**Driver Education Chapter 9** 

Natural Laws and Car Control

9.1 Gravity and Energy of Motion

The motion of the vehicle is subject to the natural laws of motion.

They include:

Inertia: Objects that are at rest tend to stay at rest, and objects that are moving tend to keep moving.

How can you feel inertia in a vehicle?

Brake rapidly, accelerate rapidly, sharp curve or turn.

Momentum: Tendency of an object to stay in motion or the inertia of an object in motion. Momentum depends upon the object's speed and weight.

Energy of Motion: Kinetic energy. The energy of motion changes in proportion with the weight of the vehicle.

A vehicles energy of motion is the **square of the speed**—if you double your speed energy of motion is 4 times as great and you will need 4 times as much time to stop.

Gravity: The force that pull all things to Earth. Drive up hill/ Drive down hill you feel gravity.

9.2 Traction and Tires

Tires are an important part of controlling your vehicle

Friction: The force that keeps tires from sliding on the road.

Traction: Makes it possible for tires to grip the road.

Tire Tread and Traction: Footprint is the pace where a tire touches the road and this is where your traction derives from. How much of the tire is actually touching the road? Tread—the grooved surface of the tire. Tread provides the traction for starting, stopping and gripping the road.

The gripping is critical to preventing skids/hydroplaning. Water flows through the treads when it is wet. The greater the tread the greater the grip. Tire size also affects the amount of tread and traction. There is a size maximum before it becomes a hazard.

Inflation and Traction:

Underinflation: only the tires outer edges are maintaining contact with the road surface. Tire will heat up and fail faster.

Overinflation: only the tire's center will maintain contact. The center of you tire will wear out quicker. Smaller traction surface.

Temperature: Weather can cause change in pressure in tires. Check your tires regularly to make sure they are inflated properly.

Using Traction

Traction is used to accelerate, brake, and steer. You have limited traction and in weather conditions it deteriorates as well as road surface. Pay attention to speed, braking, steering.

**Ensuring Good Traction** 

3 Things are required to achieve ideal levels of traction:

Vehicle Condition---tires, shocks, parts of the steering system Road Condition---dry, wet, flat, curves, gravel, snow, rain, ice Driver Action—Manage traction.

9.3 Vehicle Balance and Control in Curves

Vehicle Balance—Distribution of weight on tires. Whenever a vehicle accelerates, brakes, or turns, the changing weight on each tire affects it balance.

Center of Gravity: The center of gravity is the balance point.

- Stability: A vehicle with a center of gravity that is close to the ground is more stable and less likely roll. Taller, narrower vehicles such as SUV, pickup, vans have a higher center of gravity and tend to be less stable.
- Balance and Steering—Your vehicle may rotate around these axes in three ways: pitch, roll, yaw.

Pitch: Tilting motion from front to back

Hard accelerate or quick deceleration

Roll: Tip to the side or roll

Sharp turn with speed/curve

Yaw: rotate clockwise or counterclockwise or

yaw. tires lose traction and spin.

Forces in Curves Your ability to control your vehicle in a curve depend on the sharpness of the curve, the speed, weight of your vehicle and the shape of the roadway.

9.4 Total Stopping Distance: The distance your car travels from the time you first perceive a hazard until you reach a full stop

It will take you about 300 feet or the length of a football field to stop at 65 mph.

Perception Time and Distance.

Perception Time: The length of time it takes you to identify a hazard, predict a conflict and decide to stop. For most drivers this  $\frac{3}{4}$  of a second.

Perception Distance: Distance your vehicle travels in perception time. =1.1 times speed.

Reaction Time and Distance

Reaction Time: Length of time it takes you to apply brakes after recognizing a hazard.

Reaction Distance: Distance your vehicle travels while you react.

**Braking Distance** 

Braking Distance: Time you apply your brakes until you stop.

Braking distance is the square of your speed.

Factors that Affect Braking Distance

Driver ability, speed, vehicle conditions, roadway surface, hills, weight of the vehicles load.

9.5 Controlling Force of Impact

Force of Impact—The force with which a moving object hits another object.

Three factors determine force of impact Speed, Weight, Time Between Impact and Stopping.(Hard stop vs cushion/slow stop)

Safety Belts-active restraint device-you must engage

Air Bag—passive restraint device—automatically engages

Safety Belt—force of rapid deceleration gets distributed over the stronger parts of the body—pelvis, chest, shoulders.

Make it a habit to buckle up.

Adjust your seat back to an upright position and sit all the way back. Make sure your safety belt is not twisted.

Click the safety belt's latch into the buckle.

Adjust the lap portion of the safety belt so it is low and snug across your hips. The bottom portion of the belt should just touch your thighs. This adjustment will ensure that the crash forces are applied to your pelvic bones instead of your internal organs.

Adjust the shoulder bel snugly across your chest and collarbone.

If you don't wear the seat belt properly it cannot protect you correctly.

- Air Bags—balloon type device that automatically inflates to protect you.
  - Frontal air bags—required on cars and light trucks since Sept. 2006

Side air bags—designed to protect head and chest. Can also prevent ejection

Air bags are designed to work with seat belts, not exclusively.

Keep hands at 9/3, 8/4 for best steering. Chest at lease 10 inches away from the hub of steering wheel. Keep your passenger sheet farther back as the passenger air bag is larger. Child Passenger Safety—Safety belts do not fit children until they are between age 8 and 12.—User child seat or booster until that time.

Other Protective Devices Crush zones—front rears ends of vehicle

Energy-absorbing bumper—under 5 mph absorb collision impact.

Side Impact Panels-help absorb side collisions

Penetration Resistant Windshield—thin layer of plastic between two layers of glass.

Head Restraints—Padded headrests on the top of seats protects against whiplash. Must reach the middle of the back of your head.

Seat Belts-- https://www.youtube.com/watch?v=U\_ptXy8686s

Seat Belts--

https://www.youtube.com/watch?v=hi2FEyV2Z2E&list=PLqP9eizXMiv5Oo-CcYNh\_q7QzWzd1IkHc&index=6&t=0s

Physic of crashs--

https://www.youtube.com/watch?v=vjQA3NrVvrk&list=PLqP9eizXMiv5Oo-CcYNh q7QzWzd1IkHc&index=3&t=0s

School Bus Stop <u>https://www.youtube.com/watch?v=SfrK-</u> BMfREE&list=PLqP9eizXMiv5Oo-CcYNh q7QzWzd1IkHc&index=9&t=0s

https://www.youtube.com/watch?v=jbp04AftXVw&list=PLqP9eizXMiv5Oo-CcYNh\_q7QzWzd1IkHc&index=9 Freezing Rain:

https://www.youtube.com/watch?v=zqgutqGvtSk&list=PLqP9eizXMiv5Oo-CcYNh\_q7QzWzd1IkHc&index=68&t=0s