left hand between 7 and 9 o'clock and the right hand between 3 and 5 o'clock with the upper arms resting against the rib cage also improves stability by lowering the body's center of gravity and reduces unintended steering wheel reversals. Because of its more natural seating position, it also facilitates keeping both hands on the wheel and reduces upper and lower back pain often associated with trip driving. The driver's grip of the steering wheel should be firm but gentle. Grip the steering wheel by the outside rim. For greater sensitivity to information communicated by the vehicle, use fingers instead of palms of hands and keep thumbs up along the face of the steering wheel. Never turn the wheel while gripping it from the inside of the rim, hand facing outward.
- **Steering Techniques**—To steer when turning and moving forward, use both hands—one pushing; the other pulling. In general, when backing and turning, use one hand. Four types of steering movements will be used during various in-car exercises. They are hand to hand, limited evasive steer, hand over hand, and one hand steer.
- **Hand to Hand Steering**—Sometimes referred to as Push/Pull/Feed Steering but should not be confused with shuffle steering. Hand to hand steering permits the driver to make steering inputs ranging from very minor, one to two degrees, to gross adjustments up to a half turn of the wheel, while keeping both hands on the wheel for precision adjustments.

If turning through a slight curve, both hands will typically retain their original grip on the wheel, making only slight finger or wrist adjustments as necessary to maintain path of travel.

However, when moving through a turn, the hands may move up to 165 degrees (neither hand moves beyond the 6 or 12 o'clock positions). Depending on whether the driver initiates the turn by pulling the wheel down from the 3 or 9 o'clock position toward 6 o'clock, or pushing the wheel up from the 5 or 7 o'clock position toward 12 o'clock, the opposite hand slides up or down as appropriate to provide additional input or to stabilize steering. The process is reversed to return to a straight path. The wheel is not allowed to slip through the fingers to straighten when coming out of a turn and both hands are always on the wheel to make adjustments as necessary.

Hand to hand steering is particularly well suited for precision maneuvers, steering through curves, intersection entry and exit, and front wheel traction loss control (vehicle understeer).

- **Hand Over Hand Steering**—Hand over hand steering is particularly well suited when speed of the steering movement is critical such as skid recovery in a rear wheel traction loss (vehicle oversteer). When used to control or recover from a skid, it is important to hold the wheel in a pattern that allows the driver to use the upper left third of the wheel when steering to the left and the upper right third when turning right. This procedure allows for maximum movement of the wheel with knowledge of its neutral position. Hand over hand steering is also useful when maneuvering in a space with limited sightlines, such as perpendicular parking in a congested shopping center. When using hand over hand steering, quick movements of the hands are recommended on entry to the maneuver, with smooth slow movements when returning the wheel upon completion of the maneuver. Drivers should be aware that employing hand over hand steering under all conditions does expose one

to some additional risk of injury to arms, hands, and/or face in the event of a crash that results in air bag inflation. Use of hand over hand as the primary steering technique also raises the risk of off-road crash occurrences.

- **Limited Evasive Steering**—Crash studies indicate that inattention to the path ahead was the primary cause of nearly 21% of the reported crashes. However, 5.6% occurred as a result of failure to make a quick turn, or improper evasive action. Whether performed at low or high speed, a quick turn results in a shift of weight or center of mass to the left or right side of the vehicle.

Speed of travel and steering input have a direct influence on the level (increase) of weight transferred to the front corner opposite the direction of the turn with a reduction in the weight to the rear, particularly on the side in the direction of the turn.

When an error has been committed and closure is occurring at higher speeds, the quickness and amount of steering input needed to make a 12-foot lane change increases. This additional sudden, steering input coupled with the speed of travel, unless dampened by a smooth, rapid, limited steering effort, is capable of generating sufficient weight transfer to cause a loss of directional control.

#### **Important Points to Remember**

- In an evasive action, limited steering input of no more than 180 degrees (touch of the arms) must be quick and smooth with limited return steering to maintain vehicle balance.
  - At higher speeds, the driver may control brake prior to initiating the steering action to transfer weight to the front wheels, but must come off the brake or trail brake while steering for avoidance. As the speed increases, less steering input is needed to move the vehicle to the left or right.
  - Keep in mind that if the vehicle is equipped with ABS, stay with the brake while performing the limited steering inputs.
  - The initial steering input moves the front of the car while the second input moves the rear of the vehicle. It is critical to move the wheel back to the neutral position to stabilize the vehicle within the lane.
- **One Hand Steering**—Movement of the steering wheel with one hand is recommended only for backing maneuvers which do not require full left or right turns or when operating information, safety, or comfort devices.

Backing and steering with one hand requires shifting one's hip and seat position so the driver's head can be turned to see past the head restraint. To improve balance, the driver's right arm is often draped over the back of the seat. Visual checks to the front should be made prior to starting the backing maneuver. The left hand grips the steering wheel near the top and is moved in the direction that the driver wishes the rear of the vehicle go. The left hand at the bottom may be used to back a trailer. Sharp turns while backing may require the use of both hands. Since it is more difficult to maintain steering control when backing, all reverse movements should be made at slow speed.

# Notes

**Module Two**  
**Topic 5—Standard Vehicle Reference Points**

**30 Minutes Instructional Time**  
**Prerequisites: Qualifies for Virginia Learner's Permit**  
**Total Parental Involvement: 7 Hours**

Instructor Activities	Time Frame
<p><b>Review Module Two, Topic 5 Lesson Plans Prior to Lesson</b></p> <p><b>Show Transparencies</b></p> <p>T-2.32 "Targeting and Visual Requirements"            T-2.33 "Determining Vehicle Operating Space"            T-2.34 "Traditional Mirror Views and Blind Spots"            T-2.35 "Mirror Blind Spot and Glare Elimination"            T-2.36 "Standard Referencing Points"            T-2.37 "Front Limitation"            T-2.38 "Front Limitation"            T-2.39 "Front Limitation"            T-2.40 "Rear Limitation"            T-2.41 "Rear Limitation"            T-2.42 "Rear Limitation"            T-2.43 "Right Side Limitation"            T-2.44 "Right Side Limitation"            T-2.45 "Left Side Limitation"            T-2.46 "Left Side Limitation"            T-2.47 "Lane Position # 1"            T-2.49 "Lane Position # 2"            T-2.50 "Lane Position # 2"            T-2.51 "Lane Position # 3"            T-2.52 "Lane Position # 3"            T-2.53 "Lane Position #1"            T-2.54 "Lane Positions"            T-2.55 "Lane Positions"            T-2.56 "Possible Lane Positions"            T-2.57 "Angle Parking"            T-2.58 "Standard Reference Points"</p> <p><b>Distribute and Review Student Worksheets</b></p> <p>W-2.8 "Standard Vehicle Reference Points"</p> <p><b>Review Module Assessments Prior to Lesson</b></p> <p>MA-2.1 " Module Two Assessment"</p> <p><b>Additional Resources (Media and/or Text)</b></p> <p>"Empower Yourself with Zone Control Driving, ("Mottola)            Video: "Targeting" (IDS)            Video: "Reference Points," (IDS)            Interactive Driving Systems, Inc (IDS), Frederick R. Mottola,            P.O. Box 98, Chesire, CT 06410, Orders: (800) 764-7767</p>	<p>30 minutes (3-5 minutes) (3-5 minutes) (2-3 minutes) (2-3 minutes) (2-3 minutes) (2-3 minutes) (1-2 minutes) (1-2 minutes) (2-3 minutes) (1-2 minutes) (1-2 minutes) (2-3 minutes) (1-2 minutes) (2-3 minutes) (1-2 minutes) (1-2 minutes) (2-3 minutes) (2-3 minutes) (1-2 minutes) (2-3 minutes) (1-2 minutes) (1-2 minutes) (1-2 minutes) (1-2 minutes) (2-3 minutes) (1-2 minutes)</p> <p>5 minutes</p>

Standard Vehicle Reference Points

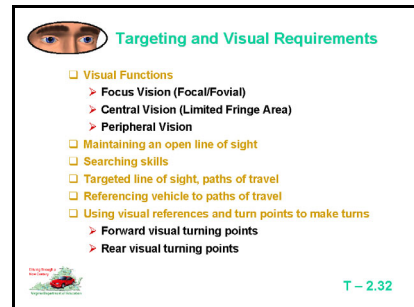
Knowledge and Skills

The student is expected to:

- define visual target with regard to path of travel.
- assess and analyze the path of travel of a vehicle, and the line of sight while seated in a vehicle.
- compare and contrast traditional mirror settings and contemporary mirror settings with regard to blind spot elimination and glare elimination.

Activities & Resources

Use Transparency T-2.32 “Targeting and Visual Requirements” to discuss the vision and perception requirements necessary for the safe operation of a vehicle.

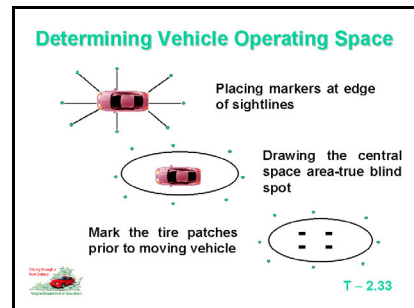


T-2.32 Targeting and Visual Requirements

Show Transparency T-2.33 “Determining Vehicle Operating Space” to discuss the space visible and not visible around the vehicle.

Visible Space

- One car-length to the front
- Two car-lengths to the rear
- One car-width to the left
- Two car-widths to the right



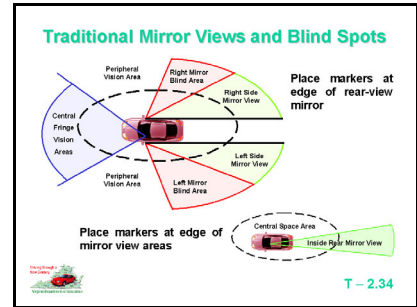
T-2.33 Determining Vehicle Operating Space

Have students participate in a Vehicle Space Demonstration (Pages 44-47):

- Student gains a perspective of space that is visible to driver.
- Student learns that the driver must look for things that can be seen.
- Because the area to the front, side, and rear is so large, reference points will help.
- Student will recognize that driving takes place in the future (targeting) and the past (mirrors). It is critical not to try to look where the vehicle is, as this area is not visible to the driver.



Show Transparency T-2.34 “Traditional Mirror Views and Blind Spots” to discuss the blind spots when using traditional mirror settings.

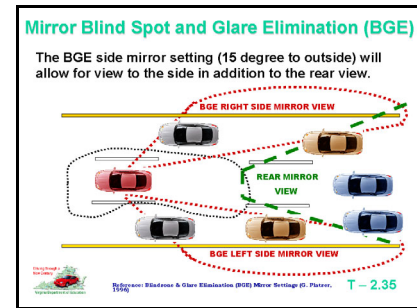


T-2.34 Traditional Mirror Views and Blind Spots

“Targeting” (IDS) may also be used to introduce or review targeting skills. The video supplements the information presented in this lesson.



Use Transparency T-2.35 “Mirror Blind Spot and Glare Elimination” to discuss mirror settings that eliminate blind spots and reduce headlight glare when driving at night.



T-2.35 Mirror Blind Spot and Glare Elimination

**Support Information****Vision and Perception Requirements**

In this module, there is an emphasis on the importance of directed attention, maintaining an open line of sight, searching skills, and targeting a line to maintain a safe path of travel. It is critical that students understand how an inadequate or improper visual search, lack of understanding of vehicle dynamics, failure to respond, or a delayed response to a threatening object or condition contributes to driver crash involvement.

**Referencing Vehicle to Path of Travel—*Visual Functions***

- Central (Focal) Vision—used to read and identify distinct objects, and covers about three percent of one's visual field
- Fringe Vision—used to judge depth and position
- Peripheral Vision—conical in shape around the other vision fields

**Maintaining an Open Line of Sight—*Searching Skills***

- Using visual references and turn points to make turns
- Forward visual turning point
- Rear visual turning point
- Targeted line of sight, paths of travel
- Referencing vehicle to paths of travel

**Introduction to Targeting**

A fixed object that appears at the end and in the center of the path you intend to drive. To select a target, first decide where you want the vehicle to travel. Then aim for an object in the center of that path.

**Advantages of Targeting**

- Allows driver to visualize the space they intend to occupy
- Helps driver start learning to use a searching process
- Gets driver to look far ahead, rather than close to vehicle
- Allows driver to plan ahead
- Increases steering precision and reduces steering reversals
- Develops skid avoidance skills

**Target Area**

The target area is the driving environment to the left and right of where the target is located. Searching the target area for driving related information is more important than trying to identify a specific target. Identification of a specific target is only necessary while learning what a target is and how to identify one.

**Target Area to Target Area**

Target Area Searching requires identification of the condition of the target area as open or closed, red light or green, stopped traffic or moving, curve or hill crest, left curve or right curve, to give you a clear picture of what to expect ahead in the vehicle's targeting path.

After knowing what the condition is in your target area, you then should assess your 12-15 second range to see what zone changes can or do affect your targeting path. Make assessments of your other zones to see what your options are. Then select the best lane position and get the best speed control in order to achieve the lowest degree of risk en route to the target area. As you get within 4-6 seconds of a zone change, you reevaluate it to insure best control.

Closer to the target area, you re-evaluate the condition of the target area and begin assessing your next target area and the zone changes that you will encounter en route. This process of searching from one target area to the next target area is repeated continually.

## Preventing Blind Spot Crashes and Eliminating Mirror Glare

**Most drivers learned about blindzones (blind spots)** in a driver education class and to look over their shoulders before changing lanes. Your first real encounter with a blindzone was probably when you tried to change lanes and got a horn blast in your ear. The adrenaline instantly kicked in as you reversed your maneuver. Your heart jumped to your throat, and you suddenly felt hot as you realized you had just made a dangerous mistake. You asked yourself, "What happened? Why didn't I see that car? Did I forget to look?"

Lots of people make that mistake every year, and sometimes it results in more than just a horn blast. The National Highway Traffic Safety Administration (NHTSA) has studied a category of accidents they call Lane Change/Merge (LCM) crashes. They estimate there are 630,000 LCM crashes with 225 fatalities annually. A NHTSA study found that about 60% of drivers involved in LCM crashes did not see the other vehicle, and about 30% of drivers misjudged the position or speed of the other vehicle.

All LCM crashes cannot be blamed on the blindzones, but blindzones are extremely important. They are not well understood by the average driver, yet they are involved in every LCM maneuver.

To understand why the blindzones are important, let's see how they are created. Most passenger cars are equipped with one inside mirror and two outside mirrors. The inside mirror provides the driver with the widest field of view and by far the most important about traffic to the rear. For this reason, drivers should consider the inside mirror their primary mirror. Transparency T-2.34 is a drawing showing the inside mirror's field of view when it is centered on the road. The marked regions are blindzones in which a vehicle cannot be seen in either the inside mirror or the driver's peripheral vision. To change lanes, the driver must turn and look into the blindzones to see if a vehicle is there.

Transparency T-2.34 shows the fields of view of the two outside mirrors. These outside mirrors have been set so that the sides of the car are just visible. The field of view of an outside mirror is about half that of the inside mirror. Note that the outside mirrors have reduced the size of the blindzones, but have added relatively little to the field of view seen in the inside mirror. Blindzones capable of hiding a vehicle still exist. With this setting of the outside mirrors, it is still necessary to turn and look into the blindzones when changing lanes. This setting is called the "Blindzone Setting."

Transparency T-2.35 shows how easily blindzones can be eliminated. The two outside mirrors are simply rotated outward to look into the blindzones instead of looking along the sides of the car. There are now four mini blindzones, but none is large enough to hide a vehicle. With this new setting, it is no longer necessary to turn and look into the blindzones. All that is required is a glance at the outside mirror to see if a car is there.

### Five Major Advantages of New Mirror Settings

- Looking into the blindzones, which can be uncomfortable and annoying, is no longer necessary.
- Only a brief glance at the mirror is required to view the blindzone, as opposed to the longer time required when turning the head. At highway speeds, turning takes your eyes off the road for about 100 feet.
- Glancing at the mirror leaves the forward scene in your peripheral view, while turning your head completely eliminates the forward view.
- The blindzones can be easily included in your visual scanning.
- At night, glare from the outside mirrors is virtually eliminated. The reason for this is that a following car's headlamps are not visible until the car moves into the blindzone, and at that point, the high intensity portion of the headlamp's beam does not hit the mirror.

**“Blindzone/Glare Elimination Setting” or “BGE Setting”**

The BGE Setting requires turning the field of view of each outside mirror outward by about 15 degrees from the Blindzone Setting. For the driver’s side mirror, this can be done by placing your head against the side window and then setting the mirror to just see the side of the car. Do the same with the passenger’s side mirror, but position your head at the middle of the car. You should next check to see that the blindzones are truly eliminated. From the normal driving position, watch a car as it passes you. It should appear in the outside mirror before it leaves the inside mirror, and it should appear in your peripheral vision before leaving the outside mirror. This is your proof that the blindzones have been eliminated and that your mirrors are correctly set.

When changing lanes with BGE Setting, you must *first* look in the inside mirror for vehicles approaching from the rear; *then* glance at the outside mirror to see if a vehicle is in the blindzone. A good rule to follow when changing lanes is that if you can see the entire front of a vehicle in the inside mirror, and that vehicle is not gaining on you, it is safe to change lanes provided there is no vehicle in the blindzone. This is similar to the rule used when passing which says wait until you see the front of the car you just passed before changing lanes.

The Blindzone Setting and BGE setting are both useful. For most driving situations the BGE Setting is best. Occasionally, the Blindzone Setting is required. This will be true when the rear window is blocked by cargo, or if you are in heavy stop and go traffic and a car on your bumper blocks your rear view of adjacent lanes.

When driving with the BGE Setting, most drivers initially feel a sense of confusion with the outside mirrors. You are not sure where they are pointed; you miss not seeing the sides of the car; and you do not know how to interpret what you see. Don’t give up. The confusion will go away with practice.

**Mirror Usage—Summary**

- Understand that the inside mirror is truly your primary mirror. THE INSIDE MIRROR SHOWS YOU EVERYTHING EXCEPT THE BLINDZONES.
- Do not look at the outside mirror except to see if a vehicle is in the blindzone. THE OUTSIDE MIRRORS SHOW YOU ONLY THE BLINDZONES.
- If you are in doubt about the position of the driver’s side mirror, move your head to the side window and check to see that the side of the car is just visible. For the passenger’s side mirror, move your head toward the middle of the car.
- Mirrors are detection devices and should not be used for extended periods of time while driving.
- Mirrors should be checked prior to and after any speed or position change.
- Students should recognize what is visible in the mirrors to the rear.
- A traditional mirror setting leaves a blind spot to the side and provides the same information that is available through the rear view mirror.
- The contemporary mirror setting helps to alleviate the blind spot and enlarges the area visible to the driver.
- Car mirrors are not sufficient visual tools to allow a driver to back a car. This is due to the inability to monitor rear tire movement. The mirrors would need to be much larger to be effective for backing the vehicle.

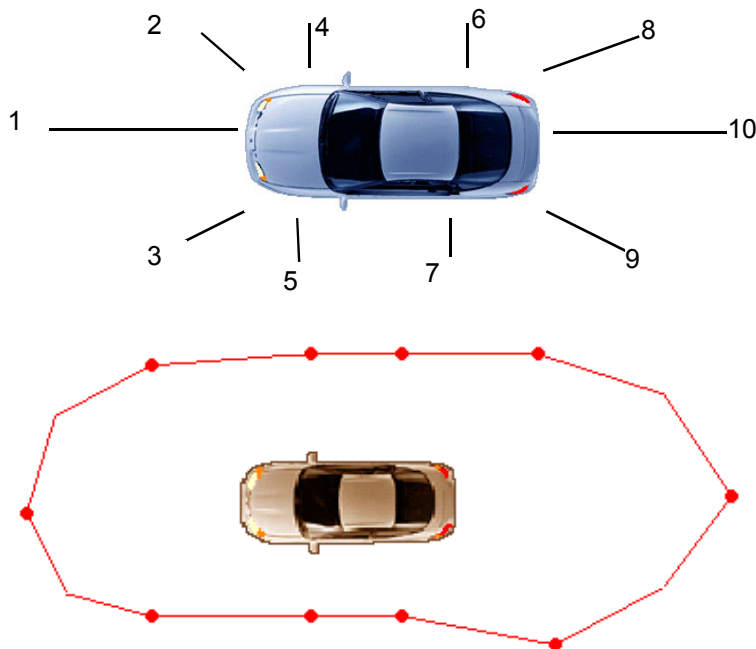
## Vehicle Space Demonstration

Instructor Activities	Student Activities
<p><b>Classroom Supplement</b></p> <ul style="list-style-type: none"> <li>• Prepare several vehicles for demonstration of area of visibility around a car with and without mirrors.</li> <li>• Prepare a surface for chalking/painting of lines or placing of cones or paper cups around each vehicle.</li> <li>• Organize cooperative learning groups.</li> <li>• Supervise students in activity or assign task to paraprofessional aide.</li> </ul> <p><b>Alternate activity</b> Homework assignment with personal vehicle - allow students to photograph and present a PowerPoint presentation.</p> <p><b>Resources</b></p> <ul style="list-style-type: none"> <li>• Vehicles for size of the group</li> <li>• Chalking or marking devices for group, as needed</li> <li>• Forms for transferring and maintaining data</li> <li>• Photography equipment, if desired</li> <li>• Space for drawing on surface large enough to demonstrate the hidden area around the vehicle</li> </ul>	<p><b>Group activity segment</b></p> <ul style="list-style-type: none"> <li>• Determine 1st student in driver's seat.</li> <li>• Determine design or photograph use and drawing responsibilities.</li> </ul> <p><b>Session activity</b></p> <ul style="list-style-type: none"> <li>• Place 1st driver in the preferred position for driving vehicle with properly adjusted seat, steering, mirrors, and restraints.</li> <li>• Place 2nd student outside of vehicle at front bumper.</li> <li>• 2nd student backs slowly away from bumper until driver sees shoes of the student (with and without mirrors).</li> <li>• 3rd student marks location on surface.</li> <li>• 2nd and 3rd students repeat activity at eight locations.</li> <li>• All students aid in connecting location markers and transfer to data sheet or photograph for portfolio.</li> <li>• Process is repeated for all drivers.</li> <li>• At the completion of these activities, the students should mark the areas of contact between road and tire.</li> <li>• Place results in portfolio for future reference.</li> </ul>

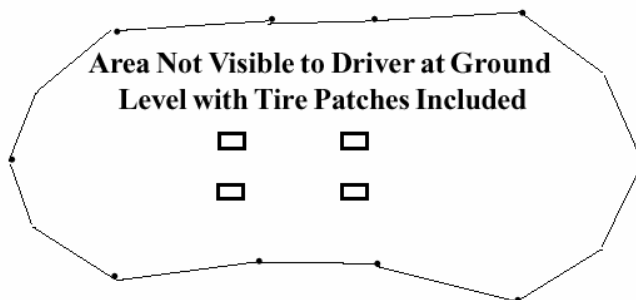
## Vehicle Space Demonstration

### Diagram 1—Vehicle Operating Space

Two or three students are needed to assist in this exercise. One student should be seated behind the wheel of the vehicle. The other students should position themselves close to the vehicle in positions illustrated below. Starting at the 1 position and repeating for 2 to 10, ask the student in the car to wave hand when he can see the shoes of the student outside the car as they walk slowly away. Mark the positions so that a chalk line can be drawn from one point to another. This will indicate an area that is one length of the vehicle to front, two lengths of vehicle to rear and one width of the vehicle to the left and two widths to the right. This space is not visible to the driver.



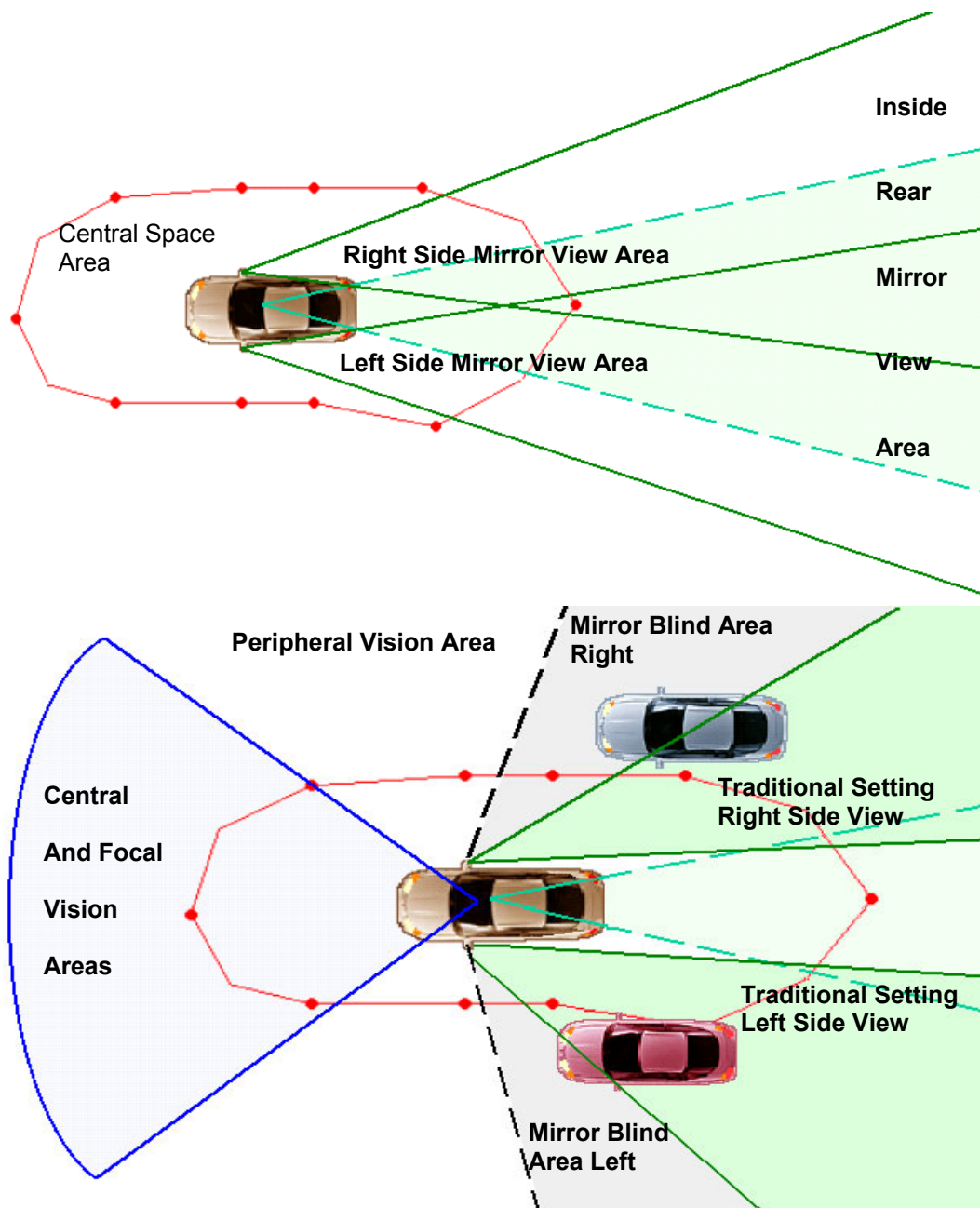
Outline the tire patches with chalk and then have a licensed driver move the vehicle out of the space to indicate how small the contact area is in relation to the space being driven down the roadway. This exercise dramatizes why the driver needs to establish a target area that is far from the vehicle, since all the decisions have to be made based on what is happening in the intended path of travel.



## Vehicle Space Demonstration

**Diagram 2—Mirror View Areas and Blind Spots**

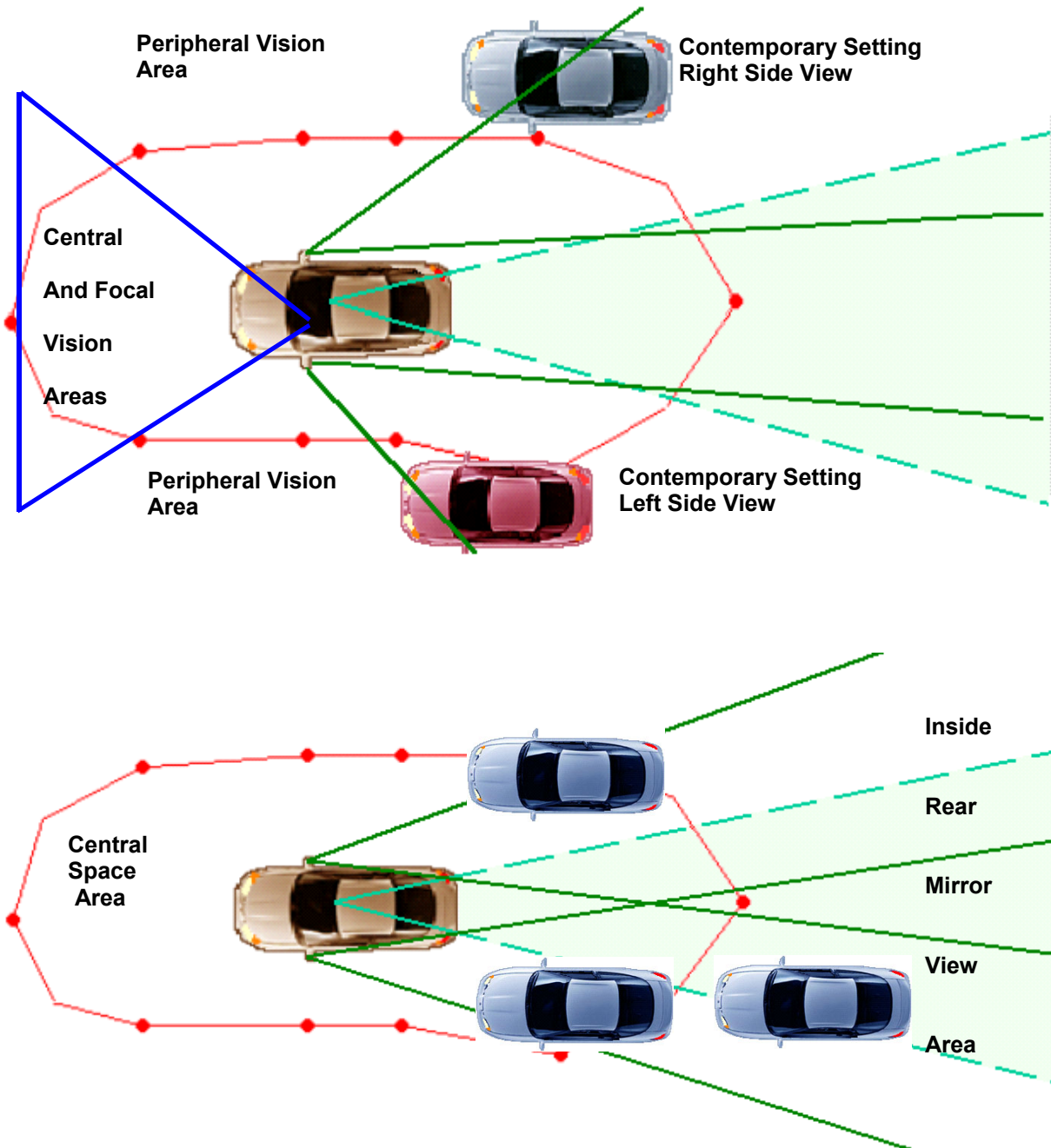
Two or three students will need to assist in this exercise. One student should be seated behind the wheel of the vehicle. The other students should position themselves close to the back of the vehicle. Starting at the rear view mirror position, ask the student in the car to wave a hand when he/she can see the shoes of the student outside the car as they walk slowly away. Mark the positions so that a chalk line can be drawn from one point to another. This should indicate an area that is about 200 feet to the rear for ground view. Mark the areas for the side view also recognizing the location of the mirror blind spot. Use the traditional mirror settings and the contemporary mirror settings to indicate the method to reduce the mirror blind spot to the sides with the contemporary settings.





# Vehicle Space Demonstration

Diagram 3— Blind Zone and Glare Elimination (BGE) Mirror Settings





# Notes

Standard Vehicle Reference Points

Knowledge and Skills

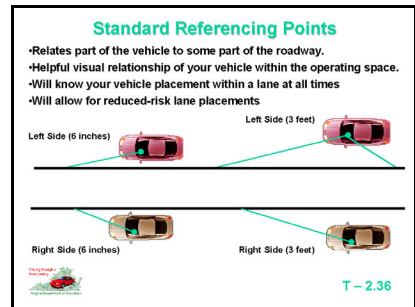
The student is expected to understand standard vehicle reference points.

Activities & Resources

Provide Worksheet W-2.8 "Standard Vehicle Reference Points" as a class activity and topic assessment.

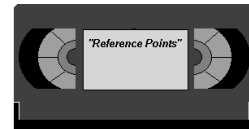


Use Transparency T-2.36 "Standard Referencing Points" to discuss techniques for establishing reference points from the roadway to the vehicle.



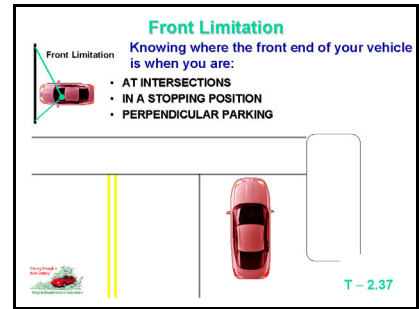
T-2.36 Standard Referencing Points

"Reference Points" (IDS) may also be used to introduce or review reference point skills. The video supplements the information presented in this segment.

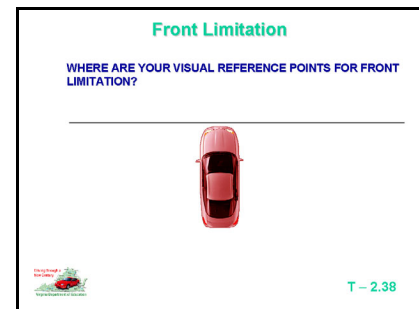


Use Transparencies T-2.37, T-2.38, and T-2.39 “Front Limitation” to discuss establishing front reference points.

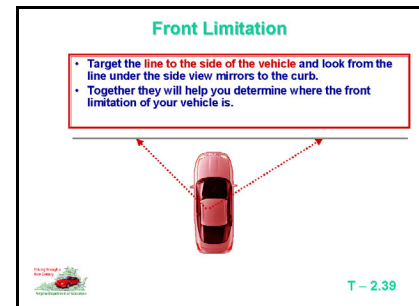
- Intersections
- Stopping position
- Perpendicular parking
- Placing front of vehicle even with a line or curb (The curb or line should appear to run into the right side corner post or under the left side mirror.)



T-2.37 Front Limitation



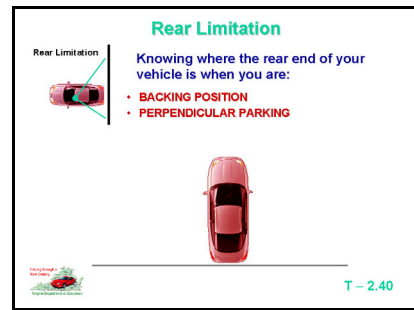
T-2.38 Front Limitation



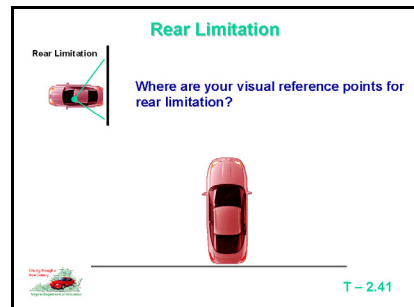
T-2.39 Front Limitation

Use Transparency T-2.40, T-2.41, and T-2.42 "Rear Limitation" to discuss establishing rear reference points.

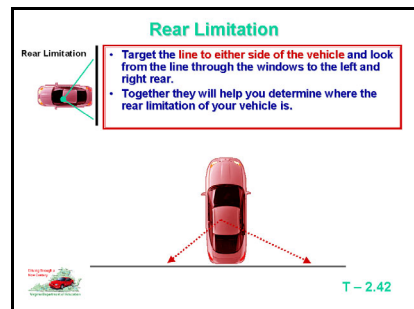
- Backing position
- Perpendicular parking
- Placing back bumper of vehicle so it is lined up with any rear line or curb



T-2.40 Rear Limitation



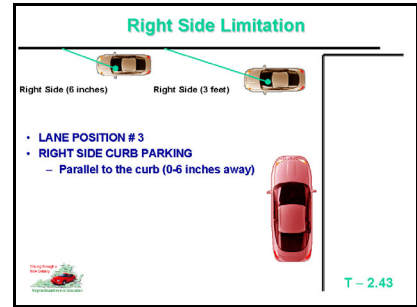
T-2.41 Rear Limitation



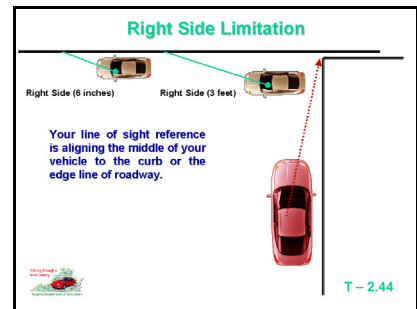
T-2.42 Rear Limitation

Use Transparency T-2.43 and T-2.44 “Right Side Limitation” to discuss establishing reference points for right side limitation.

- Lane position 3
- Curb parking to right side
- Parking close to a white line, curb, or straight line to the right side of the vehicle being driven; the center line of the hood appears to be next to the line or curb (T-2.43)
- Parking close to a white line, curb or straight line to the right side of the vehicle being driven; the center line of the hood appears to be next to the line or curb (T-2.44)
- Placing the right side of the vehicle three feet from a white line or the curb (T-2.44)
- Placing the right side of the vehicle six feet away from a line or curb (T-2.44)



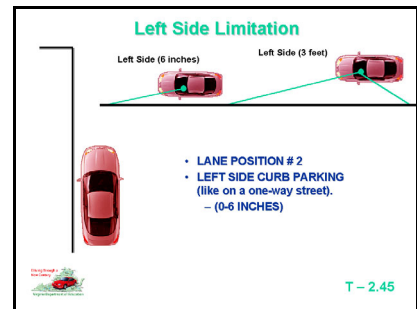
T-2.43 Right Side Limitation



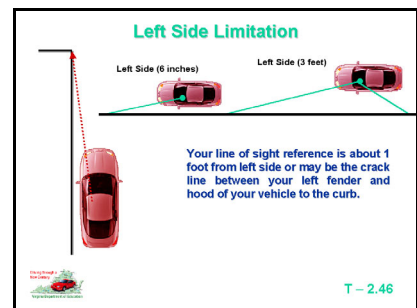
T-2.44 Right Side Limitation

Use Transparency T-2.45 and T-2.46 “Left Side Limitation” to discuss establishing reference points for left side limitation.

- Lane position 2
- Curb parking to left side



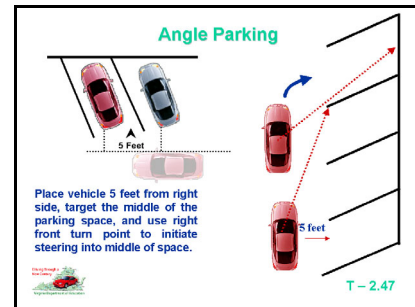
T-2.45 Left Side Limitation



T-2.46 Left Side Limitation

Use Transparency T-2.47 “Angle Parking” to discuss setup and entry reference points for angle parking.

- Position 5 feet from lines
- Using right front turn point while targeting middle of lane



T-2.47 Angle Parking

## Support Information

### Standard Vehicle Reference Points

#### Definition of Reference Points

From the driver's seat, see some part of the vehicle as it relates to some part of the roadway, to know where the vehicle is actually located.

#### Reference Point Usage

Drivers cannot see the actual position of the car in relation to the roadway. The reason for this is that the driver's view of the road is blocked by the dashboard and by the hood of the car. Reference points can be developed to serve as a guide to overcome the vision problems a driver encounters. *Note: Reference points are drawn on Transparencies T-2.36 and T-2.37.*

The reference point to tell where the right tires are located is the hood ornament. If the car doesn't have a hood ornament, the curb would appear to be at the center of the hood. When the front of the car is even with a line, the driver will see that line appear near the passenger's side mirror. When the car is 3-6 inches away from a line to the left, the driver will see that line appears to be one foot in from the edge of the left fender.

#### Standard Reference Points

The reference points presented show the way most drivers will see them. They are our "standard" reference points. When attempting to discover a reference point, first use the "standard" reference point. If the "standard" reference point was accurate for you, continue to use it. If any "standard" reference point does not work for you, make note of your "personal" reference point. It won't be more than a few inches away from the "standard" reference point. Once you succeed, remember the correct picture of your "personal" reference point for future use.

Reference points are the tools necessary for the driver to receive accurate feedback for successful performance. If a driver parks alongside a curb perfectly but didn't use reference points, there was no learning of what gave the perfect results. It would be difficult to repeat the same actions with the same results.

# Notes

Standard Vehicle Reference Points

Knowledge and Skills

The student is expected to describe the placement options in a traffic lane utilizing visual reference points.

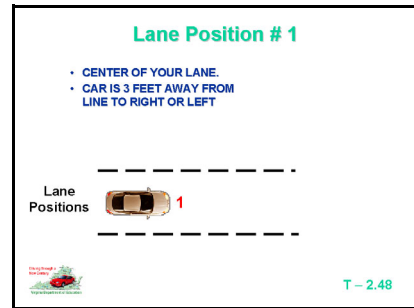
Activities & Resources

Use Transparencies T-2.48 and T-2.49 "Lane Position #1" to discuss establishing reference points for the center of lane position.

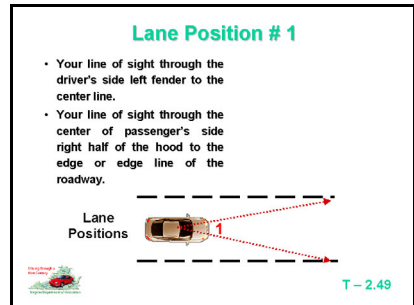
- Center of lane
- Three feet from left side
- Three feet from right side

The driver is able to avoid a path of travel (POT) or a line of sight (LOS) restriction or problem to the left side of lane. (T-2.48)

The driver is able to avoid a path of travel (POT) or a line of sight (LOS) restriction or problem to the right side of lane. (T-2.49)



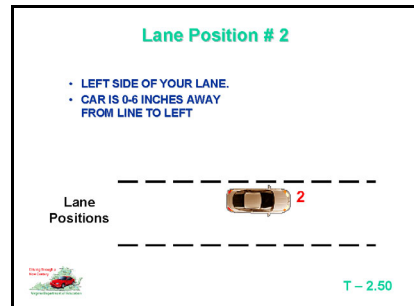
T-2.48 Lane Position #1



T-2.49 Lane Position #1

Use Transparency T-2.50 "Lane Position # 2" to discuss establishing reference points for left side lane limitation.

- Left side of the lane
- 0-6 inches from the left side line

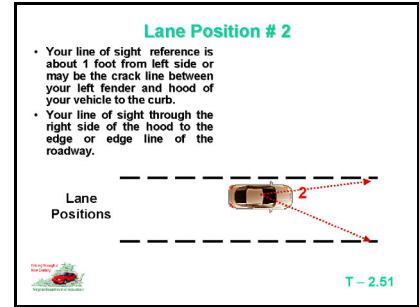


T-2.50 Lane Position # 2



Use Transparency T-2.51 "Lane Position #2" to continue discussing the establishment of reference points for left side lane limitation.

The driver is able to avoid a path of travel (POT) or line of sight (LOS) restriction or problem to the left side of the lane by positioning over the white line to the right.

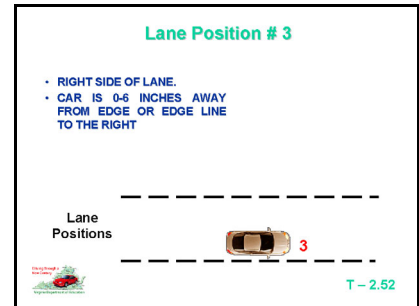


T-2.51 Lane Position #2

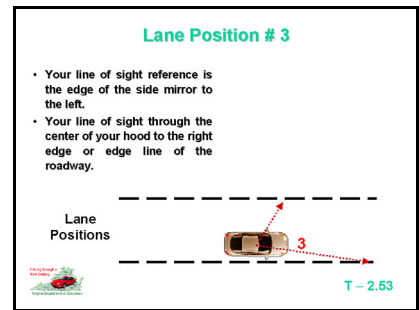
Use Transparency T-2.52 and T-2.53 "Lane Position # 3" to discuss establishing reference points for right side lane limitation.

- Right side of lane
- 0-6 Inches from right edge line

The driver is able to avoid a path of travel (POT) or a line of sight (LOS) restriction or problem to the right side of the lane by positioning over the yellow or white line to the left. (T-2.53)

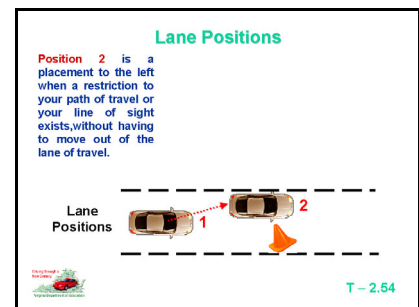


T-2.52 Lane Position #3



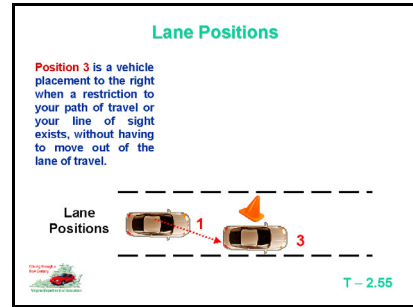
T-2.53 Lane Position # 3

Use Transparency T-2.54 "Lane Positions" to discuss establishing lane positions from Lane Position # 1 to Lane Position # 2 to avoid a path of travel or line of sight restriction. Ask students to identify when this position adjustment would be used.



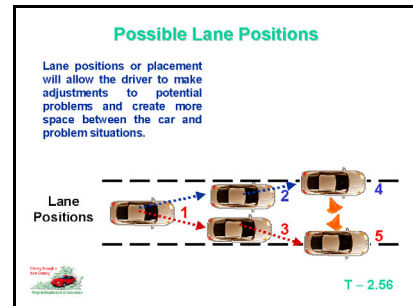
T-2.54 Lane Positions

Use Transparency T-2.55 “Lane Positions” to discuss establishing lane positions from Lane Position # 1 to Lane Position # 3 to avoid a path of travel or line of sight restriction. Ask students to identify when this position adjustment would be used.



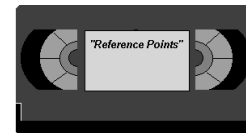
T-2.55 Lane Positions

Use Transparency T-2.56 “Possible Lane Positions” to discuss establishing lane positions from Lane Position # 1 to Lane Position # 2, 4 or 3, 5, to avoid a path of travel or line of sight restriction. Ask students to identify when these position adjustments would be used.

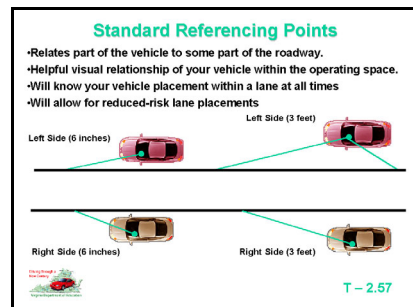


T-2.56 Possible Lane Positions

“Reference Points” (IDS) may also be used to introduce or review reference point skills. The video supplements the information presented in this segment.



Use Transparency T-2.57 “Standard Referencing Points” to review standard vehicle reference points for gaining good lane position and placement.



T-2.57 Standard Referencing Points

**Lane Position Options**

With the use of reference points you can accurately position your vehicle within a lane to gain best space management. There are five choices for lane position without making a lane change. Transparency T-2.37 shows the three most frequently used lane positions. The fourth and fifth positions—which require straddling the lane line to the left (LP4) or to the right (LP5)—are only used sparingly to momentarily control two lanes.

Most cars are less than six feet wide; the highway lanes are commonly twelve feet wide. That gives you six feet of empty space to the side without leaving the lane. There is enough room in most lanes to fit two cars.

- **Lane Position #1** is where the car is centered within the travel lane.
- **Lane Position #2** is where the car is 3-6 inches away from the left line of the travel lane.
- **Lane Position #3** is where the car is 3-6 inches away from the right line of the travel lane. (Special LP3 - When there is no lane line, Lane Position #3 is at least three feet away from the curb or from the shoulder of the road.)

# Notes

# Curriculum Scope and Sequence Modules for Driver Education in Virginia

## Module Two

### Worksheets

- W-2.1 Driver Preparations
- W-2.2 Under the Hood Checks
- W-2.3 Control and Information Devices
- W-2.4 Control, Information, Comfort, and Safety Devices
- W-2.5 Family Vehicle Instrument Panel
- W-2.6 Family Vehicle Equipment
- W-2.7 Vehicle Balance Basics
- W-2.8 Standard Vehicle Reference Points

### Simulation

- SLS-2.1 Simulation Laboratory Session

### Assessment

- MA-2.1 Module Two Assessment

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



List the pre-drive, driver readiness, starting, and securing tasks used when preparing to drive.

**Pre-drive Tasks**

- 
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**Driver Readiness Tasks**

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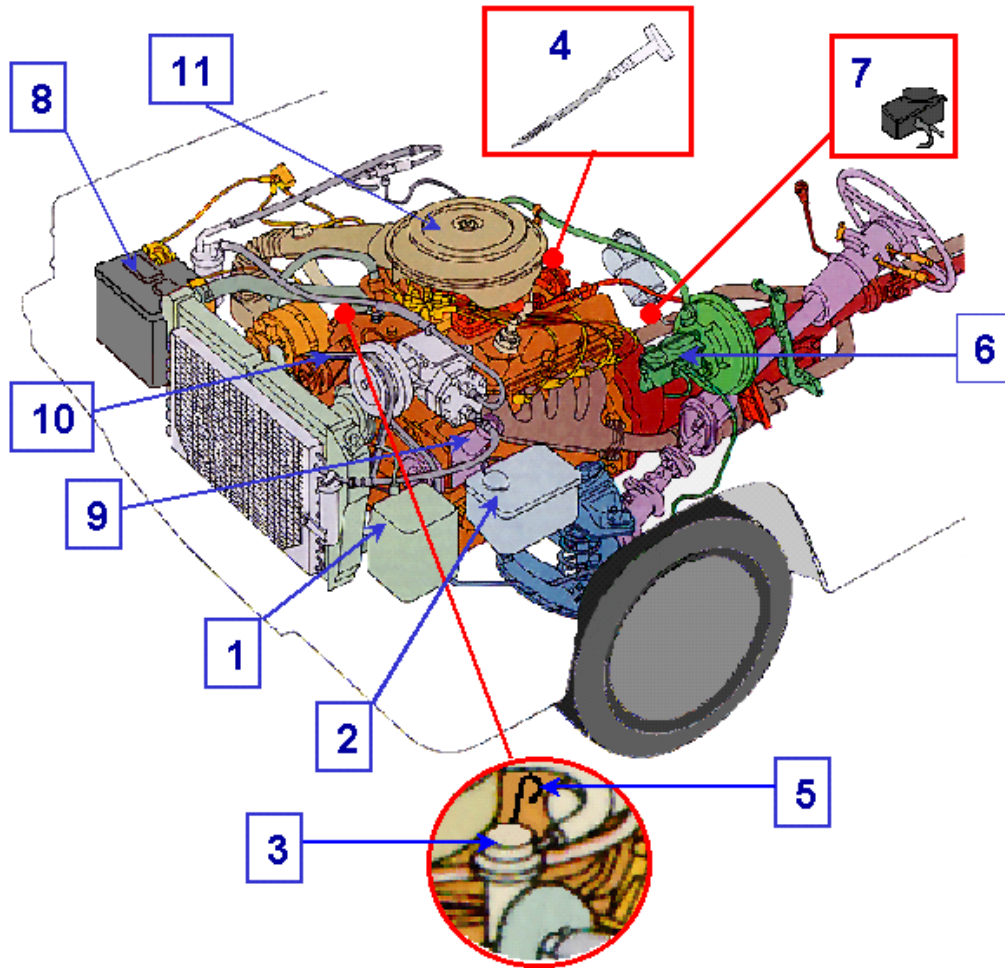
**Starting Tasks**

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- 

**Securing Tasks**

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The driver education instructor may list tasks that are specific to the local program needs. For instance, the program may have a standard shift vehicle for use in program.



Using the picture with numbered lines leading to points on the engine, identify the items by writing the corresponding number.

- \_\_\_\_\_ Windshield Washer Fluid Reservoir
- \_\_\_\_\_ Drive Belts
- \_\_\_\_\_ Engine Oil Filler Cap
- \_\_\_\_\_ Engine Coolant Reservoir
- \_\_\_\_\_ Brake Fluid Reservoir
- \_\_\_\_\_ Transmission Fluid Dipstick (Automatic Transmission)
- \_\_\_\_\_ Engine Oil Dipstick
- \_\_\_\_\_ Power Steering Fluid Reservoir
- \_\_\_\_\_ Air Filter Assembly
- \_\_\_\_\_ Battery
- \_\_\_\_\_ Clutch Fluid Reservoir (Manual Transmission)



















The items listed should be checked regularly to assure safe operation and to protect the engine.



Fill in the alert symbols, warning symbols, and control devices found on Transparencies T-2.11 and T-2.12 as a classroom activity



















- |          |          |           |
|----------|----------|-----------|
| A. _____ | N. _____ | AA. _____ |
| B. _____ | O. _____ | BB. _____ |
| C. _____ | P. _____ | CC. _____ |
| D. _____ | Q. _____ | DD. _____ |
| E. _____ | R. _____ | EE. _____ |
| F. _____ | S. _____ | FF. _____ |
| G. _____ | T. _____ | GG. _____ |
| H. _____ | U. _____ | HH. _____ |
| I. _____ | V. _____ | II. _____ |
| J. _____ | W. _____ | JJ. _____ |
| K. _____ | X. _____ | KK. _____ |
| L. _____ | Y. _____ | LL. _____ |
| M. _____ | Z. _____ | MM. _____ |

**Alert/Warning Symbols and Controls**

A. 	F. 	K. 	P. 
B. 	G. 	L. 	Q. 
C. 	H. 	M. 	R. 
D. THEFT	I. 	N. 	S. 
E. 	J. 	O. 	

T-2.11

**Alert/Warning Symbols and Controls**

T. 	Y. 	DD. 	II. 
U. 	Z. 	EE. 	JJ. 
V. 	AA. O/D OFF	FF. 	KK. 
W. 	BB. 	GG. 	LL. 
X. 	CC. 	HH. 	MM. ETS OFF

T-2.12

## Worksheet W-2.4

### Control, Information, Comfort, and Safety Devices

Label the Control and Information Devices as directed by the instructor during classroom discussion.

#### Left Control Panel

01. \_\_\_\_\_
02. \_\_\_\_\_
03. \_\_\_\_\_
04. \_\_\_\_\_

#### Functional Levers

05. \_\_\_\_\_
06. \_\_\_\_\_
07. \_\_\_\_\_
08. \_\_\_\_\_

#### Passive Restraint

09. \_\_\_\_\_

#### Left Instrument Cluster

10. \_\_\_\_\_
11. \_\_\_\_\_
12. \_\_\_\_\_
13. \_\_\_\_\_
14. \_\_\_\_\_
15. \_\_\_\_\_
16. \_\_\_\_\_
17. \_\_\_\_\_
18. \_\_\_\_\_
19. \_\_\_\_\_

#### Center Instrument Cluster

20. \_\_\_\_\_
21. \_\_\_\_\_
22. \_\_\_\_\_
23. \_\_\_\_\_
24. \_\_\_\_\_
25. \_\_\_\_\_

#### Right Instrument Cluster

26. \_\_\_\_\_
27. \_\_\_\_\_
28. \_\_\_\_\_
29. \_\_\_\_\_
30. \_\_\_\_\_
31. \_\_\_\_\_
32. \_\_\_\_\_
33. \_\_\_\_\_
34. \_\_\_\_\_
35. \_\_\_\_\_
36. \_\_\_\_\_
37. \_\_\_\_\_

#### Auxiliary Panel Controls

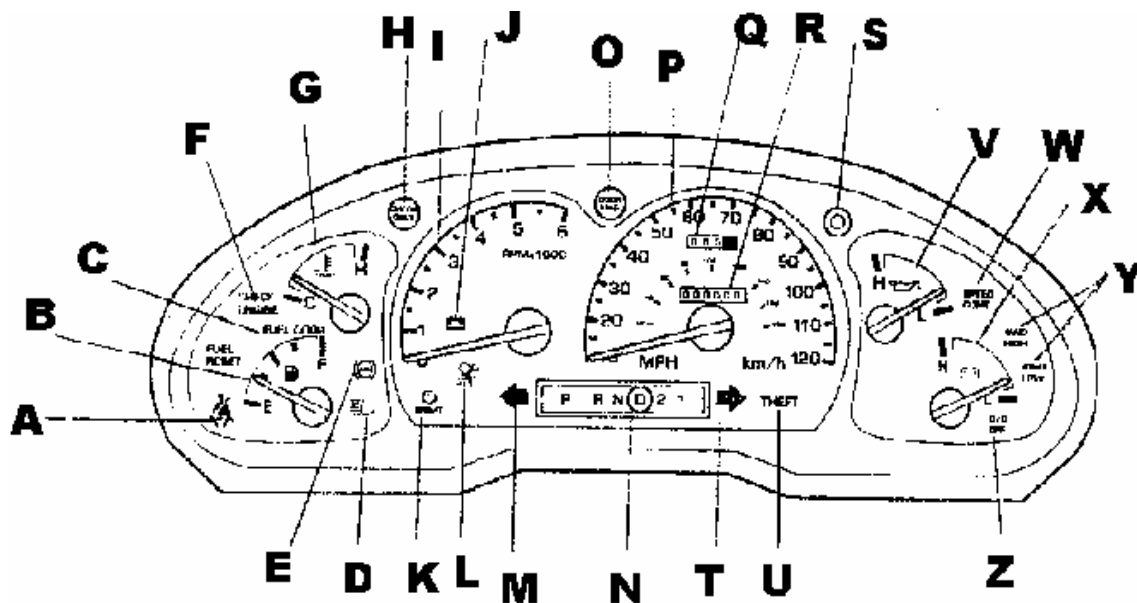
38. \_\_\_\_\_
39. \_\_\_\_\_
40. \_\_\_\_\_
41. \_\_\_\_\_
42. \_\_\_\_\_
43. \_\_\_\_\_
44. \_\_\_\_\_

Identify the instruments and gauges on the instrument panel of your family car or that of a friend and list them below.

- A. \_\_\_\_\_
- B. \_\_\_\_\_
- C. \_\_\_\_\_
- D. \_\_\_\_\_
- E. \_\_\_\_\_
- F. \_\_\_\_\_
- G. \_\_\_\_\_
- H. \_\_\_\_\_
- I. \_\_\_\_\_
- J. \_\_\_\_\_
- K. \_\_\_\_\_
- L. \_\_\_\_\_
- M. \_\_\_\_\_

- N. \_\_\_\_\_
- O. \_\_\_\_\_
- P. \_\_\_\_\_
- Q. \_\_\_\_\_
- R. \_\_\_\_\_
- S. \_\_\_\_\_
- T. \_\_\_\_\_
- U. \_\_\_\_\_
- V. \_\_\_\_\_
- W. \_\_\_\_\_
- X. \_\_\_\_\_
- Y. \_\_\_\_\_
- Z. \_\_\_\_\_

Now draw the instrument panel on the rear side of this sheet and use the image below as a guide to label the instruments and gauges on your drawing.

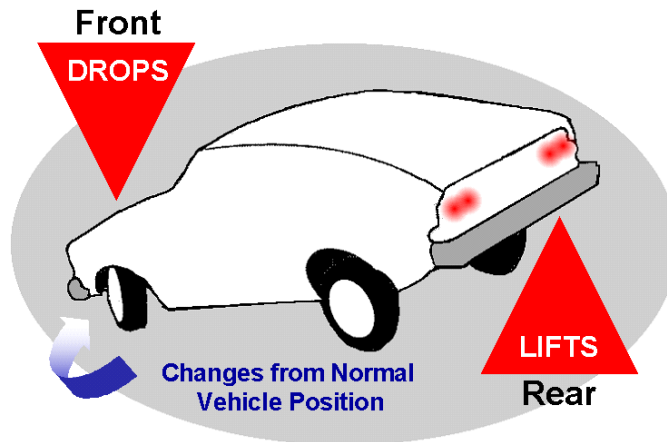


**Use this worksheet to determine whether your family vehicle or that of a friend is equipped with the following safety, communication, comfort, and convenience devices and if so equipped, where the control levers, switches, or buttons are located.**

<b>Equipped</b>	<b>Yes/No</b>	<b>Location of control lever or switch</b>
Tilt steering wheel	_____	_____
Automatic Transmission	_____	_____
Manual Transmission	_____	_____
Parking Brake	_____	_____
Cruise Control	_____	_____
Mirror Controls	_____	_____
Hazard Flasher	_____	_____
Headlights	_____	_____
Instrument Panel Light Switch	_____	_____
Hood Release	_____	_____
Trunk Release	_____	_____
Seat Control Manual	_____	_____
Seat Control Electric	_____	_____
Separate Turn Indicator Lever	_____	_____
Windshield Wiper Switch	_____	_____
Windshield Washer Switch	_____	_____
Air Bag Cut Off Switch	_____	_____
Electric Door Locks	_____	_____
Childproof Rear Door Locks	_____	_____

Complete the following questions during the discussion ABOUT vehicle balance:

1. Define vehicle balance: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
2. If a driver brakes too hard, the vehicle weight shifts to the \_\_\_\_\_.
3. If a driver accelerates too hard, the vehicle weight shifts to the \_\_\_\_\_.
4. If a driver steers too quickly to the right, the vehicle weight shifts to the \_\_\_\_\_.
5. If a driver steers too quickly to the left, the vehicle weight shifts to the \_\_\_\_\_.
6. Explain how seating position may affect the balance of your vehicle: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
7. What is the problem shown by the vehicle below? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



Standard Vehicle Reference Points

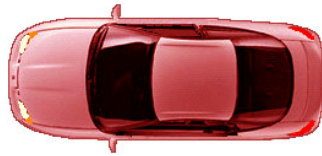
Draw the standard reference points onto the vehicles below as requested:



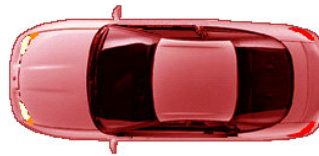
Front Limitation



0-6 inches from the right



2-3 feet from the right



5-8 feet from the right



Draw the standard reference points onto the vehicles below as requested:



Rear Limitation



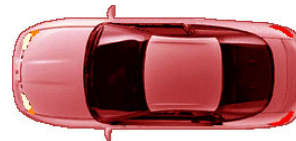
0-6 inches from the left



2-3 feet from the left



5-8 feet from the left



**Simulation Laboratory Session**

**Suggested Titles:** “Standing Out Right” (DORON Video or Laserdisc)  
“Ins and Outs of Turns” (DORON Video or Laserdisc)  
“Controlling Your Vehicle” (SSI Safe Driver Training Series)  
“Turning and Parking Maneuvers” (SSI Safe Driver Training Series)

**Learning Goals:** The student demonstrates comprehension of pre-drive, driver readiness, start, securing, and vehicle positioning in lane which will increase student’s ability to position vehicle for basic vehicle maneuvers.

**Performance:** Performances are based on the simulation video used for this section. It is recommended to start with a session that demonstrates the use of the simulator and establishes the need for procedures and good seating position. Explain the need for holding the wheel at a position that is below the center of the wheel due to airbag displacement. Demonstrate the correct seating and steering positions 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



## Module Assessment MA-2.1

### Module Two Assessment





Select the best answer and place the appropriate letter (A, B, C, D, or E) on the answer sheet provided.

1. What should a driver look for when checking around the outside of a vehicle?
  - A. Broken glass on vehicle.
  - B. Tire condition.
  - C. Fluid leaks.
  - D. Debris on ground.
  - E. All of the above.
2. Where should valuables be stored to avoid potential problems?
  - A. Right front floor board.
  - B. Rear seat.
  - C. Trunk.
  - D. Glove compartment.
  - E. All of the above.
3. When parked at a curb, from which direction should the driver approach the vehicle?
  - A. From the rear.
  - B. From the front.
  - C. From the left side.
  - D. From the right side.
  - E. None of the above.
4. When establishing a seating position, the driver should adjust for \_\_\_\_\_.
  - A. driver foot pedal position
  - B. driver hand position
  - C. driver dead pedal position
  - D. driver visual needs
  - E. all of the above
5. When starting the vehicle, what should be the first task?
  - A. Place foot on brake.
  - B. Place the gear selector in (P)ark or (N)eutral.
  - C. Place the key in the ignition.
  - D. Check or set the parking brake.
  - E. None of the above.
6. When securing the vehicle, what should be the first task?
  - A. Set the parking brake.
  - B. Park in a legal, secure parking space.
  - C. Place the gear selector in (P)ark.
  - D. Turn off any accessories.
  - E. None of the above.
7. When properly seated, the top of the steering wheel should be \_\_\_\_\_.
  - A. no higher than the top of your shoulders
  - B. no higher than your chin
  - C. no higher than your ears
  - D. no higher than the point at which you feel comfortable
  - E. none of the above
8. The purpose of the parking brake is to \_\_\_\_\_.
  - A. stop your vehicle on a slick surface
  - B. stop your vehicle on in an emergency
  - C. hold the vehicle in place when parked
  - D. hold the vehicle only when parked on a hill
  - E. all of the above.
9. Which of the following symbols represents a safety belt reminder or warning?




E. None of these.

10. Which of the following symbols represent windshield defrosters?

- E. A.  B.  C.  D.  None of these.

11. Which of the following symbols represent headlamp beam switch?

- E. A.  B.  C.  D.  None of these.

12. Which of the following symbols represent oil pressure warning?

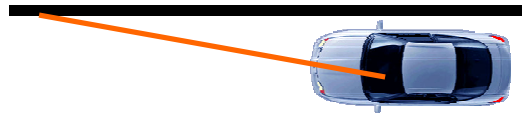
- A.  B.  C.  D.  E. None of these.

13. Pulling or pushing the lights lever will \_\_\_\_\_.

- A. flash brake lights and turn signals
- B. turn on head lights and parking lights
- C. change to or from high to low beam
- D. dim dashboard high intensity
- E. all of these

14. What reference point is illustrated here?

- A. Front alignment.
- B. Rear alignment.
- C. 6 inches from side curb.
- D. Angle parking.
- E. None of these.



15. A vehicle that is in a balanced state \_\_\_\_\_.

- A. has more weight concentrated on the front tire patches while stopping
- B. has more weight concentrated on the rear tire patches while accelerating
- C. has weight concentrated over the four tire patches while stopped
- D. has more weight shifted to the left or right front tire patch while turning
- E. none of the above

16. Weight can be shifted to the front tire patches of the vehicle by \_\_\_\_\_.

- A. covering accelerator
- B. acceleration
- C. releasing the brake
- D. controlled braking
- E. all of the above

17. The oil pressure light comes on when the vehicle is moving on the highway.

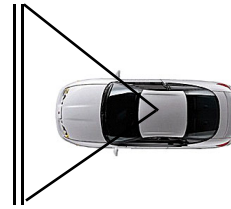
What does it mean?

- A. The oil filter should be changed.
- B. The oil pressure is low.
- C. The oil needs to be changed.
- D. It has defective warning light.
- E. None of the above.

18. Hard brake application together with sharp steering input to the left results in \_\_\_\_\_.

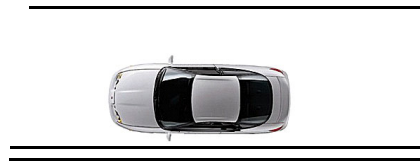
- A. major weight shift to the front tire patches
- B. major weight shift to the left front tire patch
- C. major weight shift to right front tire patch
- D. major weight shift from the right rear tire patch
- E. none of the above

19. What reference point is illustrated here?  
 A. Front alignment.  
 B. Rear alignment.  
 C. 6 inches from side curb.  
 D. Angle parking.  
 E. None of these.

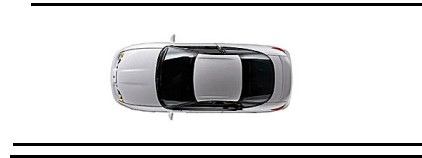


20. Changes in automotive design without appropriate adjustment on the part of drivers that appear to contribute to off road crashes are \_\_\_\_\_.  
 A. seat and steering wheel height  
 B. improved brakes and reduced lock to lock turns in steering  
 C. improved brakes and headlights  
 D. reduced lock to lock turns in steering and improved headlights  
 E. all of the above

21. What lane position is illustrated here?  
 A. Lane position one.  
 B. Lane position two.  
 C. Lane position three.  
 D. Lane position four.  
 E. None of these.

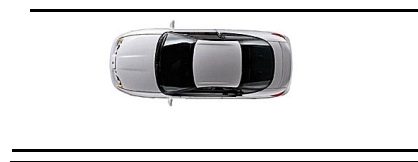


22. What lane position is illustrated here?  
 A. Lane position one.  
 B. Lane position two.  
 C. Lane position three.  
 D. Lane position four.  
 E. None of these.

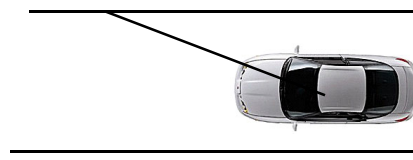


23. Effective targeting allows the driver to \_\_\_\_\_.  
 A. visualize the space they intend to occupy  
 B. begin learning to use a searching process  
 C. look far ahead  
 D. plan ahead  
 E. all of the above

24. What lane position is illustrated here?  
 A. Lane position one.  
 B. Lane position two.  
 C. Lane position three.  
 D. Lane position four.  
 E. None of these.



25. What reference point is illustrated here?  
 A. Front alignment.  
 B. Rear alignment.  
 C. 6 inches from side curb.  
 D. 2-3 feet from right.  
 E. None of these.



## Module 2 Assessment Answer Sheet

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Score: \_\_\_\_\_

- |           |           |
|-----------|-----------|
| 1. _____  | 14. _____ |
| 2. _____  | 15. _____ |
| 3. _____  | 16. _____ |
| 4. _____  | 17. _____ |
| 5. _____  | 18. _____ |
| 6. _____  | 19. _____ |
| 7. _____  | 20. _____ |
| 8. _____  | 21. _____ |
| 9. _____  | 22. _____ |
| 10. _____ | 23. _____ |
| 11. _____ | 24. _____ |
| 12. _____ | 25. _____ |
| 13. _____ |           |

## Module 2 Assessment Answer Key

Name: **ASSESSMENT ANSWER SHEET**

Date: \_\_\_\_\_

Score: **4 POINTS FOR EACH CORRECT ANSWER BELOW**

- |     |   |     |   |
|-----|---|-----|---|
| 1.  | E |     |   |
| 2.  | C | 14. | C |
| 3.  | B | 15. | C |
| 4.  | E | 16. | D |
| 5.  | D | 17. | B |
| 6.  | B | 18. | C |
| 7.  | B | 19. | A |
| 8.  | C | 20. | B |
| 9.  | C | 21. | B |
| 10. | D | 22. | A |
| 11. | B | 23. | E |
| 12. | D | 24. | C |
| 13. | C | 25. | D |