CHAPTER FIVE
NATURAL LAWS AND CAR CONTROL

5.1 GRAVITY AND ENERGY OF MOTION

5.2 FRICTION AND TRACTION

5.3 STOPPING DISTANCE

5.4 CONTROLLING THE FORCES OF IMPACT

GOOD FOR WHOM?

DID YOU EVER NOTICE THAT ANYONE DRIVING SLOWER THAN YOU IS AN IDIOT AND ANYONE DRIVING FASTER THAN YOU IS A MANIAC?

George Carlin, Comedian


MANIAC!!
©JOHN
99 BELL

HERE IS ONE WAY YOU CAN TELL
YOU MAY BE GOING TOO FAST

WOULDN’T IT BE NICE IF YOUR DOG GETTING STUCK IN THE SEAT OF YOUR CAR WAS THE WORST THING THAT HAPPENED BECAUSE YOU DROVE TOO FAST?

UNFORTUNATELY, THERE ARE OTHER CONSEQUENCES TO SPEEDING


449
CE
D.ORG

WHAT ARE THE THREE MOST IMPORTANT FACTORS IN CONTROLLING YOUR VEHICLE?

1. SPEED

2. SPEED

3. SPEED

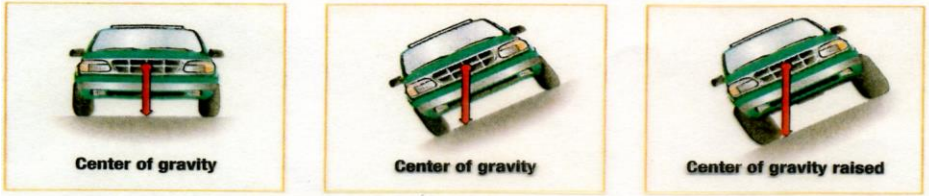
WATCH THIS VIDEO, *DRIVE IT RIGHT*, ABOUT SPEEDING PRODUCED BY ALLSTATE INSURANCE AND THE DISCOVERY CHANNEL

5.1 Gravity and Energy of Motion

Gravity

Center of Gravity

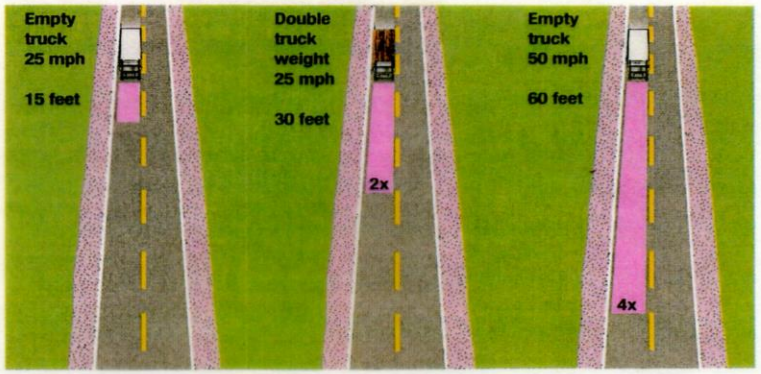
The point around which an object's weight is evenly distributed is called its **center of gravity.**



A vehicle's stability decreases as its center of gravity rises.

Energy of Motion

When an object moves, it acquires energy. This force is called **energy of motion,** or kinetic energy. The faster your vehicle moves, the more energy of motion it has. Energy of motion is also affected by the weight of the moving object.



A vehicle's energy of motion increases dramatically with increases in weight and speed.

Newton's law of motion

5/2

5.2 Friction and Traction

Friction is the force that keeps each tire from sliding on the road. You can feel this same force by rubbing your hands together.

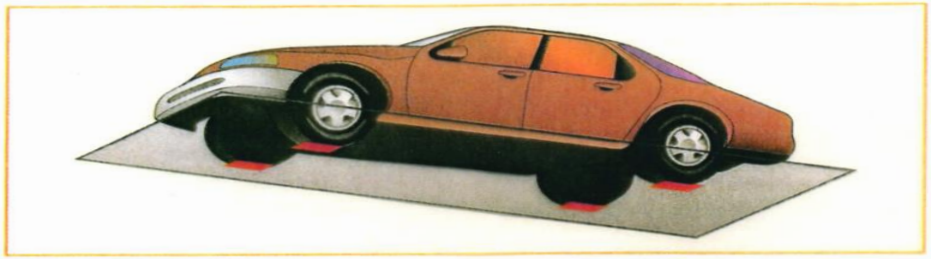
The friction created by the tire on the road is called **traction.** Traction makes it possible for your vehicle to grip the road so you can change speed and direction.

Tires

Tires make a difference in the way your vehicle performs. The simple mistake of driving with low pressure in your tires can mean the difference between avoiding a collision or hitting something.

Tread and Traction

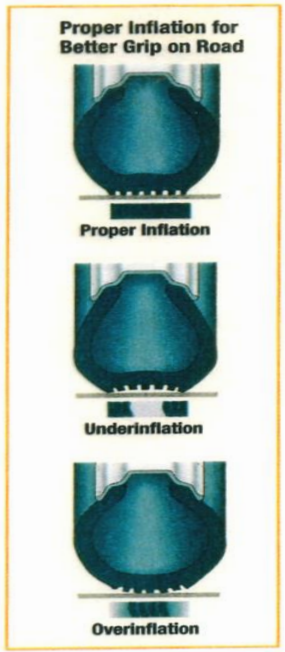
The grooved surface of a tire that grips the road is called the **tread.** When the road is wet, the tread allows water to flow through the grooves and away from the tire.



The four footprints of your tires on the road are the only contact between your car and the road.

Inflation and Traction

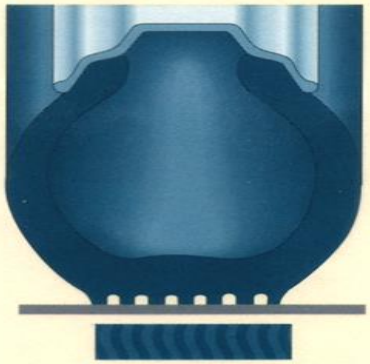
Each tire is designed to work best between a range of high- and low-inflation air pressures.



The boxes show the areas of best traction—properly inflated tires grip evenly; underinflated tires grip only by the outer edges; overinflated tires grip only in the center.

Proper Inflation for Better Grip on Road

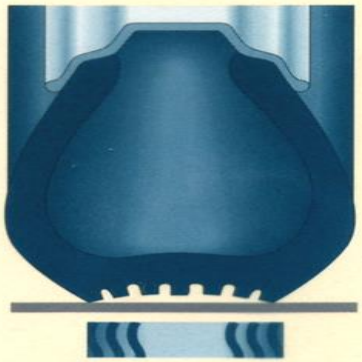
Good handling. Good, long term wear is possible



Proper Inflation

Full face of the tire tread is touching the road surface

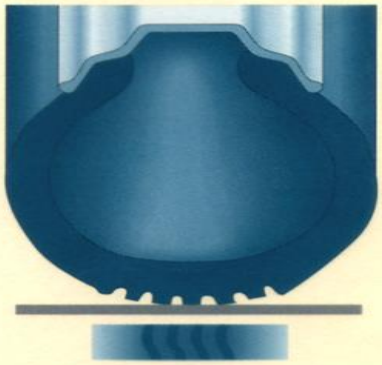
Poor handling due to side wall flexing. Vehicle will sway. Poor tire wear. Tire will wear on edges and tire will run hot



Underinflation

Only the outer edges of the tread are touching the road surface

Poor handling and will take longer to stop due to decrease in traction. Poor tire wear. Tire will wear in the center of the tread



Overinflation

Only the center of the tread is touching the road surface

USA TODAY
JUNE 13, 2005

Ford warns of dangers of older tires

It says research suggests they be replaced after six years of normal use.

By JEFF PLUNGIS
DETROIT NEWS

Ford Motor Co. has become the first U.S. automaker to warn customers that they should replace older tires, even if the treads are not worn out.

Ford officials said the move comes in response to a growing body of research that suggests that tires deteriorate as they age and can experience tread separations and other failures, even if they look robust.

"Tires degrade over time, even when they are not being used," Ford's warning reads. "It is recommended that tires generally be replaced after six years of normal service. Heat caused by hot climates or frequent high loading conditions can accelerate the aging process."

Ford's tire warning was posted on the company's Web site, www.ford.com, within the last three weeks and will be printed in owner's manuals beginning with 2006 model year vehicles. Similar warnings have appeared in Europe, but this is the first time one of Detroit's Big Three has cautioned U.S. customers.

Foreign makers, including Volkswagen AG, Toyota Motor Corp. and DaimlerChrysler AG, have alerted customers in Europe and the United States about aging tires.

In the years since the Firestone tire recall, Ford has funded several studies on tire safety, including ones on how rubber ages, how older tires perform in the field, and how to develop laboratory tests that simulate how tires age in the real world. The six-year replacement recommendation was based on a broad study of tires retrieved from the field, a Ford spokesman said.

Activist Sean Kane has petitioned the National Highway Traffic Safety Administration for an easy-to-read tire age label. Kane, the president of SRS Inc., a Massachusetts auto safety research firm, said he has documented 73 crashes related to older tires that have resulted in 50 deaths since 1999.

Kane also said the safety agency should issue a consumer advisory based on the latest research.

Safety administration spokesman Rae Tyson said the agency is not ready to issue a consumer advisory, but that does not prevent automakers or tire companies from issuing their own warnings if they have research suggesting a safety issue.

"Ford is to be commended if they want to step up and warn their customers," he said.

Check the tires

Some steps that can be taken to determine the age of tires:

Find the U.S. Department of Transportation tire ID number on the inner sidewall. It begins with the letters "DOT."

The two numbers or letters after DOT identify the plant where the vehicle was made.

The final four numbers show the week and year it was built. For example, 3197 means the 31st week of 1997.

Ford Motor Co. has more on tire safety at **www.ford.com/en/innovation/safety/tireSafety.htm.**

Source: National Highway Traffic Safety Administration

Curves

Energy of motion and traction will work on your vehicle as you drive around a curve. The energy of motion in your vehicle will try to make it go straight in a curve. The higher your vehicle's speed, the more it will tend to go straight.

Tire traction is the second force working for you in a curve. But if your speed is too high, you might not have enough traction to make the curve.

Vehicle Control in Curves

Your vehicle's speed, the sharpness of the curve, the bank of the curve, and your vehicle's load will affect the control you have in a curve.

Speed You have no control over how sharp a curve is, but you can adjust your speed. To reduce your chance of skidding, lower your speed before entering a curve. Remember, your energy of motion will change in proportion to the square of your increase or decrease in speed. If you cut your speed in half, the force pushing you off the road will be cut four times.

Sharpness of Curves The sharper a curve, the more traction your vehicle needs to grip the road. Use lower speeds for sharp curves.

Banked Curves A curve that is higher on the outside than it is on the inside is called a **banked curve.** This type of curve helps to overcome your vehicle's tendency to move to the outside of the curve. This can be very helpful on a road that has a crowned, or higher, center.

This driver slowed ahead of time for this curve.

What should the driver do to adjust for the extra load?

Load Your vehicle's load affects your control in a curve. How will adding the load to the vehicle in the right picture affect control? To maintain control, the driver must slow when heavily loaded.

Vehicle Capabilities

Vehicles of different sizes and power handle differently. Small vehicles like a motorcycle are light and can accelerate quickly. Large trucks and recreational vehicles, on the other hand, take lots of power just to accelerate to highway speeds. Large vehicles can take a long distance to stop. You need to remember these differences when you use the IPDE Process.

- Braking while turning causes split traction. Some traction Is used for turning and some is used for stopping making it harder to stop and control your vehicle

BE A SMART DRIVER
KNOW THE CAPABILITIES
OF THE VEHICLE YOU ARE
DRIVING

The question no one asks about a new car

- NICE CAR
- JUST GET IT?
- HIGH PERFORMANCE ENGINE?
- DUAL EXHAUSTS?
- HOW FAST WILL IT……..?

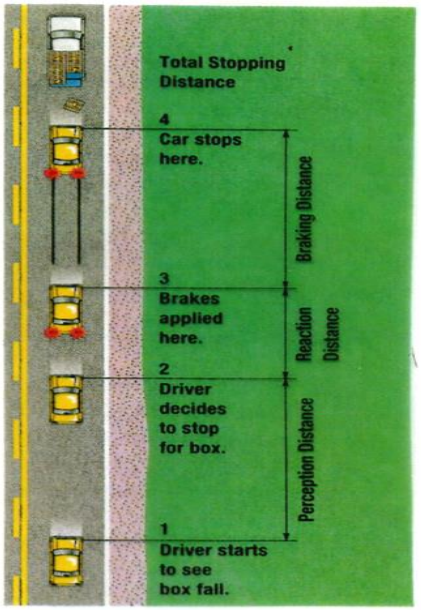
STOP?

5/4

5.3 Stopping Distance

Total Stopping Distance

The distance your car travels while you make a stop is called your **total stopping distance.**



Total stopping distance

Estimating Stopping Distance

Use the four-second rule, which enables you to project your approximate stopping distance under ideal conditions at any speed.

1. Pick a fixed checkpoint (a mark or shadow on the road) ahead where you think you could stop.
2. Count off four seconds: "one-thousand-one, one-thousand-two, one-thousand-three, one-thousand-four."
3. Check your vehicle's position. If you have just reached your fixed checkpoint, you can assume the distance you estimated in Step 1 was the approximate distance it would have taken you to stop.

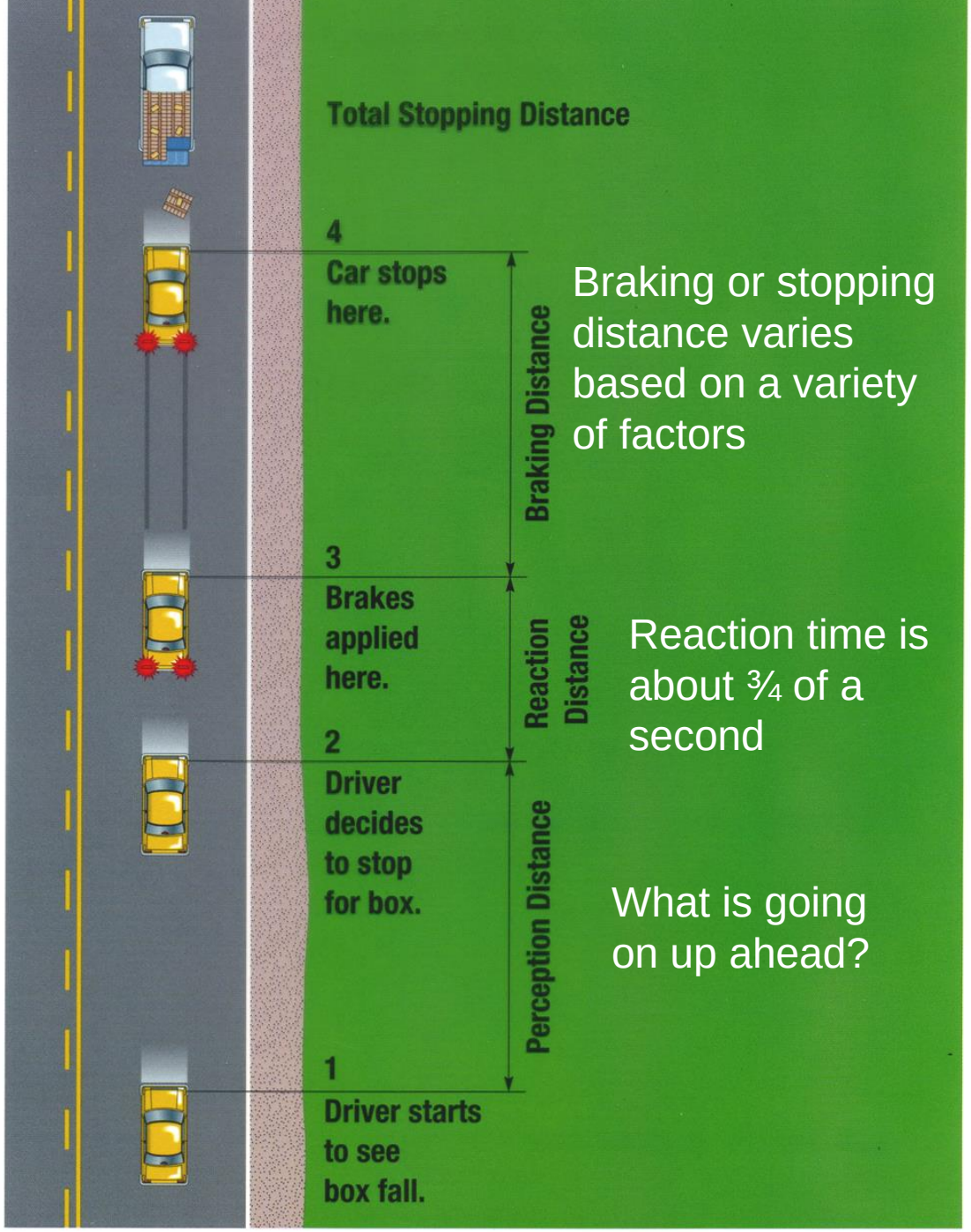
FOUR SECOND RULE

TWO SECONDS IS MINIMUM

Factors That Affect Braking Distance

These seven factors can affect your total braking distance:

- **Speed** The higher your speed, the longer your braking distance.
- **Vehicle Condition** A vehicle with worn tires, shock absorbers, or brakes needs a longer distance to stop.
- **Roadway Surface** Rain, snow, ice, dirt, wet leaves, and gravel reduce road traction and increase stopping distance.
- **Driver Ability** If you are distracted or impaired, you will take longer to stop your vehicle.
- **Antilock Braking System (ABS)** If your car has an antilock braking system, you can better control your stopping distance while turning.
- **Hills** Your braking distance increases when driving downhill.
- **Loads** Heavy loads increase your braking distance.

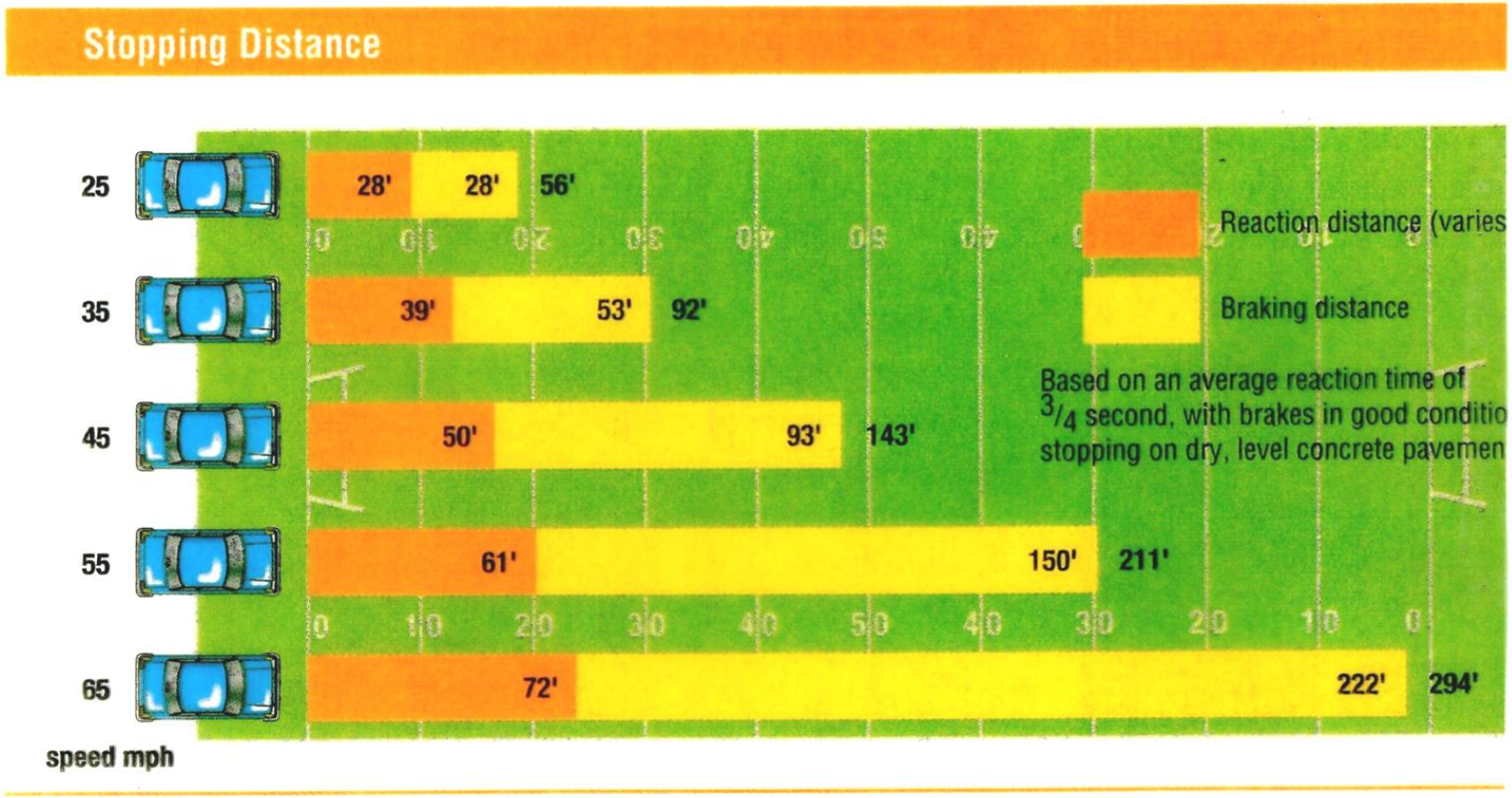


Braking or stopping distance varies based on a variety of factors

Reaction time is about ¾ of a second

What is going on up ahead?

Total Stopping Distance



Distances traveled at various speeds once driver perceives hazard and begins to stop

WHEN VEHICLE SPEED DOUBLES, STOPPING DISTANCE INCREASES ABOUT FOUR TIMES

STOPPING DISTANCE AT 25 MPH IS APPROXIMATELY 56 FEET

STOPPING DISTANCE AT 55 MPH IS APPROXIMATELY 211 FEET

NEWTON'S LAW OF MOTION STATES:

BODIES IN MOTION TEND TO STAY IN MOTION, BODIES AT REST TEND TO STAY AT REST.

5/5

5.4 Controlling Force of Impact

Force of Impact

The force with which a moving object hits another object is called **force of impact.** Three factors determine how hard something will hit another object—speed, weight, and distance between impact and stopping.

Speed Speed is the most important factor in determining how hard a vehicle will hit another object. The force of impact is in proportion to the square of the increase or decrease in the vehicle's speed. Any reduction in speed will greatly reduce the damage inflicted. Always try to reduce speed in an emergency.

Weight The heavier a vehicle, the more damage it will cause in a collision. A vehicle weighing twice as much as another vehicle will hit a solid object twice as hard.

Distance Between Impact and Stopping The distance a vehicle covers between the instant it hits an object and the moment it comes to a stop can vary greatly. Imagine hitting barrels filled with sand sitting in front of a light post rather than hitting the post itself. The barrels will slow you as you hit them rather than stopping you like the post would. This is why traffic engineers put cushioning materials in front of solid roadside objects.

Safety Belts

Three collisions occur when a vehicle hits a solid object. First, the vehicle hits the object and stops. Second, the occupants either hit the inside of the vehicle or their **restraint devices.** Third, occupants may suffer internal collisions as their organs impact inside their bodies.

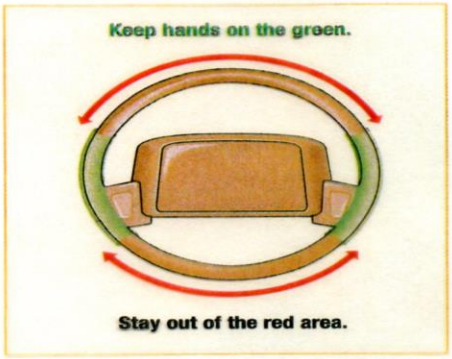
passive restraint device, such as an air bag, is a part that works automatically. A device you have to engage, like a safety belt, is called an **active restraint device.**

How to Wear Safety Belts

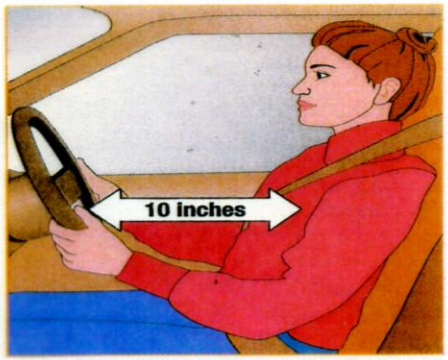
What can you do ahead of time to reduce the possibility of serious injury? Using safety belts is your number one defense. Safety belts will hold you in place during an emergency and prevent you from being thrown from your vehicle.

Air Bags

An air bag is a balloon-type device that automatically inflates to protect you. They deploy at speeds over 200 mph.



A balanced steering position between the 10 and 2 o'clock or the 8 and 4 o'clock position is best to avoid injury from an air bag.



You must have 10 inches or more between your chest and the air bag in the steering wheel.

- Air bags are designed to work with safety belts. That is why air bags are called a supplemental restraint system. Most air bags protect in frontal collisions only.

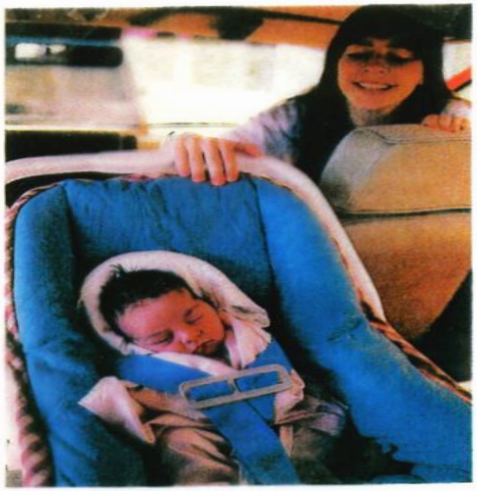
Other Protection Devices

- **Automatic safety belts** Some vehicles have automatic safety belts for occupant protection. To use these belts, you must make sure your lap belt is buckled low and across your hips. Then when your door is shut, your shoulder belt is drawn into place as shown in the picture.
- **Front and rear crush areas** Vehicles are now designed to have their front or rear end crush on impact. When this happens, the dramatic force of impact is lessened for occupants in the vehicle.
- **Energy-absorbing bumpers** Most vehicles are now equipped with bumpers that are designed to absorb low levels of impact under 5 mph without damage. This will provide protection in many minor collisions.
- **Side door beams** Many vehicles now have steel beams built into the side doors. These beams provide valuable protection in collisions where you are hit on an angle.

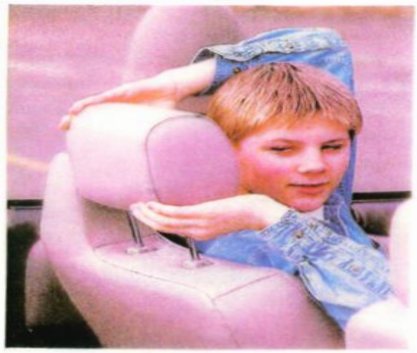
Reinforced windshield To avoid flying glass in a collision, vehicles now have laminated windshields. This means the windshield is really two pieces of glass with a thin layer of plastic in the middle.

Energy-absorbing steering wheel and column This type of steering wheel and column is designed to compress when hit.

- **Padded dash** This design feature can reduce injury in all crashes.
- **Child seats** The use of special seats for infants and small children is required in every state. These seats must be used in the back seat of your vehicle, as shown in the picture



Always use child seats in the back seat.



Adjust your head restraint to reach the middle of the back of the head.

- **Head restraints** Padded head rests on the top of seats are designed to protect you against whiplash injuries. To make sure you get the full benefit of this protection, adjust your head rest as shown in the picture.

The Des Moines Register

TUESDAY

April 18, 2006

Teen driver bill likely to die in House

By JONATHAN ROOS
REGISTER STAFF WRITER

Teen driver legislation that Gov. Tom Vilsack made a top public safety priority is likely dead for the year.

"It just got weighed down with too many amendments," on issues ranging from keg registration to driver education by parents of homeschoolers, said Rep. Dave Tjepkes, a former state trooper from Gowrie.

Public safety officials who campaigned on behalf of the Iowa KYDS (Keep Young Drivers Safe) Initiative said they would try again in 2007.

"Far too many Iowa teens are killed each year on Iowa roadways from preventable crashes," said Iowa Public Safety Commissioner Kevin Techau. "We are disappointed that the Legislature wasn't able to work with us to implement the evidence-based solutions we proposed that will save many Iowa teens' lives."

Vilsack, at a special appearance at Des Moines' Lincoln High School in January, called for new limits on teen drivers — including tighter restrictions on passengers and late-night driving, and a new ban on cell phone use while driving.

Lawmakers dropped the proposals after they drew opposition from some businesses and parents, especially in rural areas. Critics questioned whether the changes would have made a significant difference.

Instead, the Senate approved a stripped-down bill last month that would have increased behind-the-wheel training for young drivers and required that more time be spent in driver education classes on teaching about the effects of alcohol.

Senate File 2346 also would have required that back-seat passengers younger than 18 wear seat belts. The current safety-restraint age requirement is 10 or younger for back-seat occupants.

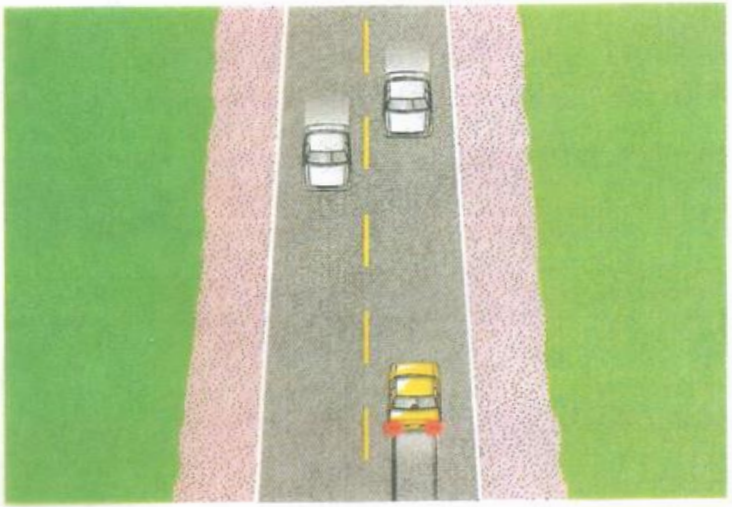
In addition, the legislation would have made it easier to sue adults who provide alcohol to minors.

The bill has been awaiting debate in the House. Tjepkes, a Republican, said there aren't enough votes to pass it. Legislative leaders hope to wrap up the 2006 session before the end of the month.

Veteran driver education instructors like Curt Hanson of Fairfield were disappointed that the Legislature failed to embrace the original public safety initiatives, designed to cut down on driving distractions.

Decision Making

1. What two things has this driver done to adjust to the air bag?



2. You are driving the yellow car and have locked your standard brakes to avoid a head-on collision. Your wheels are sliding. You want to head for the shoulder to avoid trouble. What should you do?

3. You are approaching this curve at 40 mph. To maintain control, when should you adjust your speed?

4. The driver ahead is braking to maintain control. What two factors might increase the stopping distance in this situation?