Curriculum Scope and Sequence Modules for Driver Education in Virginia

Module Eight

Driver Responsibilities: Adverse Conditions

- **Visibility in Adverse Conditions**
- **Extreme Weather Conditions**
- **Protecting Occupants**
- **Roadway and Vehicle Technology**
- **Traction Loss Concerns**

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

Table of Contents

Standards of Learning Addressed In This Module

DE.13 The student will identify changes in the environment that affect visibility and traction and demonstrate an understanding of appropriate driver reaction to these risks. Key concepts/skills include
a) driving at night;
b) smoke- and weather-related conditions;
c) road conditions and construction;
d) vehicle stability and traction control systems.

DE.14 The student will demonstrate an understanding of the proper use of vehicle occupant protection features and analyze how they reduce injury severity and increase collision survival. Key concepts/skills include
a) active restraint systems;
b) passive restraint systems;
c) child restraint systems;
d) highway safety design.

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
a) evasive maneuvers, using brake and steering combinations;
b) off-road recovery;
c) front and rear traction control.

Module Eight Introduction

Module Eight—Driver Responsibilities: Adverse Conditions

The student will appraise inclement and extreme weather conditions and predict vehicular and driver limitations; investigate roadway and vehicle technologies; demonstrate proper use of occupant protection devices; and utilize map reading and route planning techniques to avoid adverse driving conditions.

Topic 1—Visibility in Adverse Conditions

The student will recognize driver and vehicular limitations in reduced-visibility driving conditions such as glare, darkness, fog, precipitation, winter weather, or smoke; and evaluate and execute appropriate responses.

Topic 2—Extreme Weather Conditions

The student will describe extreme weather conditions relative to driving, such as flooding, heat, cold, or strong winds, and evaluate and execute appropriate responses.

Topic 3—Protecting Occupants

The student will understand the proper use of seatbelts, airbags, and child restraints.

Topic 4—Roadway and Vehicle Technology

The student will understand and properly use vehicular protection features and roadway technologies that reduce injury severity and increase collision survival.

Topic 5—Traction Loss Concerns

The student will recognize vehicular imbalance and choose appropriate countermeasures to prevent loss of vehicle control.

Minimum Time Frames **Module Eight–2.5 Hours**	
Classroom Instruction	Recommended Minutes
Topic 1 — Visibility in Adverse Conditions	20
Topic 2 — Extreme Weather Conditions	20
Topic 3 — Protecting Occupants	50
Topic 4 — Roadway and Vehicle Technology	20
Topic 5 — Traction Loss Concerns	45
Supplement—Parent Orientation	55
In-Car Instruction (Option 1)	
Behind-the-Wheel Instruction/Break	30
Observation	30
Laboratory Multiphase (Option 2)	
Behind-the-Wheel Instruction/Break	30
Observation	30
Simulation	30
Parental Involvement	60

Module Eight
Topic 1—Visibility in Adverse Conditions

20 Minutes Instructional Time
Prerequisites: Successful Completion of Modules 1 to 7

Instructor Activities	Time Frame
Review Module Eight, Topic 1 Lesson Plans Prior to Lesson	
Show Transparencies	15-20 minutes
T-8.1 "Changing Visibility at Night"	(1-3 minutes)
T-8.2 "Changing Visibility at Night"	(1-3 minutes)
T-8.3 "Headlight Alignment and Speed"	(1-3 minutes)
T-8.4 "Headlight Alignment and Speed"	(1-3 minutes)
T-8.5 "Nighttime Precautionary Measures"	(1-3 minutes)
T-8.6 "Nighttime Precautionary Measures'	(1-3 minutes)
T-8.7 "Visibility Limitations in Fog"	(1-3 minutes)
T-8.8 "Visibility Limitations in Fog"	(1-3 minutes)
T-8.9 "Visibility Limitations in Bad Weather"	(2-5 minutes)
T-8.10 "Precautions in Bad Weather"	(2-5 minutes)
T-8.11 "Precautions in Bad Weather"	(2-5 minutes)
Distribute and Review Student Worksheets	5-10 minutes
W-8.1 "Adverse Conditions"	
Review Module Assessments Prior to Lesson	
MA-8.1 "Module Eight Assessment"	
Additional Resources (Media and/or Text)	
Video: "Night Driving" (AAA)	
Video: "Driving in Bad Weather" (AAA)	
"Drive Right" Ch. 12	
"How to Drive" Ch. 9	
"Handbook Plus" Ch. 13	
"License To Drive" Ch. 14,15	
"Responsible Driving" Ch. 12	

Visibility in Adverse Conditions

Knowledge and Skills

The student is expected to describe visibility problems associated with driving at night.

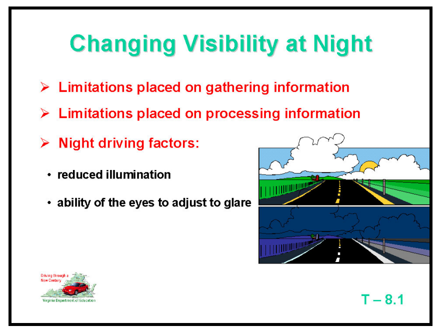
Activities & Resources

Show video "Night Driving" (AAA) to demonstrate some of the visibility problems associated with night driving.

Use Transparency T-8.1 "Changing Visibility at Night" and Worksheet W-8.1 "Adverse Conditions" to discuss the visual problems associated with driving at night and other glare-inducing situations and driver actions that can be taken to lessen the effects.

Limitations
- Gathering information (Searching)
- Processing information (Evaluating)

Factors
- Reduced illumination
- Ability to adjust to glare conditions

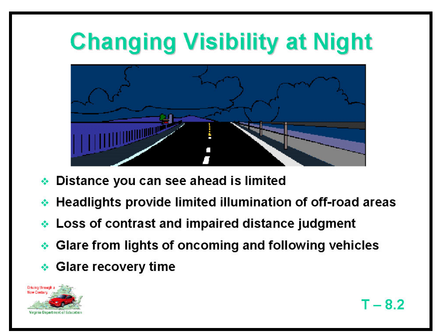


T-8.1
Changing Visibility at Night

Worksheet

Use Transparency T-8.2 "Changing Visibility at Night" and Worksheet W-8.1 "Adverse Conditions" to continue discussing the visual problems associated with driving at night.

- Limited distance ahead
- Limited illumination of headlights
- Loss of contrast and distance judgment
- Glare conditions exist
- Glare recovery time



T-8.2
Changing Visibility at Night

Worksheet

Changing Weather and Conditions of Visibility

Prior to this lesson, information presented and discussed has focused on how to develop an effective search pattern and how to gather information under normal circumstances by determining line of sight and path of travel. This topic will address problems arising from limitations placed on visibility when driving at night and in fog, heavy rain, snow, and smoke. Methods for coping with strong steady or gusting cross winds will also be discussed.

Glare Considerations

- At daybreak and in the late afternoon, the sun's rays shine directly into your windshield, making it very hard to see.

- To avoid being blinded by headlights of oncoming cars, reduce speed and look to the right-hand side of the road; make brief glances ahead to monitor path of travel.

- To avoid being blinded by headlights of following vehicles, use contemporary side mirror settings; adjust your inside mirror to "night" setting; never wear sunglasses at night.

Sources of Glare

- Oncoming and following vehicle headlights
- High beam
- Misaligned headlights
- Vehicle loaded improperly
- Dirty windshield
- Paper on dashboard
- Snow-covered landscape
- Facing the sun at dawn or dusk
- Flashing advertisement signs
- Flood lights on businesses next to roadway
- Traditional versus contemporary side mirror setting

Topic: 1 Lesson: 2

Visibility in Adverse Conditions

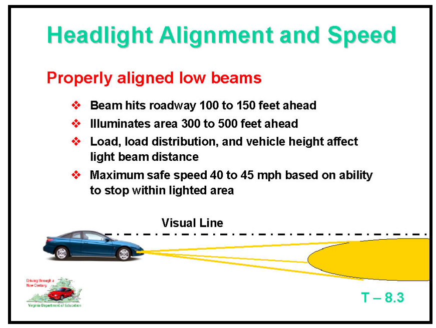
Knowledge and Skills

The student is expected to describe vehicular and driver limitations associated with driving in darkness and glare-induced situations.

Activities & Resources

Use Transparency T-8.3 "Headlight Alignment and Speed" to discuss visual and speed problems associated with driving at night, and properly aligned low beams.

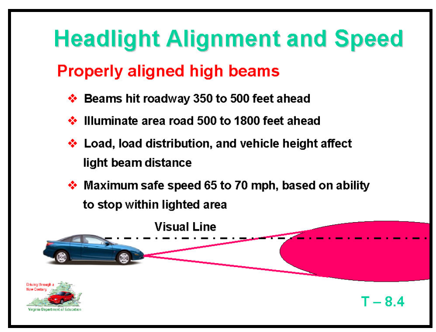
Properly aligned low beams
- Beam distance
- Illumination area
- Load distribution
- Safe speed that allows driver to stop



T-8.3
Headlight Alignment and Speed

Use Transparency T-8.4 "Headlight Alignment and Speed" to discuss visual and speed problems associated with driving at night, and properly aligned high beams.

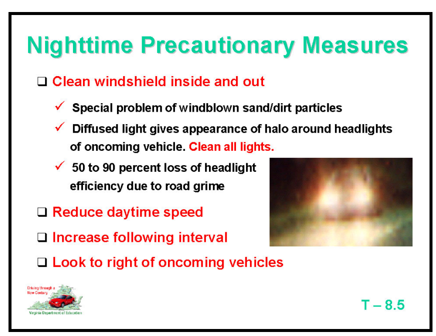
Properly aligned high beams
- Beam distance
- Illuminated area
- Load distribution
- Safe speed that allows driver to stop



T-8.4
Headlight Alignment and Speed

Use Transparency T-8.5 "Nighttime Precautionary Measures" to discuss the methods used to increase visibility at night.

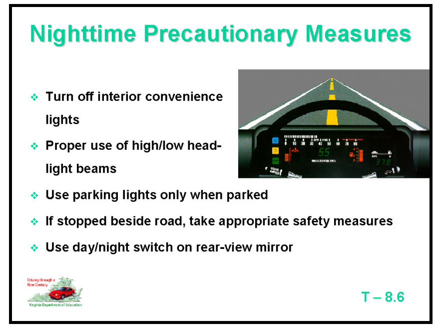
- Clean windshield
- Clean headlight lenses
- Reduce speed
- Increase following interval
- Look to right of oncoming traffic



T-8.5
Nighttime Precautionary Measures

Use Transparency T-8.6 “Nighttime Precautionary Measures” to continue discussing the methods used to increase visibility at night.

- Interior lights off
- Proper high/low beam use
- Use of parking lights
- Safety measures when stopping
- Rear view mirror day/night switch



T-8.6
Nighttime Precautionary Measures

Support Information

Driving at Night
Visibility as presented in this lesson deals with limitations placed on gathering and processing information when driving at night due to factors of reduced illumination and the ability of the eyes to adjust to glare.

Vision
- Limited visibility area ahead
- Illumination of off-road areas with headlights
- Loss of contrast and impaired distance judgment
- Glare from lights of oncoming and following vehicles and glare recovery time.

Headlight Alignment

Properly Aligned Low Beams
- Lights should be adjusted so that they illuminate the roadway 100 to 150 feet ahead, and light the area 300 to 500 feet above road.
- Load, load distribution, and vehicle height affect light beam distance.
- Maximum safe speed is 40 to 45 mph.

Properly Aligned High Beams
- Lights should be adjusted so that they illuminate the roadway 300 to 350 feet ahead, and light the area 500 to 1800 feet above road.
- Load, load distribution, and vehicle height affect light beam distance.
- Maximum safe speed is 55 to 60 mph.

Countermeasures
- Keep all glass, lights and windows clean.
- Do not place paper or other objects on dashboard.
- Adjust sun visors and mirrors.
- Sit as high in the seat as possible.
- Wear sunglasses during the day.
- Adjust speed to visibility conditions.

Visibility in Adverse Conditions

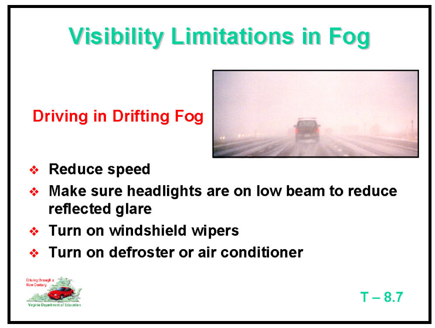
Knowledge and Skills

The student is expected to describe and identify visibility problems associated with driving in bad weather.

Activities & Resources

Use Transparency T-8.7 “Visibility Limitations in Fog” to discuss methods used to drive in drifting fog.

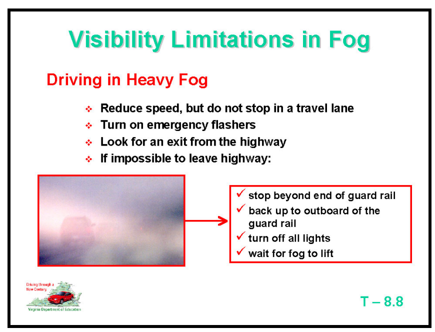
- Reduce speed.
- Use low beams.
- Use wipers.
- Use defroster/defogger if needed.



T-8.7
Visibility Limitations in Fog

Use Transparency T-8.8 “Visibility Limitations in Fog” to discuss methods used to drive in heavy fog.

- Reduce speed.
- Flashers may be needed.
- Look for exit or safe area off road.
- Stop beyond end of a guardrail for protection from rear collision if unable to leave highway.



T-8.8
Visibility Limitations in Fog

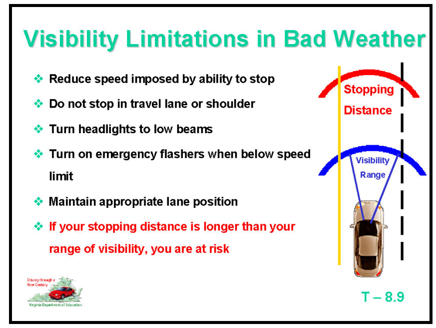
Show video “Driving in Bad Weather” (AAA) as a lead in to the next topic. Ask the students to look for problems and solutions associated with driving in the adverse conditions associated with bad weather.

Continue using Worksheet W-8.1 “Adverse Conditions” during class discussions as a study guide.

Worksheet

Show Transparency T-8.9 “Visibility Limitations in Bad Weather” to discuss problems and solutions to driving in fog, smoke, rain, or snow. Have students use Worksheet W-8.1 “Adverse Conditions” to record the solutions as reviewed.

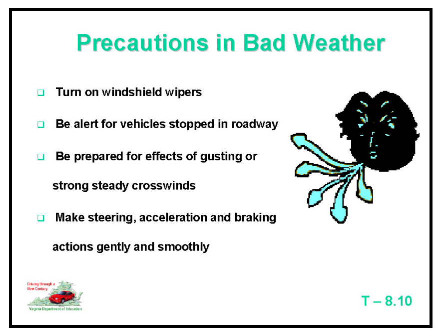
- Reduce speed.
- Do not stop in travel lane.
- Use low beams.
- Use flashers when driving below speed limit.
- Maintain lane position.



T-8.9 Visibility Limitations in Bad Weather

Show Transparency T-8.10 “Precautions in Bad Weather” to continue discussing problems and solutions when driving in fog, smoke, rain, or snow.

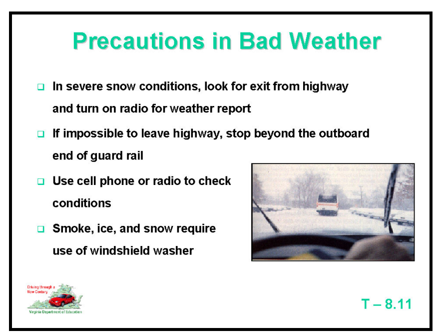
- Use wipers.
- Be alert for stopped vehicles.
- Be aware of crosswinds.
- Ensure smooth vehicle operation.



T-8.10
Precautions in Bad Weather

Show Transparency T-8.11 “Precautions in Bad Weather” to discuss problems and solutions for driving in winter weather.

- In snow, exit and listen for weather warnings.
- Stopping behind guardrail is critical if unable to exit highway.
- Use low beams.
- Use cell phone/radio to determine location of problem areas.
- Use windshield washer.



T-8.11
Precautions in Bad Weather

Visibility Limited by Fog, Smoke, Rain, or Snow
Visibility, as presented in this lesson, deals with atmospheric conditions beyond control of the vehicle operator. While all of these conditions limit visibility, an additional problem associated with smoke, rain, and snow is that of gusting or continuous high winds. In contrast, fog appears to settle over the roadway in a virtual blanket. *The strongest recommendation is not to knowingly drive into any of the conditions listed above.*

Fog
Persons involved in multi-vehicle crashes in fog often state that they had driven through patches of light, drifting fog in the area, but nothing serious, and had continued to travel at the prevailing speed. Suddenly it was impossible to see—and they braked hard, only to run into a vehicle stopped in the road ahead or to be rear-ended. The correct response would have been to reduce speed as soon as they were aware of drifting fog.

Driving in Fog
- Reduce speed.
- Make sure headlights are on low beam to reduce reflected glare.
- Turn on windshield wipers.
- Turn on defroster or air conditioner.

Heavy Fog
- Further reduce speed but do not stop in a travel lane.
- Turn on emergency flashers.
- Look for an exit from the highway.
- If impossible to leave highway, stop beyond end of guardrail, back up to the outboard of the guardrail and turn off all lights and wait for fog to lift.

Heavy Smoke, Rain or Snow
In an instant, the following situations can occur:
- Smoke is evident ahead. Suddenly smoke and ashes from a large brush fire cover the road making it very difficult to see.
- It's sprinkling. A few moments later rain is falling in a solid sheet, slashing across the road.
- Snow is falling in large lazy flakes. Two miles down the road, it becomes a whiteout.

Precautionary measures should be taken as soon as any of the initial conditions become evident. In most instances brush fires will be restricted to a limited area and torrential rains are of short duration. The snowstorm-induced whiteout could cover a much greater area. In all three situations,
- continue to reduce speed to limits imposed by visibility, but do not stop in travel lane or on shoulder near road*.
- turn headlights to low beam.
- turn on emergency flashers.
- maintain lane position 1.
- turn on windshield wipers.**
- be alert for vehicles stopped in roadway.
- be prepared for effects of gusting or strong steady crosswinds.
- make steering, acceleration, and braking actions gently and smoothly.

* For snow condition look for exit from highway and turn on radio for weather report. If impossible to leave highway, stop beyond end outboard of guardrail. If available, use a cell phone to check road conditions.
** Snow and smoke may require use of windshield washer.

Module Eight
Topic 2—Extreme Weather Conditions

20 Minutes Instructional Time
Prerequisites: Successful Completion of Modules 1 to 7

Instructor Activities	Time Frame
Review Module Eight, Topic 2 Lesson Plans Prior to Lesson	
Show Transparencies	15-20 minutes
T-8.12 "Low Water Crossings"	(2-3 minutes)
T-8.13 "Low Water Crossings"	(2-3 minutes)
T-8.14 "Low Water Crossings"	(2-3 minutes)
T-8.15 "Hot and Cold Temperatures"	(2-3 minutes)
T-8.16 "Cold Weather Precautions"	(3-4 minutes)
T-8.17 "Cold Weather Checks"	(3-4 minutes)
T-8.18 "Hot Weather Checks"	(3-4 Minutes)
Distribute and Review Student Worksheets	5-10 minutes
W-8.2 "Low Water Crossings"	
Review Module Assessments Prior to Lesson	
MA-8.1 "Driving in Adverse Conditions"	
Additional Resources (Media and/or Text)	
Video: "Driving in Bad Weather" (AAA—(800) 305-7233)	
"Drive Right" Ch. 12	
"How to Drive" Ch. 9	
"Handbook Plus" Ch. 13	
"License To Drive" Ch. 14,15	
"Responsible Driving" Ch. 12	

Knowledge and Skills

The student is expected to describe and understand types of floods and safety precautions for approaching flooded roadways.

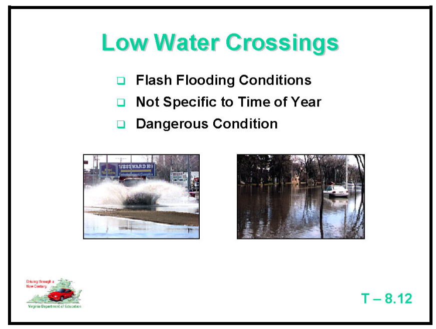
Activities & Resources

Review low water crossing concepts using Worksheet W-8.2 “Low Water Crossings” for information related to this special intersection situation.

Worksheet

Show Transparency T-8.12 “Low Water Crossings” to introduce safety concepts for approaching a low water crossing.

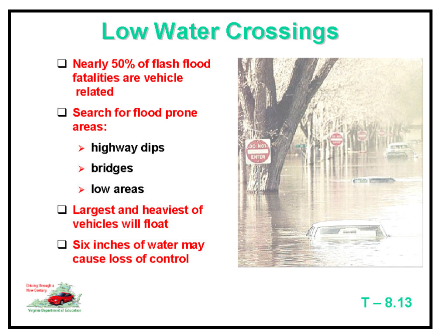
- Flash flooding conditions
- Not specific to time of year
- Dangerous condition for drivers and vehicles



T-8.12 Low Water Crossings

Show Transparency T-8.13 “Low Water Crossings” to review safety concepts for approaching a low water crossing.

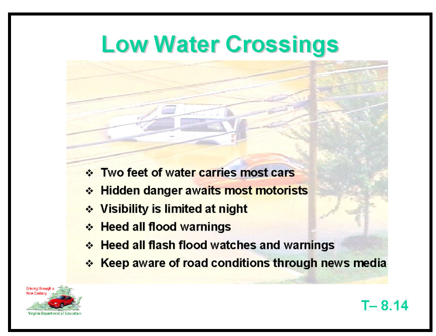
- 50% of flash flood fatalities are vehicle-related.
- Search for flood prone areas.
- All vehicles can float.
- Six inches of water can cause loss of control.



T-8.13 Low Water Crossings

Show Transparency, T-8.14 “Low Water Crossings” to review safety concepts for approaching a low water crossing.

- Two feet of water carries a car.
- Hidden dangers exist when visibility is limited.
- Listen to flood watches and warnings.
- Stay aware of road conditions.



T-8.14
Low Water Crossings

Low Water Crossings

- Nearly half of all flash flood fatalities are vehicle related. In severe rainstorms, keep a look out for flooding at highway dips, bridges, and low areas.
- Even the largest and heaviest of vehicles will float. As little as six inches of water may cause you to lose control of your vehicle. Two feet of water will carry most cars away. Do not drive through flowing water.
- A hidden danger awaits most motorists where a road without a bridge dips across a creek bed. Motorists develop false confidence when they normally or frequently pass through dry low-water crossings.
- Roadbeds may have been scoured or even washed away during flooding, creating unsafe driving condition. People who repeatedly drive through flooded low-water crossings often do not recognize the dangers of a small increase in the water level.
- Driving too fast through low water will cause the vehicle to hydroplane and lose contact with the road surface. Driving at night, when visibility is limited, increases the vulnerability of the driver to any hidden dangers.
- Heed all flood and flash flood watches and warnings. Keep abreast of road conditions through the news media.

How Do Flash Floods Occur?

Several factors contribute to flash flooding. The two key elements are rainfall intensity and duration. Intensity is the rate of rainfall, and duration is how long the rain lasts. Topography, soil conditions, and ground cover also play an important role. Flash floods occur within a few minutes or hours of excessive rainfall, a dam or levee failure, or a sudden release of water held by an ice jam. Flash floods can roll boulders, tear out trees, destroy buildings and bridges, and scour out new channels. Rapidly rising water can reach heights of 30 feet or more. Furthermore, flash flood-producing rains can also trigger catastrophic mudslides. You will not always have a warning that these deadly, sudden floods are coming.

Most flash flooding is caused by slow-moving thunderstorms, thunderstorms repeatedly moving over the same area, or heavy rains from hurricanes and tropical storms. Occasionally, floating debris or ice can accumulate at a natural or man-made obstruction and restrict the flow of water. This can cause flooding upstream. Subsequent flash flooding can occur downstream if the obstruction should suddenly release.

Types of Floods

River Flood—Flooding along rivers is a natural and inevitable part of life. Some floods occur seasonally when winter or spring rains, coupled with melting snows, fill river basins with too much water too quickly. Torrential rains from decaying hurricanes or tropical systems can also produce river flooding.

Coastal Flood—Winds generated from tropical storms and hurricanes or intense offshore low pressure systems can drive ocean water inland and cause significant flooding. Escape routes can be cut off and blocked by high water. Coastal flooding can also be produced by sea waves called tsunamis, sometimes referred to as tidal waves. These waves are produced by earthquakes or volcanic activity.

Note: Coastal flooding caused by the storm surge associated with hurricanes is described in publication NOAA/PA 78019, “Storm Surge and Hurricane Safety.”

Urban Flood—As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Urbanization increases runoff 2 to 6 times over what would occur on natural terrain. During periods of urban flooding, streets can become swift moving rivers, while basements can become death traps as they fill with water.

Flash Flooding In Arroyos/Washes—An arroyo is a water-carved gully or normally dry creek bed. Arroyos can fill with fast-moving water very quickly. Flash flooding at an arroyo in Arizona took only 58 seconds to develop.

Ice Jam—Floating ice can accumulate at a natural or manmade obstruction and stop the flow of water.

Facts About Water

- Water weighs 62.4 lbs. per cubic foot and typically flows downstream at 6 to 12 miles an hour.
- When a vehicle stalls in water, the water's momentum is transferred to the car. For each foot the water rises, 500 lbs. of lateral force is applied to the car.
- But the biggest factor is buoyancy. For each foot the water rises up the side of the car, the car displaces 1,500 lbs. of water. In effect, the car weighs 1,500 lbs. less for each foot the water rises.
- Two feet of water will carry away most automobiles.

What YOU Can Do

Know your flood risk and elevation above flood stage. Do your local streams or rivers flood easily? If so, be prepared to move to a place of safety. Know your evacuation routes. Keep your automobile fueled; if electric power is cut off, gas stations may not be able to operate pumps for several days. Store drinking water in clean bathtubs and in various containers; water service may be interrupted. Keep a stock of food that requires little cooking and no refrigeration; electric power may be interrupted. Keep first aid supplies on hand. Keep a NOAA Weather Radio, a battery-powered portable radio, emergency cooking equipment, and flashlights in working order. Install check valves in building sewer traps to prevent flood water from backing up into the drains of your home.

[Video available; Hidden Danger, ($3.50). National Weather Service, 301-713-0006]

Notes

Extreme Weather Conditions

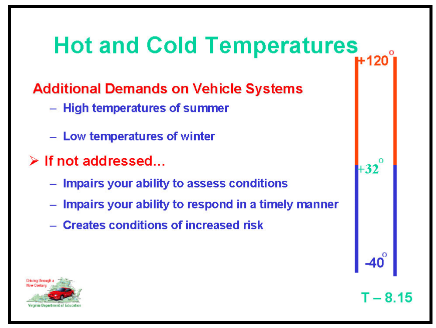
Knowledge and Skills

The student is expected to describe vehicular and driver limitations associated with flooding, heat, cold, and strong winds.

Activities & Resources

Show Transparency T-8.15 "Hot and Cold Temperatures" to discuss driving in very hot or very cold conditions.

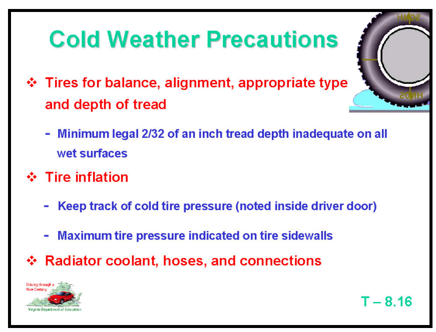
- Demand on systems
- Potential problems



T-8.15
Hot and Cold Temperatures

Show Transparency T-8.16 "Cold Weather Precautions" to continue discussing driving in very hot or very cold conditions.

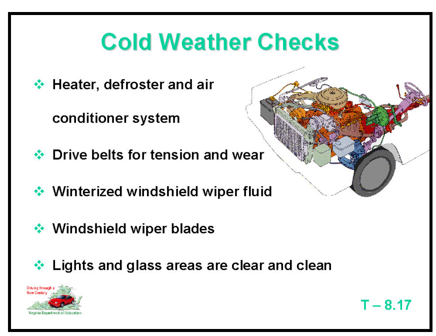
- Demand on tires
- Inflation critical
- Radiator coolant and hoses



T-8.16
Cold Weather Precautions

Show Transparency T-8.17 "Cold Weather Checks" to discuss driving in cold conditions.

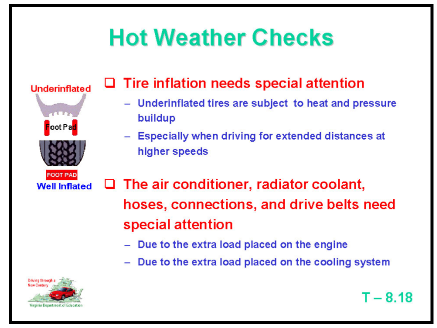
- HVAC systems
- Drive belts
- Wiper blades and fluids
- Clean lights and glass areas



T-8.17
Cold Weather Checks

Show Transparency T-8.18 “Hot Weather Checks” to discuss driving in hot weather conditions.

- Tire inflation needs
- HVAC systems
- Drive belts



T-8.18
Hot Weather Checks

Finish this topic area with a class discussion regarding how to manage a vehicle buffeted by strong gusts of wind.

Support Information

Extreme Temperatures
Extreme temperatures place demands on the vehicle that could increase risk.

Unusually Strong Wind Conditions
Strong winds create a problem called buffeting. This condition occurs on bridges such as the Chesapeake Bay Bridge, through mountain passes and ravines, and when being passed by large trucks. These wind gusts and blasts can cause total loss of vehicle control.

When driving on a highway with steady strong crosswinds, a driver should be alert to prevailing wind direction and velocity, the terrain through which they are passing, and condition of the road surface. Driving out of a wooded area, from behind a long ridge, or from under an overpass on an ice packed road and being struck by a strong wind gust can easily cause a vehicle to move one lane to the left or right or spin completely out of control. (Dealing with conditions of reduced traction will be addressed in another session.)

How To Respond
- Reduce speed.
- Check for oncoming and following traffic.
- Time exposure to wind when clear of traffic.
- Adjust position leeward to lane position 2 or 3.
- Just prior to exposure to wind, steer windward toward lane position 3 or 2.
- Be prepared to countersteer.
- Stay off brake.

Notes

Module Eight
Topic 3—Protecting Occupants

50 Minutes Instructional Time
Prerequisites: Successful Completion of Modules 1 to 7

Instructor Activities	Time Frame
Review Module Eight, Topic 3 Lesson Plans Prior to Lesson	
Show Transparencies	45-50 minutes
T-8.19 "Safety Restraints for Adults"	(4-6 minutes)
T-8.20 "Safety Restraints for Adults"	(4-6 minutes)
T-8.21 "Safety Restraints for Adults"	(4-6 minutes)
T-8.22 "Safety Restraints for Adults"	(4-6 minutes)
T-8.23 "Safety Restraints for Adults"	(4-6 minutes)
T-8.24 "Safety Restraints for Youth"	(4-6 minutes)
T-8.25 "Occupant Protection"	(4-6 minutes)
T-8.26 "Restraints Protect"	(4-6 minutes)
T-8.27 "Movement of Belted Occupant"	(4-6 minutes)
T-8.28 "Types of Belt-Locking Systems"	(4-6 minutes)
T-8.29 "Adjusting Belts for Proper Fit"	(4-6 minutes)
Distribute and Review Student Worksheets	5-10 minutes
W-8.3 "Occupant Protection"	
Review Module Assessments Prior to Lesson	
MA-8.1 "Module Eight Assessment"	
Additional Resources (Media and/or Text)	
Video: "Reducing Your Risks in the Crash" (AAA)	
"Drive Right" Ch. 5	
"How to Drive" Ch. 3	
"Handbook Plus" Ch. 11	
"License To Drive" Ch. 16	
"Responsible Driving" Ch. 7, 14	

Topic: 3 Lesson: 1

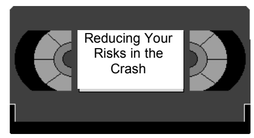
Protecting Occupants

Knowledge and Skills

The student is expected to demonstrate proper usage of adult and youth occupant protection devices.

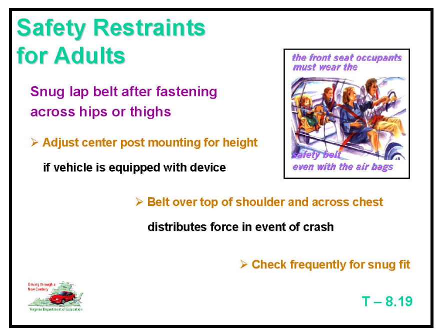
Activities & Resources

Show the video “Reducing Your Risks In the Crash” (AAA) as an introduction to the need for occupant protection.



Use Transparency T-8.19 “Safety Restraints for Adults” to discuss of the proper use of occupant protection devices.

- Adjusting lap belt
- Adjusting shoulder belt
- Importance of a snug fit



T-8.19
Safety Restraints for Adults

Use Transparency T-8.20 “Safety Restraints for Adults” to continue discussing proper use of occupant protection devices.

- Seat back adjustment
- Occupant movement
- Locking devices

T-8.20
Safety Restraints for Adults

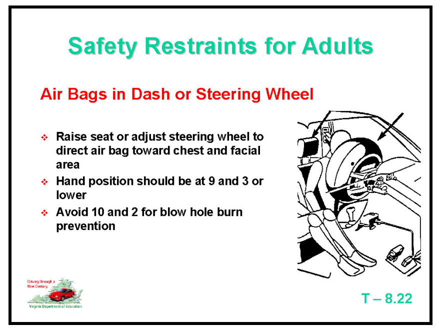
Use Transparency T-8.21 “Safety Restraints for Adults” to discuss the proper use and precautions necessary when using occupant protection devices.

- Air bags and young passengers
- Protection device
- Speed of inflation and 10-inch clearance

T-8.21
Safety Restraints for Adults

Use Transparency T-8.22 “Safety Restraints for Adults” to further discuss the proper use and precautions necessary when using occupant protection devices. Students will complete Worksheet W-8.3 “Occupant Protection.”

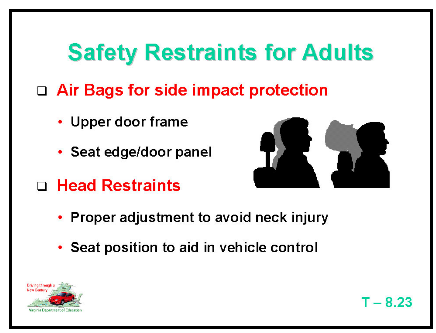
- Adjusting steering wheel
- Hand position
- Avoiding hot gas blow hole



T-8.22
Safety Restraints for Adults

Use Transparency T-8.23 “Safety Restraints for Adults” to continue discussing the proper use and precautions necessary when using occupant protection devices.

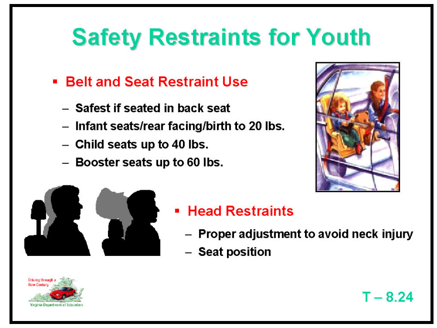
- Airbag side impact protection
- Seating young persons
- Adjusting head restraints



T-8.23
Safety Restraints for Adults

Use T-8.24 “Safety Restraints for Youth” to discuss the proper use and precautions necessary when using occupant protection devices.

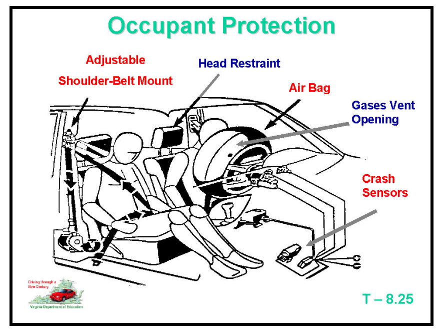
- Seats
- Belts
- Restraints



T-8.24
Safety Restraints for Youth

Use T-8.25 “Occupant Protection” to discuss the proper use and precautions necessary when using occupant protection devices.

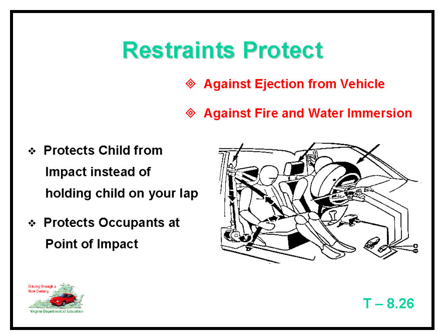
- Shoulder restraint devices
- Air bag components
- Air bag hot gas vent hole locations



T-8.25
Occupant Protection

Use T-8.26 “Restraints Protect” to discuss the proper use and precautions necessary when using occupant protection devices.

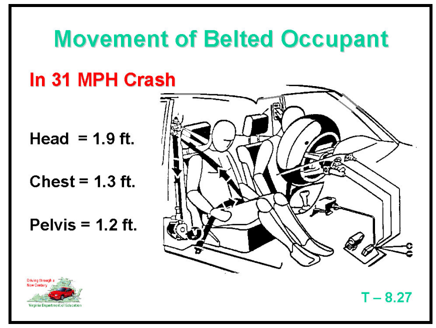
- Ejection
- Fire and water immersion
- Impact protection



T-8.26
Restraints Protect

Use T-8.27 "Movement of Belted Occupant" to discuss crash protection when using occupant protection devices.

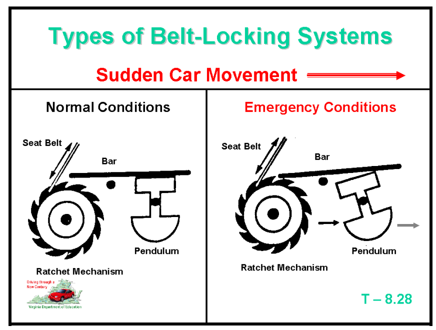
- Head
- Chest
- Pelvis



T-8.27
Movement of Belted Occupant

Use T-8.28 "Type of Belt-Locking Systems" to discuss seat belt mechanics.

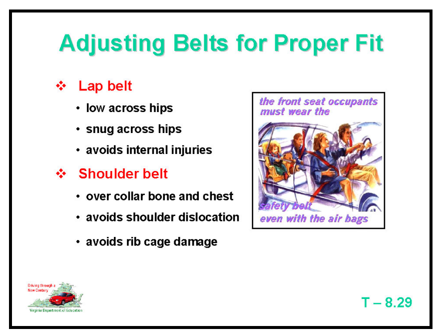
- Normal position allows movement.
- Lock position restrains occupant.



T-8.28
Type of Belt-Locking Systems

Use T-8.29 "Adjusting Belts to Proper Fit" to review the proper use and precautions necessary when using occupant protection devices.

- Lap belt position
- Shoulder belt position



T-8.29
Adjusting Belts for Proper Fit

Students will complete Worksheet W-8.3 "Occupant Protection" during this section.

Worksheet

Protecting Occupants

For most people, the term "occupant protection" refers to safety belts, child restraints, and driver/passenger side air bags. In the context of this lesson, the term "occupant protection" is much more inclusive, incorporating technological advances in vehicle integrity in the event of a crash, and vehicle response capability. Advances in roadway and off-road design, and the re-engineering of crash barriers to meet changes in motor vehicle weight and size have added substantially to crash survival.

Adults—Safety Belt

- Lap belt should be snug after fastening across hips or thighs.
- Adjust center post mounting for height if vehicle is equipped.
- Put belt over top of shoulder and across chest to distribute force in event of crash—check frequently for snug fit.

Adults

- Keep seat back in upright position to avoid submarining in frontal crash.
- Discuss movement of belted occupant in 31 mph crash.
- Explain types of locking devices.

Air Bags/Dash and Steering Wheel

- No passenger under 12 years of age should ride in front seat.
- Protect occupants against head and chest injuries.
- Airbags inflate at speeds of up to 200 mph.
- Driver should adjust seat for minimum 10 inch clearance between chest and steering wheel.
- Raise seat (no power seat - use wedge-shaped cushion), adjust steering wheel downward if possible to direct air bag at chest instead of face.

Location of Side Impact Protection Airbags

- Side impact protection airbags are located in the upper door frame and near the seat edge/door panel.
- Never lean against the door—maintain a 10-inch distance from bag.

Children and Youth

- Children are safest if seated in the rear seat.
- Use infant seat for children under 20 lbs.
- Face infant seat to rear in rear seat.
- Child seat is required for children up to 40 lbs.
- Booster seat required up to 60 lbs.

Head Restraints

- Use infant seat for children under 20 lbs.
- Face infant seat to rear in rear seat.
- Child seats required to 40 lbs.

Occupant Protection

- System Parts
- Passive Devices
- Active Devices

All crashes have two separate collisions. The first is the vehicle collision, and the second is the collision of occupants inside the vehicle. It is this second collision that often causes injury and death.

Module Eight
Topic 4—Roadway and Vehicle Technology

20 Minutes Instructional Time
Prerequisites: Successful Completion of Modules 1 to 4

Instructor Activities	Time Frame
Review Module Eight, Topic 4 Lesson Plans Prior to Lesson	
Show Transparencies	15-20 minutes
T-8.30 "Highway Safety Design Features”	(2-3 minutes)
T-8.31 "Highway Safety Design Features”	(2-3 minutes)
T-8.32 "Highway Safety Design Features”	(2-3 minutes)
T-8.33 "Automotive Technology”	(2-4 minutes)
T-8.34 "Controlling Consequences”	(4-6 minutes)
Distribute and Review Student Worksheets W-8.4 "Highway Design Features”	5-10 minutes
Review Module Assessments Prior to Lesson MA-8.1 "Module Eight Assessment”	
Additional Resources (Media and/or Text) Video: "Making Safer Roads” (Insurance Institute for Highway Safety — http://www.hwysafety.org/video_orders.htm). Video: “New Vehicle Technology” (National Safety Council (800) 621-7619) Video: “Stomp, Stay, Steer” Video: “ESP” Stomp, Stay, Steer and ESP are both available at no charge from Continental TEVES, (800) 694-5200. “Drive Right” Ch. 13 “How to Drive” Ch. 1 “Handbook Plus” Ch. 9,13 “License To Drive” Ch. 6 “Responsible Driving” Ch. 11	

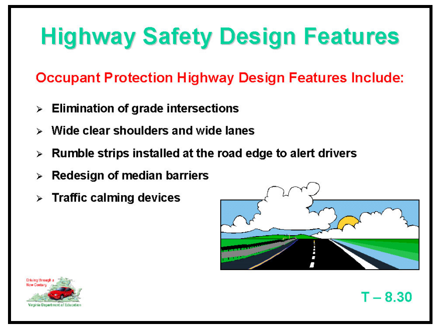
Knowledge and Skills

The student is expected to describe the safety features built into highway design, and how they reduce the consequences of a crash.

Activities & Resources

Use Transparency T-8.30 “Highway Safety Design Features” to discuss the features incorporated into highway design to enhance occupant safety.

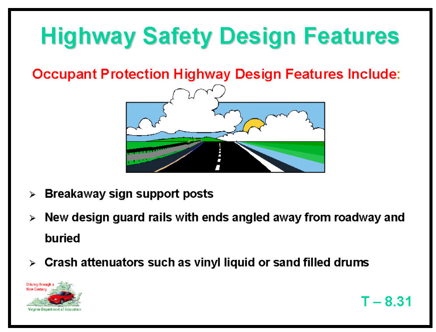
- Intersections
- Shoulders
- Rumble strips
- Median
- Calming devices



T-8.30
Highway Safety Design Features

Use Transparency T-8.31 “Highway Safety Design Features” to discuss the features incorporated into highway design to enhance occupant safety.

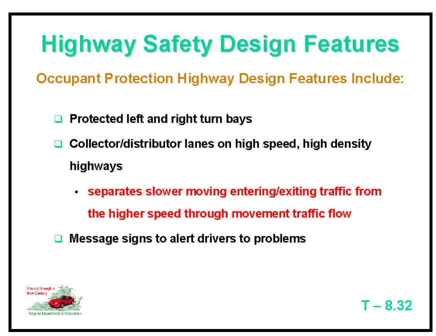
- Sign supports
- Guard rails
- Crash attenuators



T-8.31
Highway Safety Design Features

Use Transparency T-8.32 “Highway Safety Design Features” to continue discussing the features incorporated into highway design to enhance occupant safety.

- Turn bay lanes
- Special lanes for travel
- Message signs



T-8.32
Highway Safety Design Features

Students will complete Worksheet W-8.3 “Occupant Protection” during this section.

Worksheet

Use video “Making Safer Roads” (Insurance Institute for Highway Safety) to illustrate the newer safety features being designed into roadways today and in the future.

Support Information

Highway Design Features

- Wide, clearly-marked lanes and clear highway shoulders
- Rumble strips
- New design median barriers
- Break away sign support posts
- New design guard rails
- Crash attenuators
- Protected left and right turn bays

See the Virginia’s Smart Road Project at the Virginia Department of Transportation’s website:

http://www.vdot.state.va.us/proj/smart_over.html

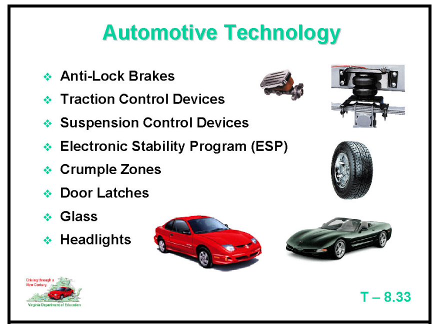
Knowledge and Skills

The student is expected to describe the safety features built into vehicle design, and how they reduce the consequences of a crash.

Activities & Resources

Use Transparency T-8.33 “Automotive Technology” to discuss of the technological advances in automotive design and construction and their contribution to occupant safety.

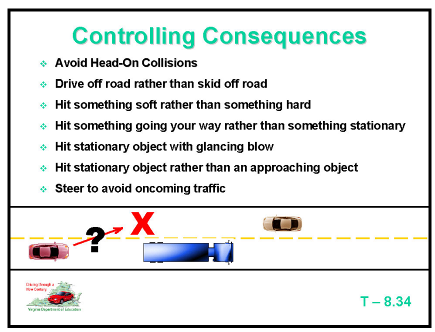
- Anti-lock brakes
- Traction control devices
- Suspension control devices
- Electronic stability/active handling systems
- Crumple zones
- Door latches
- Glass
- Headlights



T-8.33
Automotive Technology

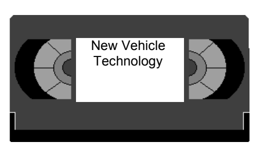
Use Transparencies T-8.34 “Controlling Consequences” to discuss how the driver can avoid consequences by using advances in automotive design and construction to contribute to occupant safety.

- Avoiding collisions
- Reducing consequences



T-8.34
Controlling Consequences

Show video “New Vehicle Technology” (National Safety Council) to illustrate the newer safety features being designed into vehicles today and in the future.



Types of Collisions

Head-On Collisions
The possibility of serious injury and death is more likely with a front-impact crash. Head-on collisions are more likely to occur on 2-lane highways, in narrow lanes, and in construction zones.

Rear-End Collisions
Rear-end collisions are one of the most common types of multiple vehicle collisions. Tailgaters are especially at risk.

Side-Impact Collisions
Despite recent safety advances in side protection such as reinforced steel beams in doors and side-mounted airbags, most vehicles are less well-equipped to withstand a side impact than they are a head-on impact. If you are at risk of colliding with the side of another vehicle, honk your horn and flash your lights to warn the other driver. Swerve right rather than left when there is no time to look first.

If your car is about to be hit, your best option is to accelerate rather than brake if the way is clear. Accelerating will get you past the danger more quickly. Braking may actually contribute to a side-impact collision, especially if the other driver has judged that your speed is sufficient to avoid a crash. If the way ahead is not clear, another alternative is to turn in the direction that the other vehicle is moving to force the impact behind you to the rear of your vehicle. If you turn in the direction of the approaching car, you risk colliding head-on with it.

Technology for Protection

New vehicle technology aids the driver in maintaining balance control when performing avoidance maneuvers and increased protection should a crash occur. Enhanced control is provided through technologies such as the following:

Anti-lock brake systems which are designed to allow steering and simultaneous braking without losing vehicle balance. Anti-lock brakes do not necessarily shorten stopping distance on dry pavement, but generally shorten stopping distances on wet surfaces where traction loss can be a serious problem.

Traction control systems are designed to activate brake sensors, which do not allow the wheels to spin. The process is basically the reverse of anti-lock brakes. The device allows acceleration input without loss of vehicle balance.

Suspension control systems adjust vehicle balance at struts or shock absorbers through adjustment of fluid or air pressure when too much weight is suddenly transferred to a given shock or strut.

Electronic Stability Program (ESP) compares where a driver is steering the vehicle with where the vehicle is actually going. When ESP senses a disparity between the two, it selectively applies any one of the vehicle's brakes to reduce the discrepancy and help the driver retain control and stability.

In Case of Oversteering
When ESP detects oversteer, it applies the outside front brake.

In Case of Understeering
When ESP detects understeer, it applies the inside rear brake to help the vehicle rotate faster.

Controlling Consequences

- Avoid head-on collisions.
- Drive off road rather than skid off road.
- Hit something soft before something hard.
- Hit something going your way rather than something stationary.
- Hit stationary object with glancing blow.
- Hit stationary object rather than an approaching object.
- Steer to avoid oncoming traffic.

Stability Enhancement System

Definitions

There are many automotive stability enhancement systems on the market today, with more arriving almost daily. These systems each have an acronym unique to their design, performance, or marketing features. Some of these names and acronyms are trade names of the system or vehicle manufacturers.

Currently Known Acronyms

Antilock Braking Systems

ABS
(*Anti-lock Braking System*)
RWAL
(*Rear Wheel Anti-lock*)
SCS
(*Stop Control System*)

Traction Control Systems

ASC
(*Automatic Stability Control*)
ASR
(*Automatic Stability Regulation*)
Brake Only Traction

ETS (*Enhanced Traction System)*
TCS (*Traction Control System*)

TCB (*Traction with Brake Int.)*
TRAC
EDS

Active Yaw Control Systems

Active Brake

Active Handling

Active Safety

Advance Trac
ASMS
(*Automotive Stability Management System*)
ATTS
CBC (*Cornering Brake Control*)
DSC (*Dynamic Stability Control*)
DTSC
(*Dynamic Stability and Traction Con trol*)
ESBS
ESP (*Electronic Stability Program*)
ICCS (*Integrated Chassis Control System*)
IVD (*Integrated Vehicle Dynamics*)
PCS (*Precision Control System*)
PSM
SCS (*Stability Control System*)
StabiliTrac
Traxxar
VDC (*Vehicle Dynamics Control*)
VSA (*Vehicle Stability Assist*)
VSC (*Vehicle Stability Control*)
YCS (*Yaw Control Stability*)

System Descriptions
In this section, the minimum criteria of each system are listed. In addition, a brief description of atypical implementation and the advantages of each system are provided. This description is not intended to limit innovations such as development of alternate sensors, etc., but represents the current state of the art systems. In addition, it should be noted that performance of the systems might vary somewhat from manufacturer to manufacturer and from vehicle to vehicle as the systems are calibrated to satisfy the needs of a specific vehicle and target the customer.

Anti-Lock Braking Systems (ABS)
A system is identified as an Antilock Braking System if it
- is computer controlled.
- has a means to determine if any wheel is about to lock.
- has the capability of regulating the brake torque at the wheels to limit wheel lock.
- controls the brake torque to each of the front wheels independently and the rear wheels either independently, or as a pair.

ABS systems monitor the vehicle wheel speeds and regulate the brake forces to control the slip between the tire and the road surface. By avoiding wheel lock, vehicle stability is improved and the driver retains the ability to steer the vehicle. On most surfaces, the stopping distance of a vehicle with ABS is improved when compared to the same vehicle without ABS. Whether the rear wheels are controlled individually or as a pair depends on the specific characteristics of the vehicle including load distribution and inherent vehicle stability, and the target market for the vehicle.

Rear Wheel Anti-Lock (RWAL)
A system is defined as a Rear Wheel Anti-lock System if it
- is computer controlled.
- has a means to determine if a rear wheel of the vehicle is about to lock.
- has the capability of regulating the brake torque at the rear wheels to limit wheel lock.

RWAL systems monitor the vehicle’s wheel speeds and limit the rear wheel brake torques to limit rear wheel lock-up. By avoiding rear wheel lock-up, the vehicle stability is improved. This system does not control the vehicle’s front wheels and does not provide steering or stopping distance improvement.

Engine and Brake Traction Control Systems (EBTCS)
A system is defined as an Engine and Brake Traction Control System if it
- is computer controlled.
- has a means to determine if a drive wheel is spinning.
- has the capability of applying brake force individually to the drive wheels to limit wheel spin.
- has the capability of controlling engine torque to reduce the brake torque needed to limit wheel spin.

Traction Control Systems monitor the wheel speeds and apply brake torques and/or control engine torque to the drive wheels as necessary to control spinning during acceleration. By controlling wheel spin, the vehicle stability, steerabililty and acceleration are improved. Also, since the brakes can be applied to the drive wheels individually, engine torque can be transferred through the differential from one wheel to another. This can improve vehicle mobility and acceleration on surfaces that have non-uniform frictions (such as a condition where one drive wheel is on a slippery surface and another is on a higher-friction surface). The capability for controlling engine torque allows the system to minimize use of the brakes by reducing engine torque.

Brake Traction Control System (BTCS)
A system is defined as a Brake Traction Control System if it
- is computer controlled.
- has a means to determine if a drive wheel is spinning.
- has the capability of applying brake force individually to the drive wheels to limit spinning.

Brake Traction Control Systems monitor the wheel speeds and apply brake torque to the drive wheels as necessary to control spinning during acceleration. By controlling wheel spin, the vehicle stability, steerabilitly, and acceleration are improved. Also since the brakes can be applied to the drive wheels individually, engine torque can be transferred through the differential from one wheel to another. This can improve vehicle mobility and acceleration on surfaces that have non-uniform frictions (such as a condition where one drive wheel is on a slippery surface and another is on a higher-friction surface.) Since the Brake Traction Control Systems do not have the capability of reducing engine torque, the duration of their activation must be limited, especially at high speeds. These systems may be deactivated at high speeds and may include algorithms to estimate brake temperatures and disable the system if the temperatures exceed a certain limit.

Engine Only Traction Systems (ETS)
A system is defined as an Engine Only Traction System if it
- is computer controlled.
- has a means to determine if a drive wheel is spinning.
- has the capability of controlling engine torque to limit wheel spin.

Engine Only Traction Systems monitor vehicle wheel speeds to determine if a drive wheel is spinning during acceleration, and reduce engine torque to control spinning. Controlling wheel spin can improve vehicle stability, steerability, and acceleration capability. No brake applications are used with this system, and it does not have any ability to transfer torque from one wheel to another.

Active Yaw Control Systems (AYC)
A system is defined as an Active Yaw Control System if it
- is computer controlled and the computer contains a closed-loop algorithm designed to limit understeer and oversteer of the vehicle.
- has a means to determine vehicle yaw velocity and side slip.
- has a means to monitor driver steering input.
- has a means of applying and adjusting the vehicle brakes to induce correcting yaw torques to the vehicle.
- is operational over the full speed range of the vehicle (except below a minimum speed where loss of control is unlikely).

Active Yaw Control Systems in use today can be divided into four categories:

Four Wheel AYC Systems with Engine Control
- This system must have the means to apply all four brakes individually and a control algorithm that utilizes this capability.
- The system must have an algorithm to determine the need, and a means to modify engine torque, as necessary, to assist the driver in maintaining control of the vehicle.
- The system must be operational during all phases of driving including accelerating, coasting, and decelerating (including braking).
- The system must stay operational when ABS or Traction Control is activated.*

Four Wheel AYC Systems without Engine Control

- This system must have the means to apply all four brakes individually and a control algorithm that utilizes this capability.
- The system must be operational during all phases of driving including accelerating, coasting, and decelerating (including braking).
- The system must stay operational when ABS or Traction Control is activated.*

Two Wheel AYC Systems with Engine Control:

- This system must have the means to apply all four brakes individually and a control algorithm that utilizes this capability.
- The system must have an algorithm to determine the need and a means to modify engine torque, as necessary, to assist the driver in maintaining control of the vehicle.
- The system must be operational during all phases of driving including accelerating, coasting, and decelerating (including braking).
- The system must stay operational when ABS or Traction Control is activated.*

Two Wheel AYC Systems without Engine Control:

- This system must have the means to apply all four brakes individually and a control algorithm that utilizes this capability.
- The system must be operational during all phases of driving including accelerating, coasting, and decelerating (including braking).
- The system must stay operational when ABS or Traction Control is activated.*

**Some systems may have limited Yaw Control performance during ABS or Traction Control activation.*

All Active Yaw Control Systems are assumed to include ABS. The vehicles may also include other brake-related or stability enhancement features such as

- traction control to control wheel spin during acceleration.
- dynamic brake proportioning to control the vehicle front/rear brake balance.
- engine drag control to prevent excessive wheel slip due to throttle lift-off or down shifting.
- other computer-controlled features which can activate or modify vehicle braking.
- other computer-controlled stability enhancement features.

If any of these features are included on the vehicle, the Active Yaw Control System must be capable of coordinating their activities to aid the driver in maintaining control of the vehicle and to prevent undesirable interactions.

Active Yaw Control Systems use various sensors (typically wheel speed sensors, steering angle sensors, yaw rate sensors, and accelerometers) to monitor the dynamic state of the vehicle and the driver's commands. They then apply the vehicle's brakes (and adjust engine torque) to make appropriate adjustments to the rotational movement about the vehicle's vertical axis and correct the path of the vehicle to the driver's intended path. These systems improve the vehicle's stability, the driver's control of the vehicle, and correct understeer and oversteer conditions that occur.

The type of Active Yaw Control used on a specific vehicle is the decision of the vehicle manufacturer. Factors affecting this decision may include handling characteristics of the vehicle, vehicle weight distribution, powertrain size and type, intended vehicle use, size, cost, and targeted customer.

Other Stability Enhancement Features
While the emphasis of today's Yaw Control Systems is placed on control of the brake forces, the broader objective of such systems is to control the forces between the tire and the road by any actuation mechanism. In addition to the brakes, other systems are capable of effecting the wheel forces and thereby influencing the vehicle's dynamic behavior. These systems include the suspension, steering, and drivetrain.

Controlled suspension systems have the ability to manage vertical wheel loads and thus influence the longitudinal and lateral force capability of each tire.

- Damping coefficients
- Spring rates
- Anti-roll bar rates
- Other suspension components

Controlled steering systems have the ability to actively adjust the steered angle or the camber angle of any or all of the wheels to influence the longitudinal and lateral forces of the tire.

Drivetrain controls have the ability to adjust the engine torque applied to each of the wheels to influence the longitudinal and lateral forces of the tire. This may be accomplished by a combination of engine torque adjustment and control of differentials to manage the torque across axles.

Integrated Vehicle Systems
[Vehicle Dynamics Control (VDC), Integrated Chassis Control System (ICCS), Electronic Stability Programs (ESP), Dynamic Stability Control (DSC)]

These systems combine vehicle stability features such as ABS, Traction Control, Electronic Brake Distribution (Dynamic Rear Proportioning), Active Yaw Control Systems, Suspension Controls, and Steering Controls on one vehicle. Each manufacturer may package and name these combinations to suit their specific vehicle and customer needs. These names may be trademarks of individual manufacturers.

Discussion
The advent of the automotive microprocessor and sensor technologies has made possible an array of electronically controlled vehicle stability enhancement systems. These systems have the capability of applying or regulating the brake force at the wheels to influence the stability and/or steering and handling of the vehicle. In addition, many of the systems have interfaces with the powertrain, suspension, steering, and other vehicle systems to further enhance their control capability.

Each of these systems is designed to optimize use of the friction at the tire/road interface. Since the friction between these patches of tire and the road surface is the force which allows the vehicle to accelerate, decelerate, and turn, optimization of this force provides the opportunity to enhance vehicle stability and handling.

Some of these systems, such as ABS, have widespread application in the market and already are contributing to improved handling and control of vehicles. Others, such as Active Yaw Control, are beginning to penetrate the market and demonstrate their benefits in assisting driver control and making further contributions to vehicle safety.

As these systems have been developed, each manufacturer has included its own features and in many cases has marketed them under their own name. In some cases this has caused confusion in the industry. In some cases, different systems may have been called the same or very similar names, and in other cases, similar systems have been referred to by different names. Some differentiation between manufacturers will continue to exist, and manufacturers will continue to market features or combinations of features under their own names. The definitions outlined here provide a baseline set of agreed-upon definitions to avoid confusion, to represent the current state of the art vehicle control technologies, and provide building blocks for further development.

Conclusions
Over the past several years, engineers at the motor vehicle manufacturers and their suppliers have developed an array of stability enhancement systems. These systems are all computer-controlled and use various sensors to monitor vehicle parameters. They improve the vehicle stability and handling by optimizing the use of the friction between the tires of the vehicle and the road surface.

Additional Resource—Continental Teves (1-800-694-5200)

Free Videos
“Stomp, Stay, Steer” - ABS video
“ESP” - Electronic Stability Program video

Website
http://www.contiteves.com

Module Eight
Topic 5—Traction Loss Concerns

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

Instructor Activities	Time Frame
Review Module Eight, Topic 5 Lesson Plans Prior to Lesson	
Show Transparencies	35-45 minutes
T-8.35 "Condition of the Road Surface"	(1-3 minutes)
T-8.36 "Condition of the Road Surface"	(1-3 minutes)
T-8.37 "Traction Loss Causes"	(3-5 minutes)
T-8.38 "Traction Loss Causes"	(3-5 minutes)
T-8.39 "Traction Loss Considerations"	(2-5 minutes)
T-8.40 "Traction Loss Considerations"	(2-5 minutes)
T-8.41 "Traction Loss Considerations"	(2-5 minutes)
T-8.42 "Traction Loss Considerations"	(2-5 minutes)
T-8.43 "Traction Loss to Front Tires"	(4-6 minutes)
T-8.44 "Front Traction Loss Correction"	(4-6 minutes)
T-8.45 "Traction Loss to Rear Tires"	(4-6 minutes)
T-8.46 "Rear Traction Loss Correction"	(4-6 minutes)
T-8.47 "Off-Road Recovery"	(4-6 minutes)
Distribute and Review Student Worksheets	5-10 minutes
W-8.5 "Front Wheel Traction Loss"	
W-8.6 "Rear Wheel Traction Loss"	
Review Module Assessments Prior to Lesson	
MA-8.1 "Module Eight Assessment"	
Additional Resources (Media and/or Text)	
Video: "Get a Grip," (Goodyear/ADTSEA)	
Video: "Get Ready, Get Set, Go In Snow" (AAA)	
"Drive Right" Ch. 12, 17	
"Handbook Plus" Ch. 18	
"How To Drive" Ch. 8, 11	
"License To Drive" Ch. 18	
"Responsible Driving" Ch. 11	

Traction Loss Concerns

Knowledge and Skills

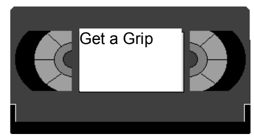
The student is expected to:

- define traction and vehicle balance.
- describe various road conditions that affect traction.

Activities & Resources

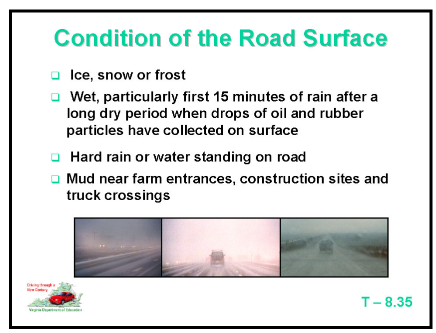
Define traction, then have students give examples of the types of problems and circumstances that may cause a loss of traction.

Show one of the traction-related videos: “Get a Grip,” “Get Ready, Get Set, Go In Snow,” or a Ford Series video relating to traction loss or driving in the rain or snow.



Show Transparency T-8.35 “Condition of the Road Surface” and ask the class to describe roadway conditions that can create traction loss.

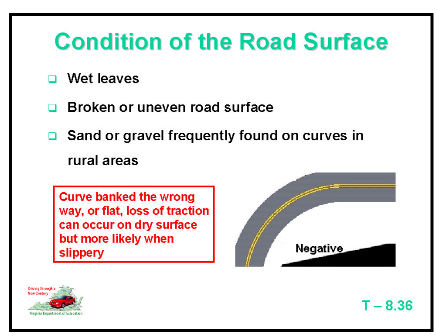
- Ice and snow
- Wet surfaces
- Hard rain or standing water
- Muddy areas



T-8.35
Condition of the Road Surface

Show Transparency T-8.36 “Condition of the Road Surface” and ask the class to describe roadway conditions that can create traction loss.

- Wet leaves
- Uneven road surfaces
- Sand or gravel-covered areas
- Negative-banked curve



T-8.36
Condition of the Road Surface

Changing Traction Conditions
If asked about traction loss, skidding, or problems of directional control, most drivers think of winter with wet snow or ice-covered roads. In fact, skidding is a major contributor to traffic crashes at all times of the year. For instance, running-off the roadway events with subsequent loss of control and crashes account for over 50 percent of all occupant deaths. This lesson will address the causes of traction loss, detection of the onset of loss of directional control, and measures to correct the problem.

Traction
- Traction or adhesion is the grip between the tires and the road surface, which allows a vehicle to start, stop, and/or change direction. Three types of traction influence the control/or movement of a motor vehicle: static, rolling (dynamic), and sliding.
- A stationary vehicle parked on a flat surface with its brakes set is an example of static traction. It has the greatest resistance to movement.
- There is greater traction between a stationary wheel and the road than there is between a sliding wheel and the road. Sliding traction does not grip the road as well as static traction.
- There is more traction between a rolling wheel and the road than there is between a sliding wheel and the road. This is why a driver needs to keep the wheels rolling and not lock the brakes when trying to steer or stop a vehicle that is sliding.
- Traction between the tires and the road does not remain constant. For example, sand, gravel, or water on the road decreases the level of traction. As speed increases, traction between the tires and the road decreases. With decreased traction, the possibility of skidding or sliding increases.

Road Surface Conditions
- Ice, snow or frost
- Wet surface
- Standing water
- Mud
- Wet leaves
- Uneven surface
- Sand or gravel
- Curves

Traction Loss Concerns

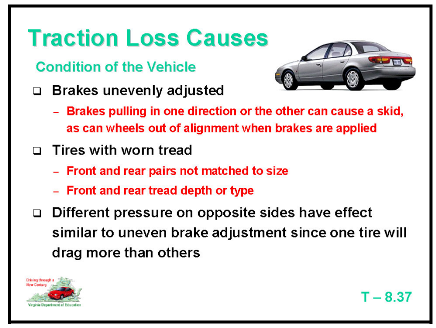
Knowledge and Skills

The student is expected to list vehicle conditions and driver actions that create traction loss and vehicle imbalance.

Activities & Resources

Show Transparency T-8.37 “Traction Loss Causes” to discuss common vehicle factors that affect traction loss.

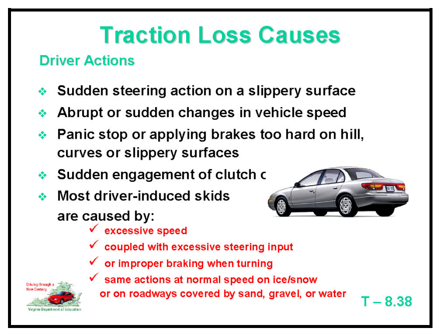
- Misadjusted brakes
- Worn tires
- Uneven tire pressure
- Tires do not match on front wheel drive vehicles



T-8.37
Traction Loss Causes

Show Transparency T-8.38 “Traction Loss Causes” to discuss common driver actions that affect traction loss.

- Sudden steering actions
- Sudden changes in speed
- Panic stops
- Sudden clutch usage (standard transmission)

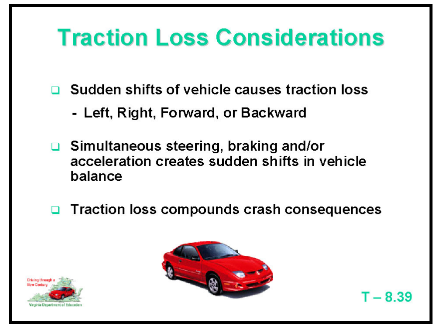


T-8.38
Traction Loss Causes

Show the video “Get A Grip” to relate loss of traction of front and rear wheels to driver actions for controlling a skid.

Show Transparency T-8.39 “Traction Loss Considerations” to discuss vehicle balance problems and the relationship to traction loss.

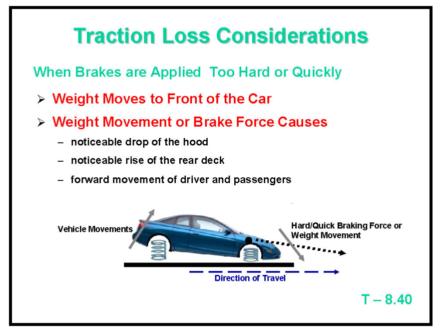
- Sudden shifts of vehicle
- Simultaneous actions
- Traction loss compounds losses



T-8.39
Traction Loss Considerations

Shows Transparency T-8.40 “Traction Loss Considerations” to discuss common driver braking actions that affect traction loss.

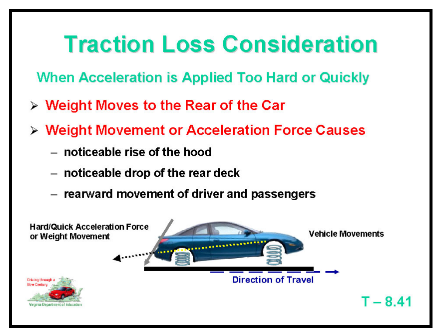
- Braking too hard
- Weight shifts to front of car
- Traction loss can occur
- Recognize hood movement downward



T-8.40
Traction Loss Considerations

Show Transparency T-8.41 “Traction Loss Considerations” to discuss vehicle balance problems and the relationship to too much acceleration.

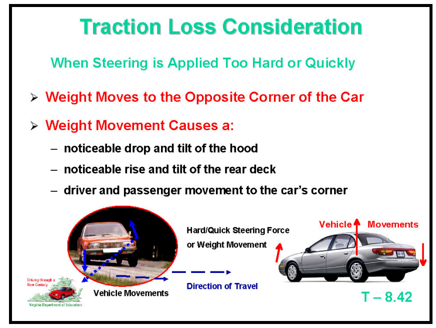
- Accelerating too hard
- Weight shifts to rear of car
- Traction loss can occur
- Recognize hood movement upward



T-8.41
Traction Loss Considerations

Show Transparency T-8.42 “Traction Loss Considerations” to discuss vehicle balance problems and the relationship to too much steering.

- Sudden steering or too much steering
- Weight shifts to the side and front of car
- Possible traction loss
- Recognizing hood movement upward on one side and downward on other side



T-8.42
Traction Loss Considerations

Support Information

Vehicle Balance Concepts

Vehicle suspension, geometry, and tire pressure are basic components of balance when at rest.

Vehicle in Motion

- Sudden steering, braking, and/or acceleration change vehicle balance and traction dramatically.
- Sudden loss of vehicle balance causes traction loss.
- Traction loss compounds crash results.

Application of Brakes

- Weight or center of mass transfers to the front of the vehicle.
- This causes a noticeable drop of the hood and a rise of the rear deck.
- Occupants feel forward movement.

Acceleration

- Weight or center of mass transfers to the rear of the vehicle.
- This causes a noticeable rise of the hood and drop of the rear deck.
- Occupants feel rearward movement.

Application of Steering

- Weight or center of mass transfers to the front right or left of the vehicle.
- This causes a noticeable drop and tilt of the hood and a rise and tilt of the rear deck.
- Occupants feel movement forward toward the corner of the vehicle.

Key to Vehicle Operation

- Smooth and efficient steering, braking, and accelerator movements.
- Any abrupt movements or changes of the vehicle are transferred to the vehicle suspension and have a significant affect on vehicle balance.

Recognizing Traction Loss

The driver must understand the process of traction loss and begin to recognize which part of the vehicle is losing traction in order to activate the technology needed to correct the problem. The concepts of “steering into it” should no longer be used. Besides the fact that it does not work for understeer situations, it requires the driver to try and identify what the back of the vehicle is doing. In a vehicle with a short wheel-base, this delays the process of responding with the steering wheel. A quicker response can be made by identifying when the vehicle is off-target in relation to the path of travel. The driver then takes immediate steering response toward the targeted path of travel.

Traction can be lost to the front tires or the rear tires. Sometimes combinations may lead to the two side tires sliding if the front and rear tires are actually leading the vehicle (sideways traction loss). The concepts of traction loss are important for recognizing when to activate the ABS or TCS to regain vehicle control. The following information is designed to provide procedures to encourage detection of traction loss in hopes of preventing the problem. When prevention fails, the student will have to rely on vision, motion, and steering skills to minimize the traction loss and its potential consequences.

Traction Loss Concerns

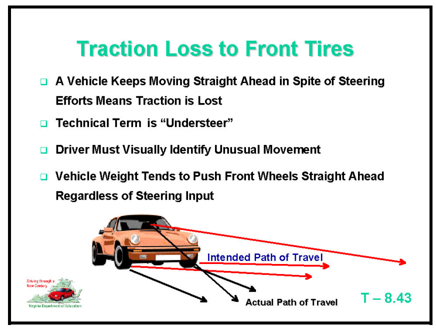
Knowledge and Skills

The student is expected to recognize and correct traction loss to front tires.

Activities & Resources

Show Transparency T-8.43 “Traction Loss to Front Tires” to discuss vehicle balance and its relationship to recognizing traction loss.

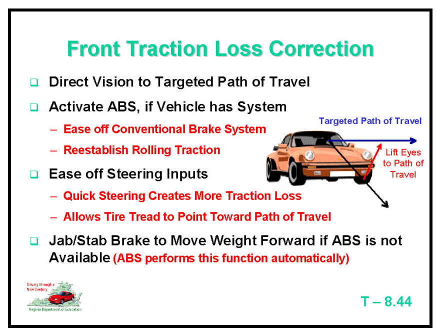
- Recognize traction loss to front tires.
- Technical term is understeer.
- Driver identifies unusual sliding movement off-target.
- Recognize hood movement straight forward even when steering.



T-8.43
Traction Loss to Front Tires

Show Transparency T-8.44 “Front Traction Loss Correction” to discuss correction of vehicle balance problems to control traction loss to front.

- Direct vision on targeted path of travel.
- Activate ABS if equipped.
- Release pedal and jab brake if not ABS equipped.



T-8.44
Front Traction Loss Correction

Students complete Worksheet W-8.5 “Front Wheel Traction Loss” during this section.

Worksheet

Traction Loss

A vehicle can lose traction in the front or rear when the driver steers, brakes, or accelerates improperly for the situation. The resulting traction loss will initially be a loss of traction to the front or rear tires. If the driver can recognize the traction loss to the front, then ABS is a helpful tool to regain steering while slowing. Keep in mind that this is totally against the past practice of keeping your foot off the pedals in a skid. If the driver can recognize traction loss to the rear tires, then the TCS is a helpful tool to regain steering while accelerating gently. The concept of gentle acceleration is also against past instruction for handling a traction loss. The difference in controlling a front and rear traction loss in “modern” vehicles is using the brake and acceleration to increase traction. These driver actions create a weight transfer to aid in maintaining the rolling traction rather than sliding traction. A vehicle has more traction with rolling traction versus sliding traction.

Front-Wheel Skid (Loss of Traction)

- Called understeer
- Vehicle sliding straight ahead in spite of steering input
- May first be identified visually
- Tires tend to roll under
- Rear wheels tend to push front straight ahead

Responding to Front Wheel Traction Loss

Look for an open path of travel and release the accelerator or brake pedal (if non-ABS) to regain vehicle balance and rolling traction to front wheels.

How Should You Steer?

Having identified a visual target, path of travel, turn the steering wheel in the direction you want the vehicle to go. This may take small readjustments as the vehicle responds to your initial steering input, especially in a front tire traction loss. Fast steering wheel movement produces more sliding traction or less rolling traction as the tire sidewall moves sideways. The key is not to steer more than necessary to keep the vehicle directed toward your path of travel.

Identifying and Responding to Front Wheel Loss of Traction

Front wheel loss of traction, called understeer, occurs when the steering wheels move from rolling traction to sliding traction. It typically occurs on a slippery surface when trying to steer a vehicle through a curve or around a corner. It also may occur as a result of approaching a curve or turning too fast and braking hard or suddenly providing too much steering input.

The traction loss may be more subtle and is identified visually when the front of the vehicle moves outward away from the travel path, even though the driver continues to turn toward the path of travel. The driver’s vision picks up the movement straight ahead, instead of through the curve or around the corner. Since the tires are designed to go straight ahead, if the wheels are turned too sharply or abruptly, the sidewalls tend to roll under and the smooth sidewall rather than the tire tread makes contact with the road. Turning force cannot be developed from the sliding traction. At the same time, the rolling rear wheels push to keep the vehicle moving in a straight line.

If the driver locks the brakes while attempting to steer around an obstacle, the vehicle simply skids into whatever he was attempting to avoid. It is critical that the driver direct his vision to the targeted path of travel and not to the skid path. Release the pedal, brake or accelerator, so the weight of the vehicle lets the tires reform from the sidewall to the tread and reestablish rolling traction. Ease off the steering. Jab the brake to shift some weight to the front of the vehicle if the vehicle does not respond to the path of travel. The steering will respond quickly when rolling traction regains, so be prepared for a sudden movement of the vehicle toward the planned path of travel.

Traction Loss Concerns

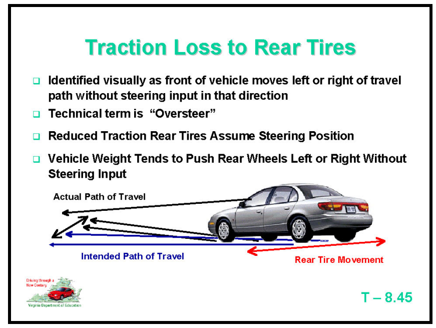
Knowledge and Skills

The student is expected to recognize and correct traction loss to rear tires.

Activities & Resources

Show Transparency T-8.45 “Traction Loss to Rear Tires” to discuss vehicle balance problems and the relationship to recognizing traction loss.

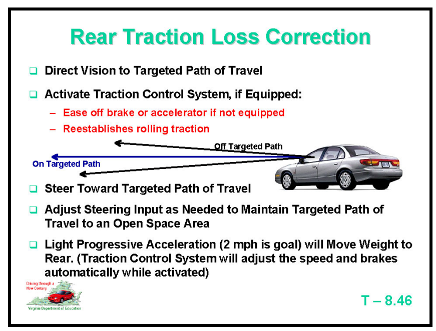
- Recognize traction loss to rear tires.
- Technical term is oversteer.
- Driver identifies unusual movement off-target.
- Recognize hood movement to left or right off-target even while not initiating steering inputs.



T-8.45
Traction Loss to Rear Tires

Show Transparency T-8.46 “Rear Traction Loss Correction” to discuss correction of vehicle balance problems to control traction loss to rear.

- Direct vision on targeted path of travel.
- Activate TCS if equipped.
- Release pedals and accelerate (2 mph target speed).
- Direct steering to targeted path of travel until traction regained to rear.
- Regain balance and rolling traction to rear tires.



T-8.46
Rear Traction Loss Correction

Use Worksheet W-8.6 “Rear Wheel Traction Loss” during this section.

Worksheet

Rear-Wheel Skid (Loss of Traction)
- Termed oversteer.
- Locked wheels try to assume front position.
- Generated by slick surface, speed, braking or sudden steering input.
- Identified visually as front of vehicle moves left or right of travel path and rear wheels try to assume front position without steering input in that direction.
- Corrected by directing vision to targeted path of travel

Change in Balance Changes Traction
- Balance loss = traction loss.
- Simultaneous driver inputs affect vehicle balance.
- Traction loss compounds crash results, due to brake or accelerator application and weight transfer of vehicle.

Responding to Rear Wheel Traction Loss
Look for an open path of travel and release the accelerator or brake pedal to regain vehicle balance and rolling traction to front wheels.

How Should You Steer?
Having identified a visual target, path of travel, turn the steering wheel in the direction you want the vehicle to go. This may take some rapid readjustments as the vehicle responds to your initial steering input, especially in a rear tire traction loss. Lateral forces in a rear wheel traction loss also will affect the movement of the vehicle. Lateral acceleration is the sideways movement of the vehicle and is determined by how fast the steering wheel is turned and the momentum of the vehicle. Fast steering wheel movement produces more side or lateral acceleration. The key is not to steer more than necessary to keep the vehicle directed toward your path of travel. When the vehicle stops moving in one direction, this energy will want to quickly move in the opposite direction; being able to respond with the steering wheel demands constant attention until the vehicle is safely back on the desired path of travel.

Identifying and Responding to Rear Wheel Loss of Traction
Rear wheel loss of traction, termed oversteer, occurs when rolling traction moves to sliding traction on the rear wheels of the vehicle. In this skid, unless corrective action is initiated quickly, the tires with less traction try to move to the front and the vehicle's natural tendency is to rotate 180 degrees and end up going backward. As with front wheel loss of traction, rear wheel traction loss may occur on a slippery surface when trying to steer a vehicle through a curve or around a corner.

It also may occur as a result of approaching a curve or turning too fast and braking hard, suddenly providing too much steering input or acceleration. On a slippery surface, the driver should recognize rear wheel loss of traction when observing that the front of the vehicle is moving to the left or right away from the targeted path of travel, even though he/she is not steering the vehicle in that direction. The best response is to keep targeting path of travel, ease off the brake or accelerator, continually steer toward the travel path, and use a very light and progressive acceleration as the rear of the vehicle recovers from sliding to rolling traction.

The key to this problem is to keep targeting the travel lane and not the side of the road and to steer back to the lane. At this point of the slide or skid the driver may not have steered enough to regain his path of travel, so he may have to increase steering inputs until rolling traction begins to help. This is where light and progressive acceleration can transfer weight and help rolling traction return from rear tire sliding traction.

Topic: 5 **Lesson: 5**

Traction Loss Concerns

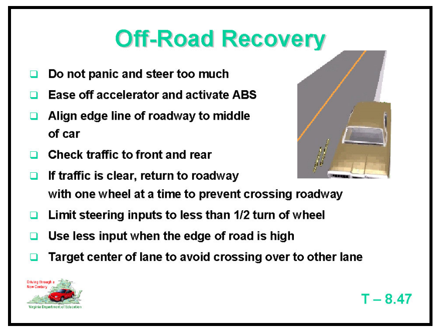
Knowledge and Skills

The student is expected to list off-road recovery procedures.

Activities & Resources

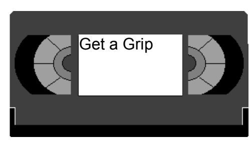
Show Transparency T-8.47 “Off-Road Recovery” to discuss correction of vehicle balance problems when running onto shoulder.

- Direct vision on targeted path of travel.
- Ease off accelerator pedal and activate ABS.
- Direct steering to targeted path of travel.
- Regain balance and rolling traction to rear tires.



T-8.47
Off Road Recovery

Show video “Get A Grip” to relate loss of traction of front and rear wheels to driver actions for controlling a skid.



Support Information

When driving off the roadway, one must deal with unstable surfaces that make traction unpredictable. Slamming on the brakes and steering changes often result in a rollover.

Off-Road Recovery

- Don’t panic and oversteer.
- Ease off the accelerator and do not brake.
- Sight/align vehicle with edge of roadway.
- Check all traffic.
- When clear, bring wheel back to road surface by turning steering wheel 1/8 to 1/4 turn.
- As wheels touch the road surface, countersteer 1/4 or 1/2 turn and turn to straighten wheels.

Curriculum Scope and Sequence Modules for Driver Education in Virginia

Module Eight

Worksheets

Simulation

Assessments

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

Worksheet W-8.1

Adverse Conditions

Changing Weather and Conditions of Visibility

Complete the following questions to the best of your ability during the class session or as a review of Topic 1 materials.

For items 1 through 7, answer the following questions:

a. How can this condition affect a driver's ability to see?
b. What adjustment should a driver make to better cope with the problem?
c. What adjustments or checks, other than driving, can be made to help compensate for the condition?

1. Sun glare:

   a.

   b.

   c.

2. Sunrise, Sunset:

   a.

   b.

   c.

3. Fog:

   a.

   b.

   c.

4. Rain:

   a.

   b.

   c.

5. Snow:

   a.

   b.

   c.

6. Temperature drops to near zero degrees:

   a.

   b.

   c.

7. Temperatures in the high 90’s, low 100’s:

   a.

   b.

   c.

Worksheet W-8.2

Low Water Crossings

1. Describe a "low water crossing":

2. How would you recognize a low water crossing?

3. Why are low water crossings so dangerous?

4. Where does a driver look for problem areas?

5. What types of vehicles are a problem at low water crossings?

6. How much water does it take to lose control of the vehicle?

7. Why are low water crossings so dangerous in Virginia?

8. How can a driver avoid potential problems?

Worksheet W-8.2

Low Water Crossing Answer Sheet

1. **A roadway area that allows water to cross in the event of sustained heavy rainfall or sudden thunderstorms and is normally a dry area.**

2. **Sometimes warning signs are posted, but mostly whenever the driver sees moving water across the roadway.**

3. **Nearly half of all flash flood fatalities are vehicle related.**

4. **Look out for flooding at highway dips, bridges, and low areas.**

5. **Any type of vehicle is dangerous, as even the largest and heaviest of vehicles will float.**

6. **Six inches of water may cause you to lose control of your vehicle, while two feet of water will carry most cars away.**

7. **They are a hidden danger that await most motorists and especially when visibility is limited at night.**

8. **Heed all flood and flash flood watches and warnings and keep abreast of road conditions through the news media.**

Worksheet W-8.3

Occupant Protection

Safety Restraints

1. How should safety belts be worn/adjusted to provide maximum protection?

   Lap belt: ____

   Shoulder belt: ____

2. The primary purpose of a driver side air bag is to:

   ____

   ____

3. What precautions should front seat occupants take in an air bag-equipped vehicle?

   ____

   ____

4. Why do you, don't you, will you, won't you use safety belts?

   ____

   ____

5. What are Virginia 's safety belt laws?

   ____

   ____

Worksheet W-8.4

Highway Design Features

Identify how each of the following contribute to occupant protection.

1. Wide, clearly marked lanes and clear highway shoulders:

   ____

   ____

2. Rumble strips:

   ____

   ____

3. New design median barriers:

   ____

   ____

4. Break away sign support posts:

   ____

   ____

5. New design guard rails:

   ____

   ____

6. Crash attenuators:

   ____

   ____

7. Protected left and right turn bays:

   ____

   ____

Worksheet W-8.5

Front Wheel Traction Loss

Complete the following questions to the best of your ability during the class session or as a review of Topic 4

1. Describe how you would recognize a front wheel traction loss while driving:

When changing sliding traction to rolling traction by, describe how you would respond below:

2. Vision Control:

3. Motion Control:

   - Brakes

   - Accelerator

4. Steering Control:

Worksheet W-8.5

Rear Wheel Traction Loss

Complete the following questions to the best of your ability during the class session or as a review of Topic 4

1. Describe how you would recognize a rear wheel traction loss while driving:

When changing sliding traction to rolling traction by, describe how you would respond below:

2. Vision Control:

3. Motion Control:
   - Brakes
   - Accelerator

4. Steering Control:

SLS-8.1

Simulation Laboratory Session

Suggested Titles: "Evasive Action Skills" (DORON Video or Laserdisc)
"Handling Weather Conditions" (DORON Video or Laserdisc)
"Avoiding Collisions" (SSI Safe Driver Training Series)
"Testing Driver Performance II" (SSI Safe Driver Training Series)

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

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

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

Instructor Activities	Student Driver Activities	Materials Needed and Notes

Notes

Module Assessment MA-8.1

Module Eight Assessment

Name: ____ Date: _________

1. If a vehicle is not equipped with Daylight Running Lights (DRL), it is recommended that drivers turn on the low beam headlights any time the vehicle is in motion. The reason for turning them on:
   A. It helps the driver see the road ahead.
   B. It helps the driver identify the edge of the road.
   C It makes it easier for other road user to see the vehicle.
   D. It makes it easier to see objects off road.

2. When driving in fog it is best to drive with ________.
   A. high beam headlights B. low beam headlights
   C. four way flashers D. parking lights

3. For a driver who has been temporarily blinded by the bright lights of an oncoming vehicle, glare recovery time ________.
   A. is the same regardless of age B. decreases with age
   B. increases with age D. is greater for men than women

4. Due to a sudden change in direction, the rear end of your vehicle skids left or right. The first thing to do is to ________.
   A. ease off brake or accelerator and steer toward lane
   B. pump brakes rapidly
   C. accelerate slightly
   D. brake and accelerate lightly

5. If the vehicle you are driving starts to hydroplane, you should ________.
   A. pump brakes to slow B. ease off accelerator, do not brake
   C. increase speed slightly D. steer sharply toward shoulder

6. The best way to control consequences if you cannot avoid a collision is to ________.
   A. throw yourself to the floor B. lock brakes and steer hard right
   C. lock brakes and turn off engine D. control brake and steer to collide at an angle with object

7. A rear facing infant seat should be properly secured in ________.
   A. the front passengers seat B. the right rear seat
   C. the left rear seat D. the center rear seat

8. Traveling 55 MPH your vehicle suddenly drifts off onto a shoulder about three inches lower than the road surface. To recover safely to the pavement you should ________.
   A. slow quickly by braking and steer sharply back to the pavement
   B. turn the steering wheel a little bit at a time to ease back onto the pavement
   C. ease off accelerator and move off road wheels 12-18 inches from road edge. When clear, steer slightly to turn back to pavement and then steer to the correct lane position
   D. ease off accelerator and move all four wheels off road. When clear steer sharply back onto roadway and steer to correct lane position

9. Children under age ______ should always ride secured in the back seat.
   A. 6 years B. 12 years
   C. 15 years D. 9 years

Module Assessment MA-8.1

...continued

10. Which of the following **does not help** make local trips easier?
    - A. Traveling during rush hour
    - B. Listening to weather reports
    - C. Leaving at the scheduled time
    - D. Allowing an extra 15 to 20 minutes

11. When preparing for a long distance trip you should ________.
    - A. take along an extra pair of gloves
    - B. pack a complete tool box
    - C. place a 5 gallon can gas in the trunk
    - D. have the vehicle serviced

12. When you will be doing all of the driving, you should limit driving to no more than____.
    - A. five hours a day
    - B. six hours a day
    - C. eight hours a day
    - D. 12 hours a day

13. If you are planning a trip someplace you have never been before, you should _______.
    - A. study a road map while driving
    - B. plan your route and stops before leaving
    - C. stop for directions at rest stops
    - D know the limits of your cell phone

14. When selecting a route for a long trip, you should ________.
    - A. just choose the Interstate
    - B choose the most leisurely route
    - C. evaluate the risks of each route
    - D. stick to four lane US highways

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15. When driving on a highway, sudden strong cross wind gusts ________.
    - A always cause severe dust problems
    - B. affect large cars more than small cars
    - C. can move a car sidewise into another lane
    - D. do not affect a car as much as a strong head wind

16. The loss of traction emergency most difficult to quickly identify is ________.
    - A. a power skid
    - B. a spin-out situation
    - C. hydroplaning
    - D. a braking skid

17. The primary problem associated with front wheel lock up when braking on a slippery surface is ____.
    - A. inability to stop the vehicle
    - B. it's hard on tires
    - C. inability to steer the vehicle
    - D the momentary increase in speed

18. When driving up a slippery hill, you can reduce the chance of the wheels spinning by ______.
    - A. increasing speed before starting up the hill
    - B. shifting into a lower gear for more torque before starting up the hill
    - C. increasing speed slightly as you move up the hill
    - D. keeping a progressive pressure on the accelerator

19. Head restraints when properly adjusted provide the most protection when a vehicle ________.
    - A. is struck from the rear
    - B. rolls over in a crash
    - C. is struck from the side
    - D. runs off the road

20. The best way to prevent skidding on a slippery road surface is to ________.
    A. drive slowly at all times
    B. pump the brakes when stopping
    C. drive in low gear
    D. steer and brake smoothly and gradually

21. Of the following, which is the most important in deciding how fast to drive in fog?
    A. how far ahead you can see
    B. the condition of your vehicle's brakes
    C. amount of traffic on the road
    D. depends on whether it's day or night

22. When traveling in very hot weather, you should ________.
    A. add dri-gas at each fill-up
    B. check tires when they are cool
    C. release hot tire pressure build up
    D. drive slower

23. When it's raining, your choice of speed should be influenced most by the ________.
    A. posted speed limit
    B. speed of other drivers
    C. size of your vehicle
    D. amount of traction

24. Explain how you would recognize a front wheel loss of traction

25. Explain how you would respond to change the sliding traction to rolling traction

Module Assessment MA-8.1

Answer Sheet

Test Answer Sheet
Circle the letter indicating the correct answer

Name: ________________________________ Date:_____/_____/_____

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

24.

25.

Module Assessment MA-8.1

Answer Key

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

24. The vehicle continues straight ahead even though I am steering to the right..
(The student does not have to use the exact words above to describe this situation...)

25, Look to the targeted path of travel, ease off any pedals or steering, steer toward the targeted path of travel, jab brake to reestablish rolling traction..
(The student does not have to use the exact words above to describe this situation...)