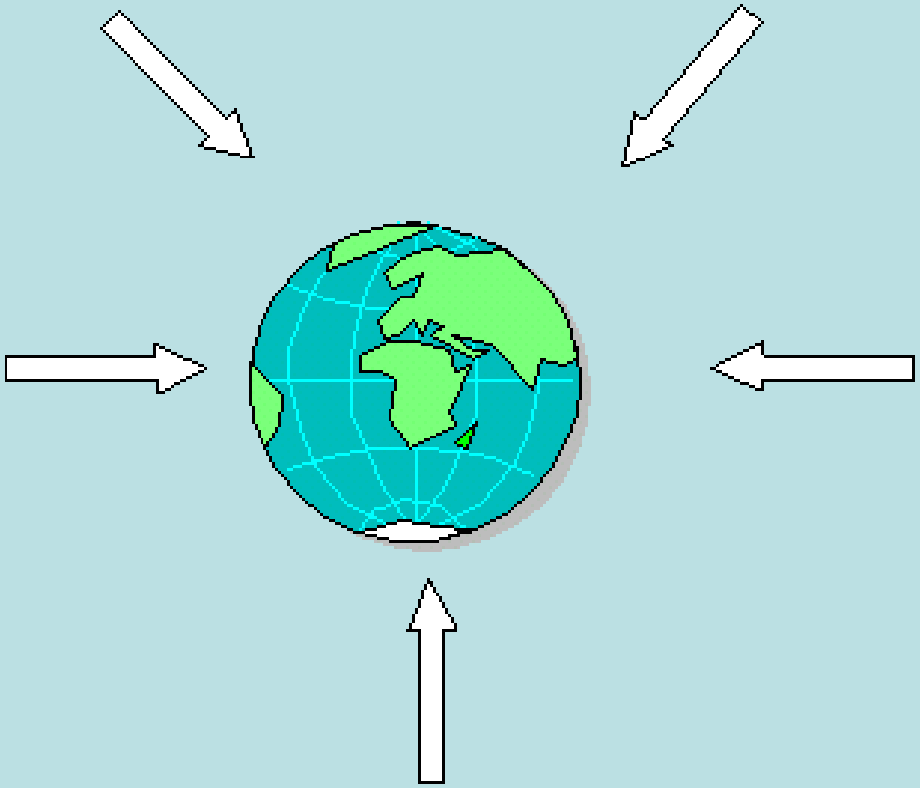
Chapter 5

5.1 Gravity and Energy of Motion

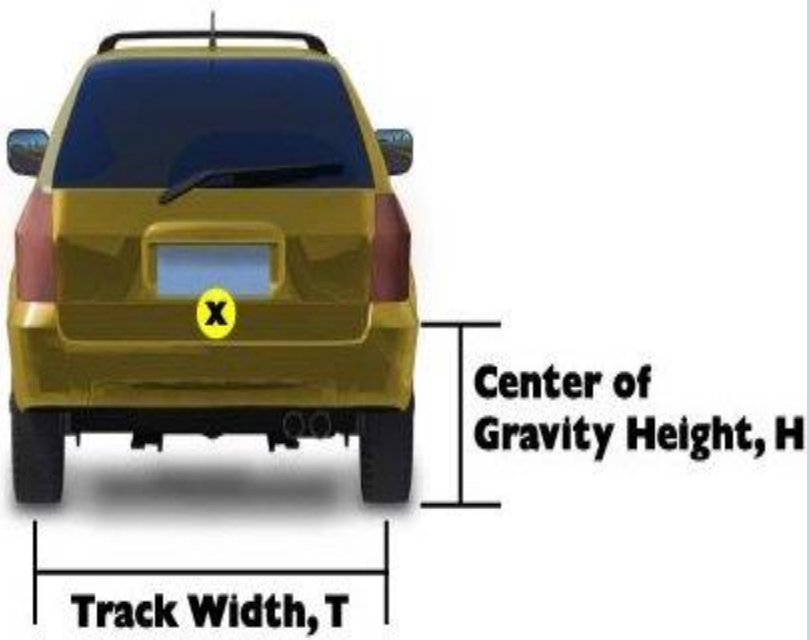
- Gravity and energy of motion are natural laws that will affect the way your vehicle performs.

- **Gravity-** is the force that pulls all things to Earth.

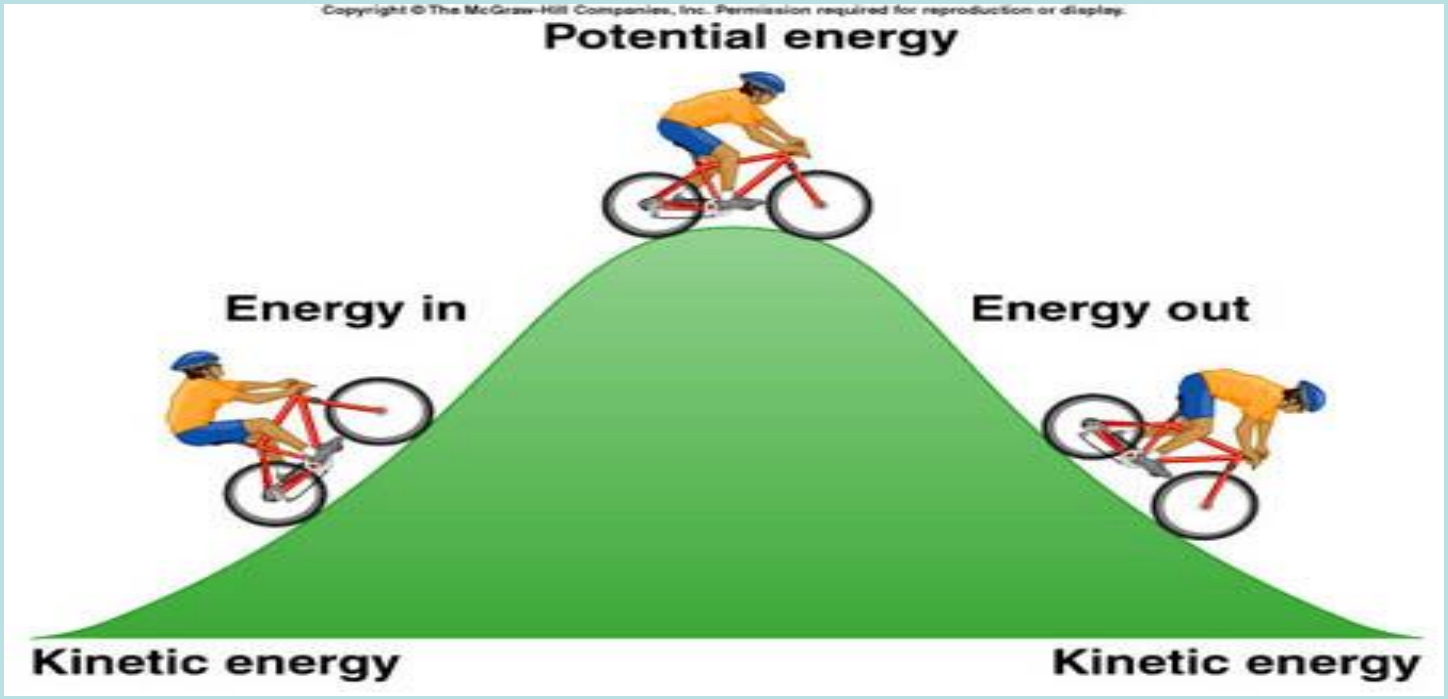


- In an uphill situation your actual stopping distance decreases.
- On a downhill road, your actual braking distance increases.

- **Center of gravity-** the point at which an object's weight is evenly distributed.
- Automotive engineers try to make a vehicle's center of gravity low so that it can perform better.



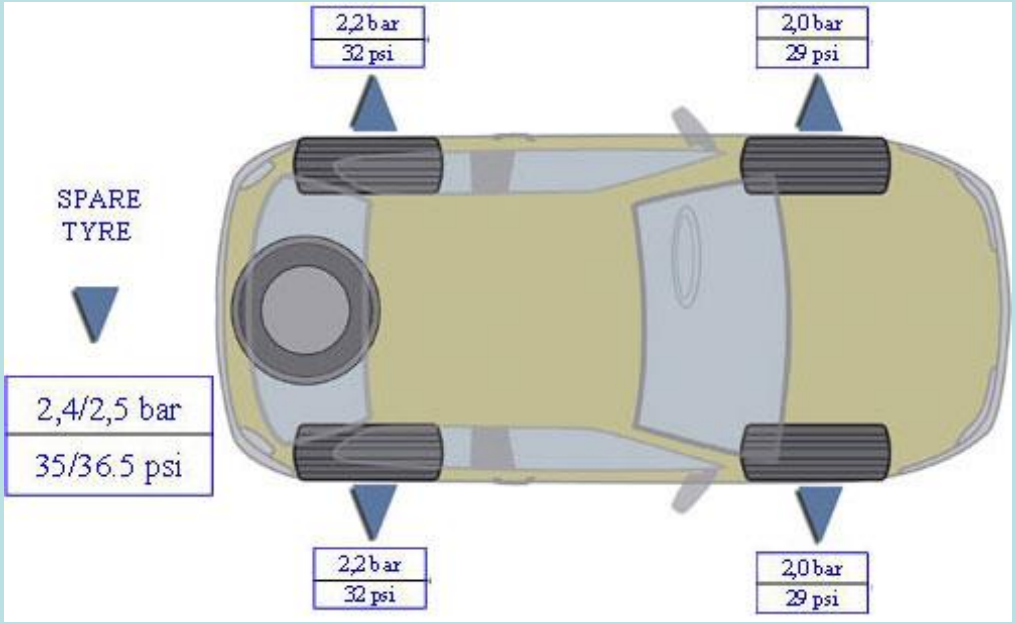
- **Energy of motion (kinetic energy)** when an object moves it acquires energy.
- The faster your vehicle moves, the more energy of motion it has.
- **Energy of motion** is also affected by the weight of the moving object.



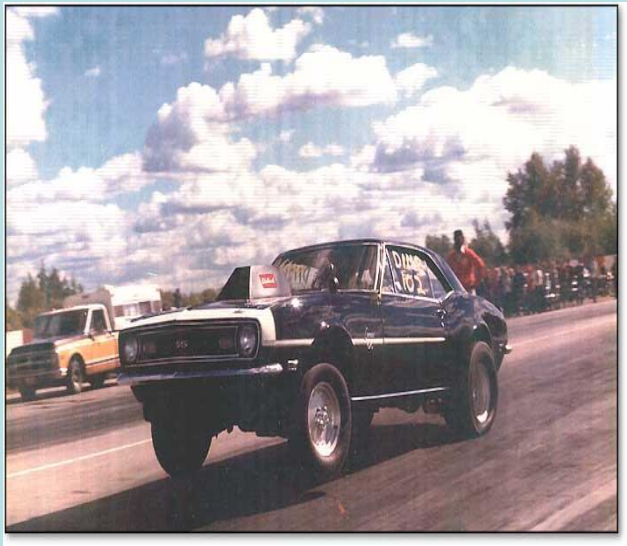
5.2 Friction & Traction

- Your 4 tires and their footprints that touch the road are the first and one of the most important parts to the control system.

- **Friction-** the force that keeps each tire from sliding on the road.



- 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.
- driving with low pressure in your tires =
- Less traction
- Can make you crash
- Gets you poor gas mileage

Tread and Traction

- **Tread** is the grooved surface of a tire that grips the road.
- **Example**: When the road is wet, the tread allows water to flow through the grooves and away from the tire.
- This allows the tire to grip the road and not lose traction.

Which of the tires are not made for street applications right or left?

- If any part of Abe Lincoln's head is covered by the tread, you're driving with the legal and safe amount of tread.
- If you can see above his head, where it says "In God We Trust," you're ready for a new tire.

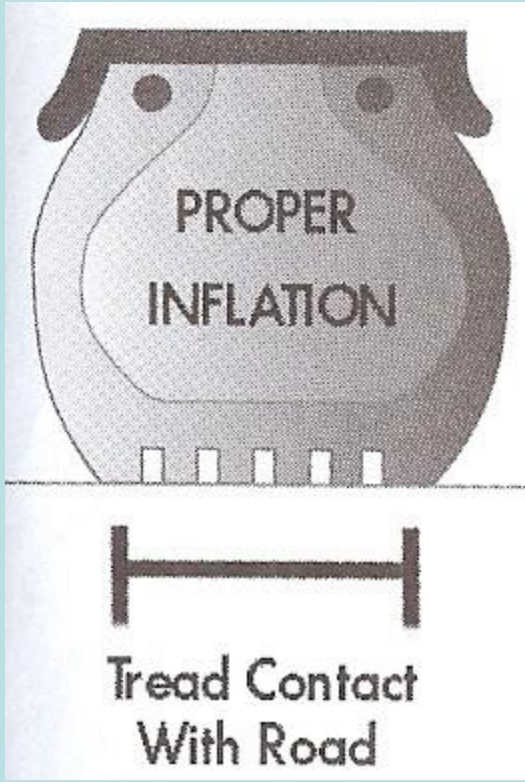
- A tires gripping ability will increase as the amount of tread touching the road increases.

- A worn, bald tire is dangerous.
- A bald tire will not grip a wet or icy road, because it has no tread, the tire may puncture.
- If this happens, the tire could suffer a blowout when all the air escapes at once

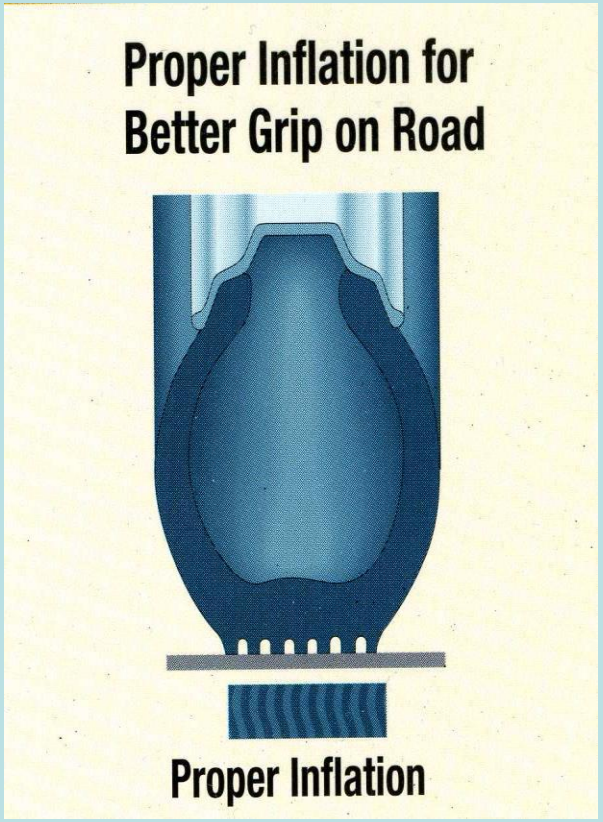
Inflation and Traction

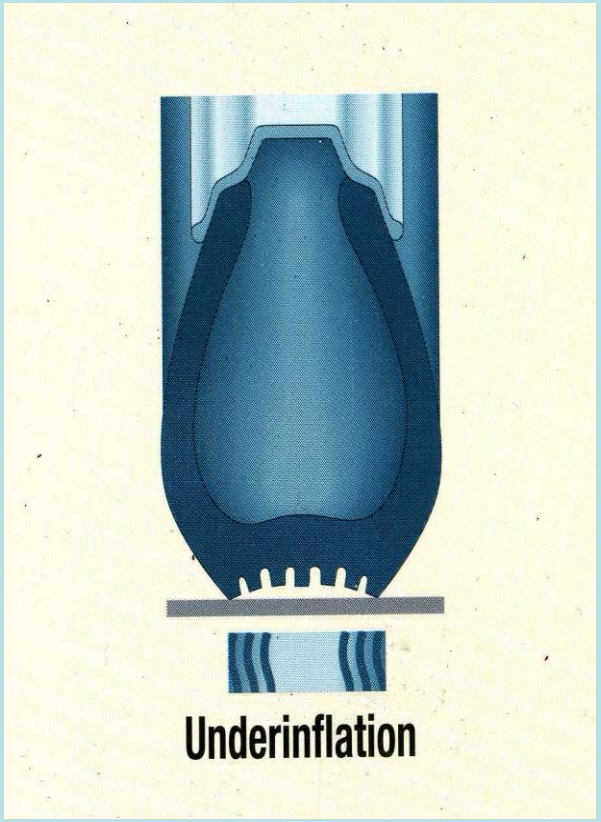
- Check your owner's manual for the best pressure to use.

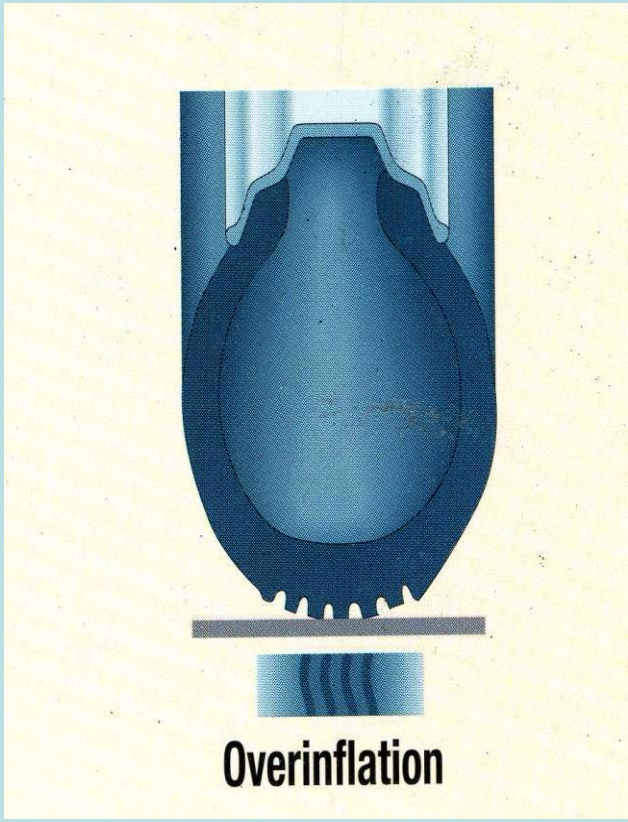
- When your tire pressure is right, you will get your best gas mileage and tire wear because tires roll easier at the right pressure.



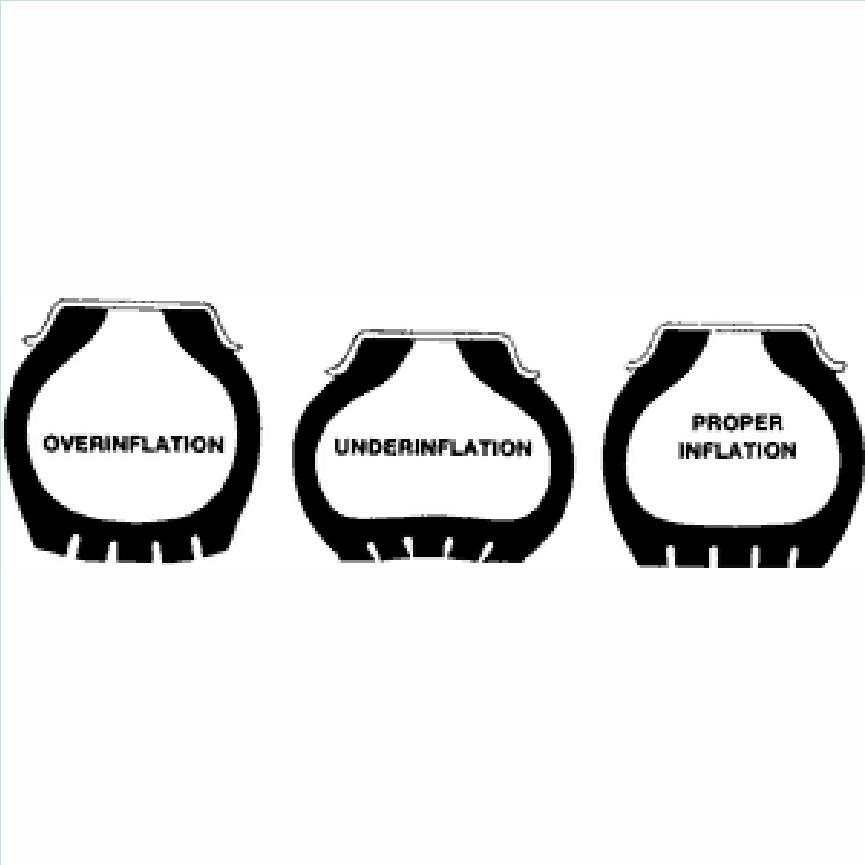
Tire Footprint







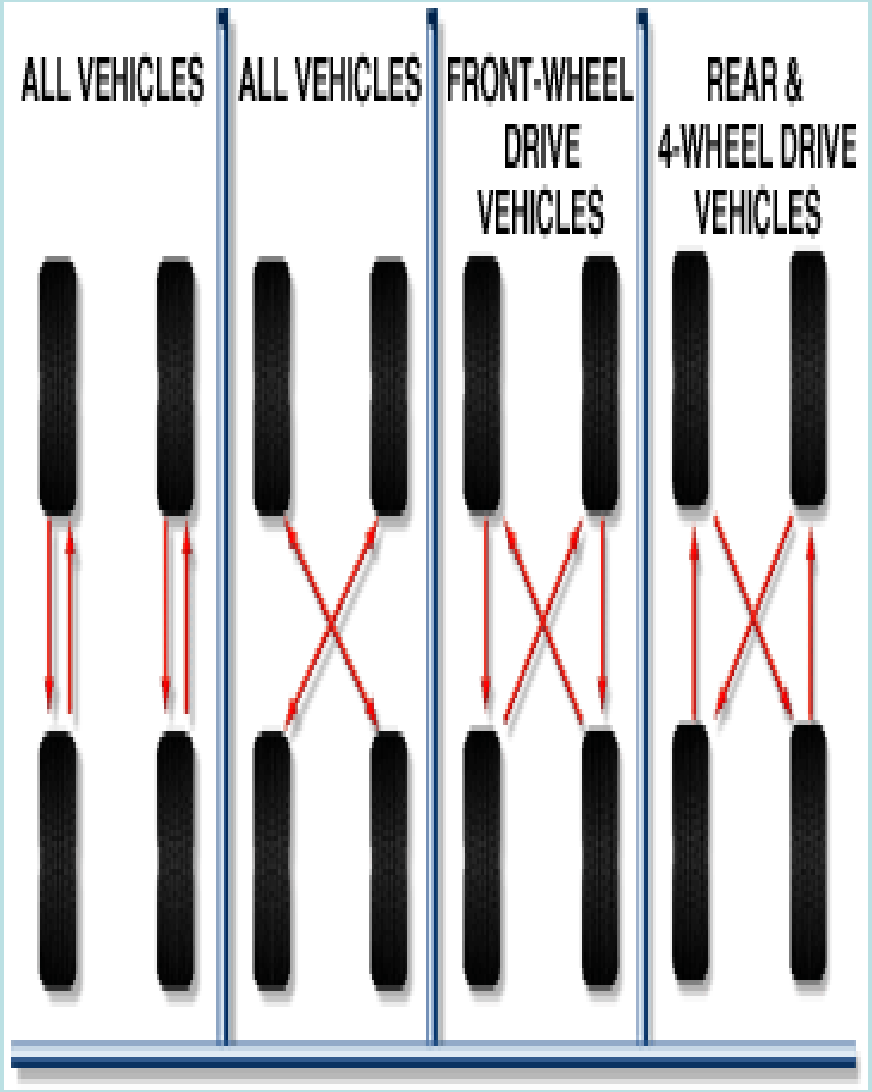
Check your pressure when the tires are cold, before you start driving.

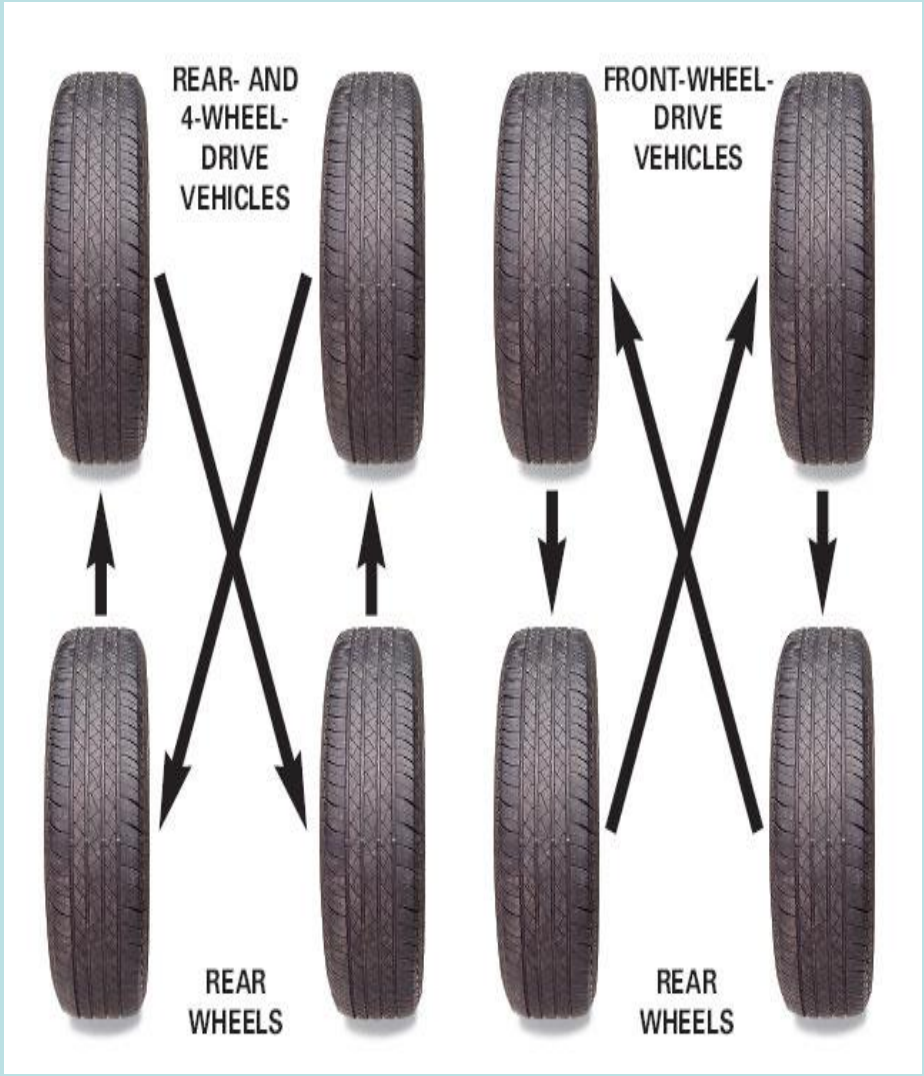


RUN FLAT TIRES

- **A run-flat tire is a tire that is designed to resist the effects of deflation when punctured, and to enable the vehicle to continue to be driven at reduced speeds 55 mph and for limited distances of up to 100 miles or even 200 miles depending on the type of tire.**

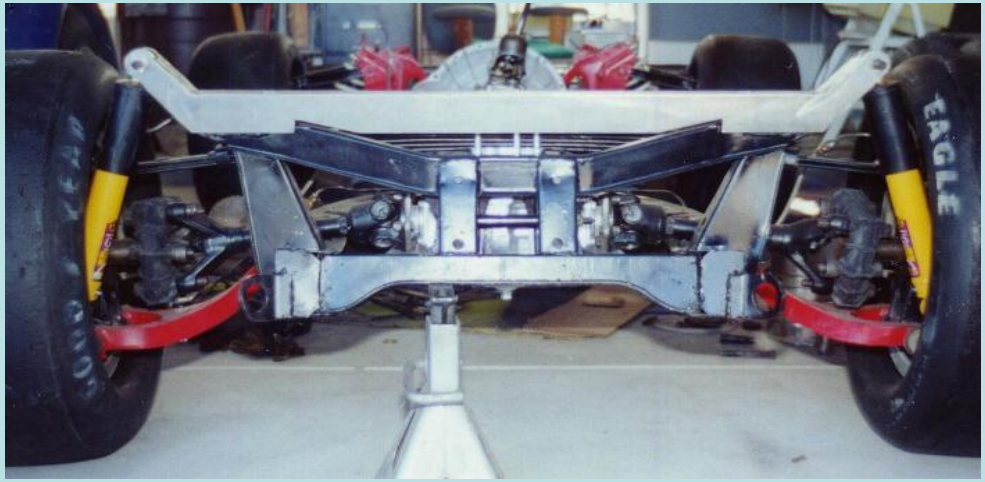
Tire Rotation

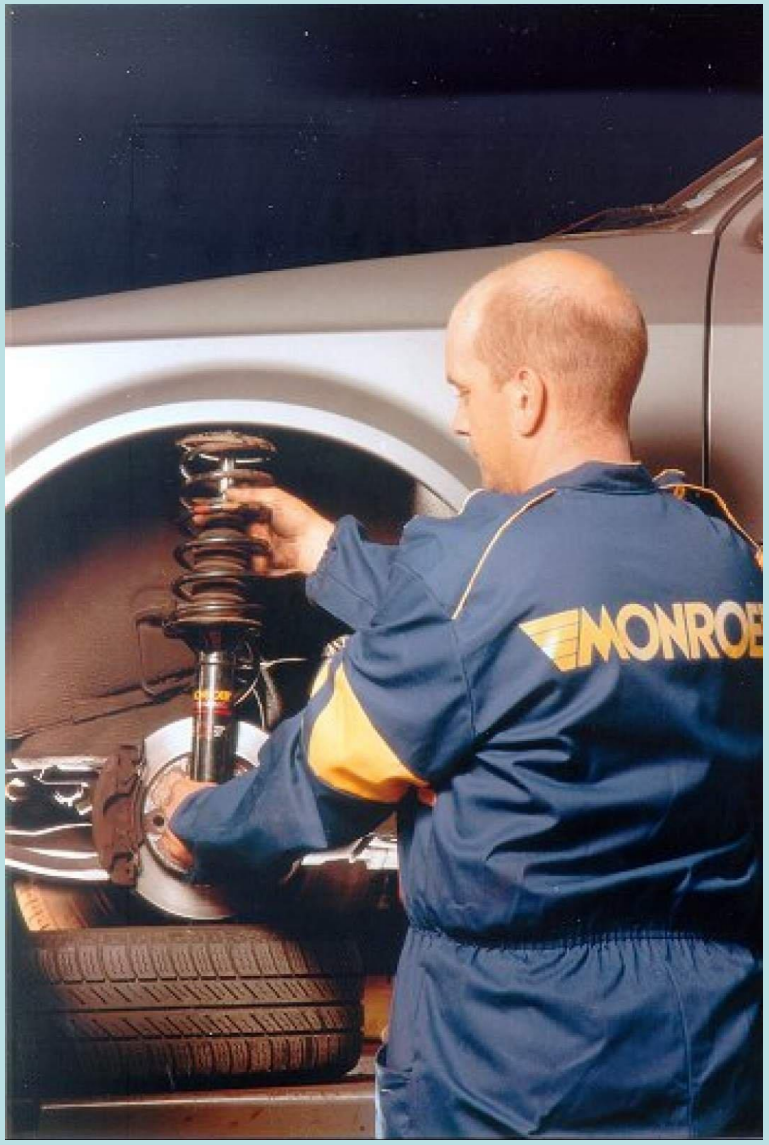




Shock Absorbers

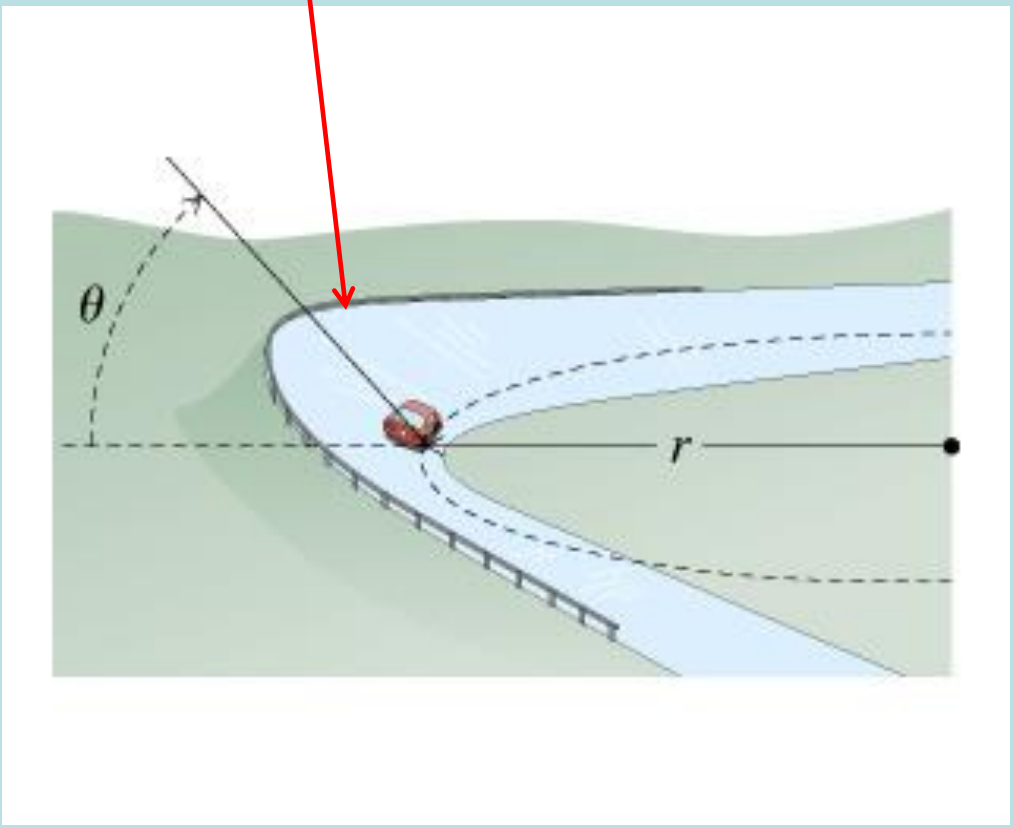
- A shock absorber is a suspension component that controls the up-and-down motion of the vehicle's wheels.





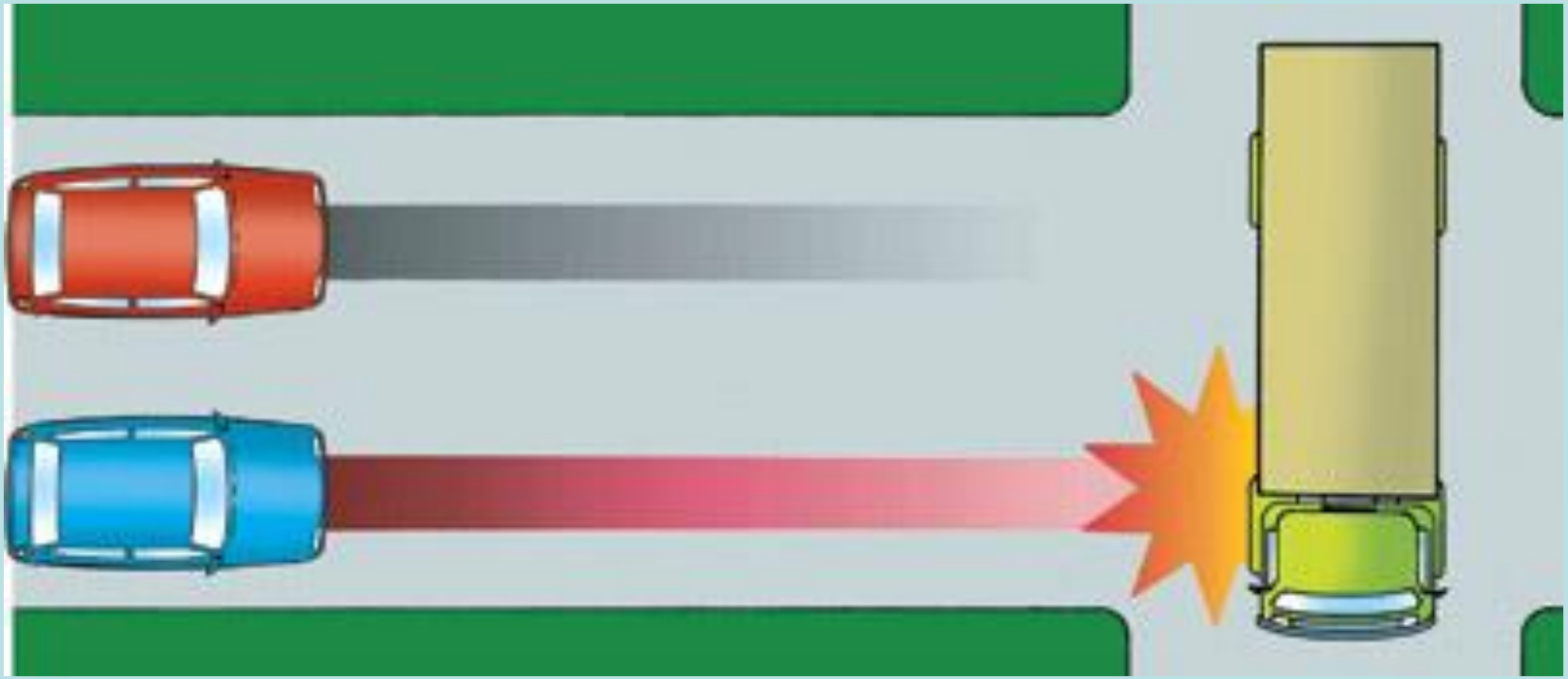
Vehicle Control Factors for Curves

- Speed
- Sharpness of curve
- Banked curves
- Load



5.3 Stopping Distance

- Total stopping distance- the distance your car travels while you make a stop.
- Measured from the point you see a hazard to the point where your vehicle stops.



Stopping Distance

- When a vehicle's weight doubles, it needs about **twice** the distance to stop.

- When a vehicle's speed doubles, it needs about four times the distance to stop. (Squared)

- If you triple the speed you will need ___ times the distance to stop.

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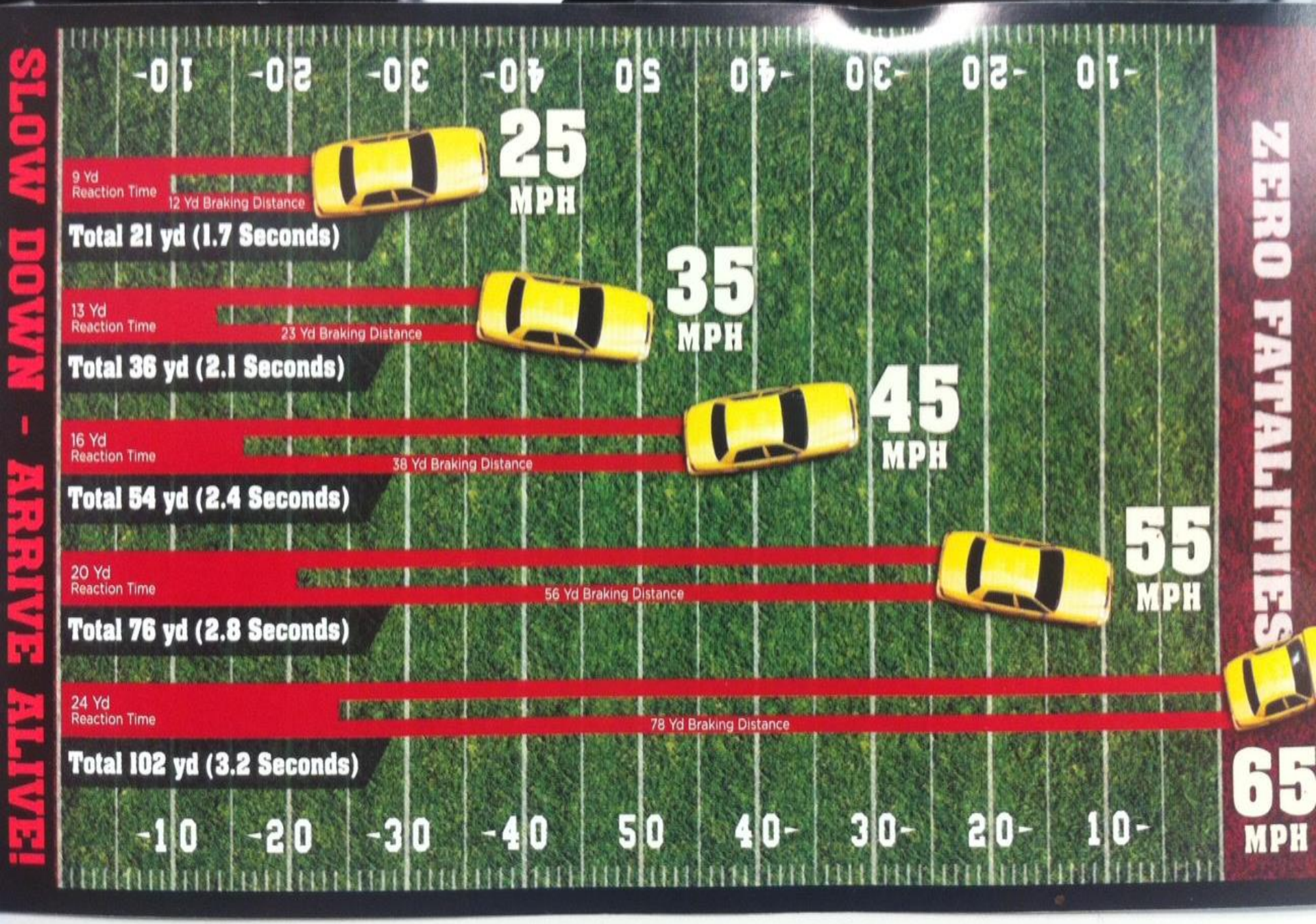
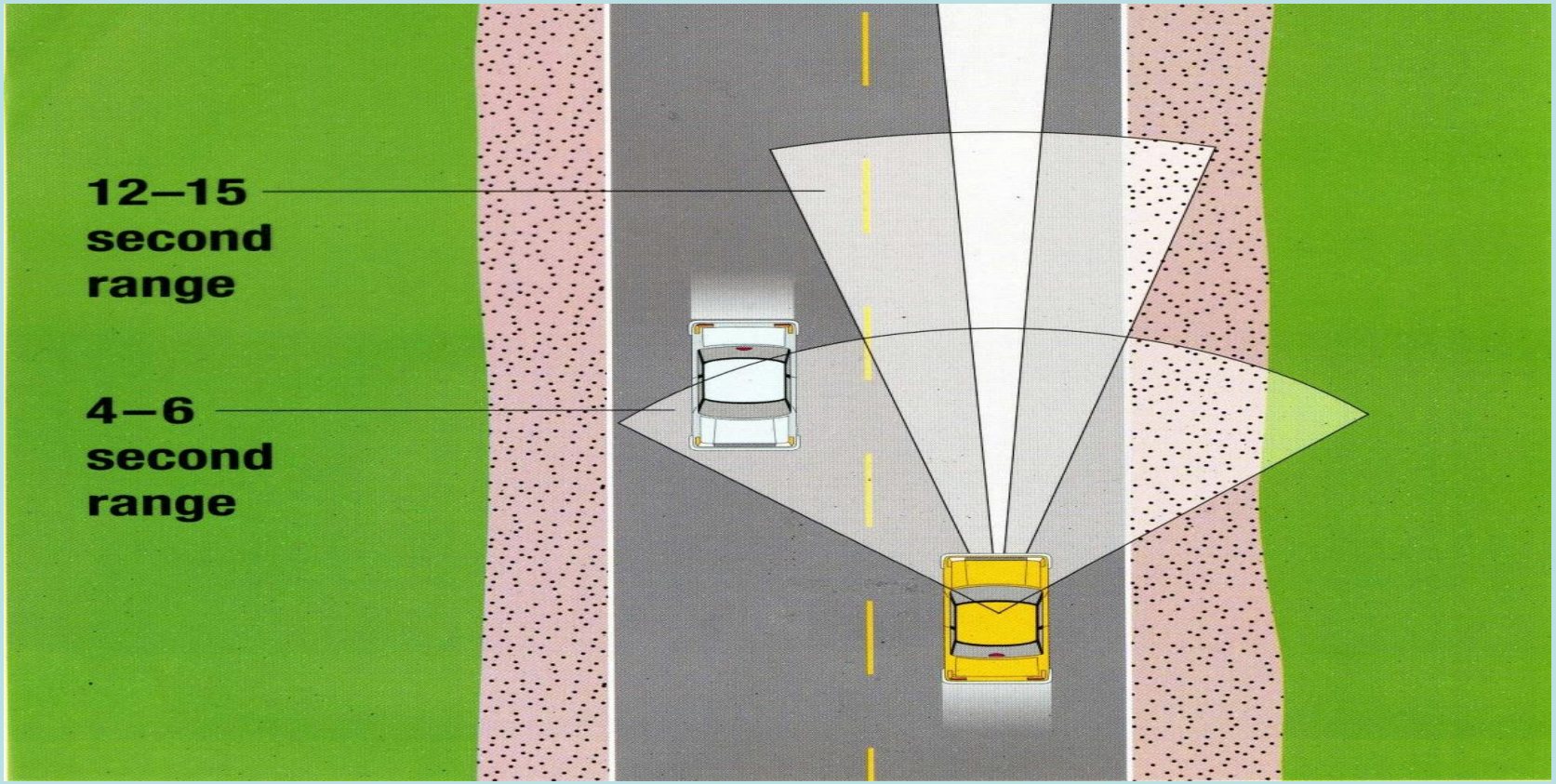

SLOW DOWN - ARRIVE ALIVE!
ZERO FATALITIES
25 MPH
9 Yd Reaction Time
12 Yd Braking Distance
Total 21 yd (1.7 Seconds)
35 MPH
13 Yd Reaction Time
23 Yd Braking Distance
Total 36 yd (2.1 Seconds)
45 MPH
16 Yd Reaction Time
38 Yd Braking Distance
Total 54 yd (2.4 Seconds)
55 MPH
20 Yd Reaction Time
56 Yd Braking Distance
Total 76 yd (2.8 Seconds)
65 MPH
24 Yd Reaction Time
78 Yd Braking Distance
Total 102 yd (3.2 Seconds)

Perception time and distance

- **Perception time**- the length of time you take to identify, predict and decide to slow for a hazard.
- Will vary depending on visibility and your abilities.
- Look 12 to 15 seconds down the road to see hazards sooner.

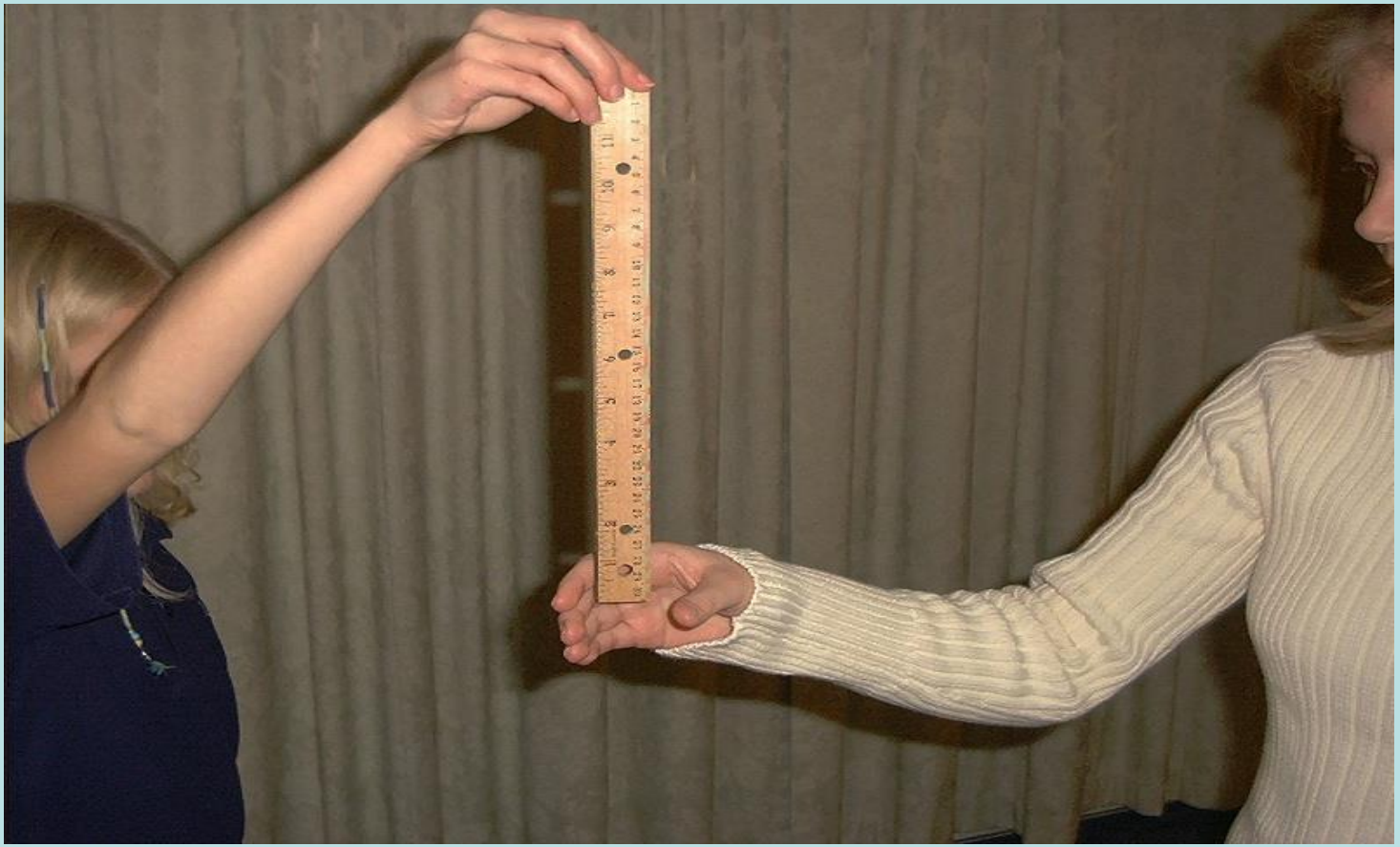


Braking distance

- The distance your vehicle travels from the time you apply the brake until you stop.

Reaction Time

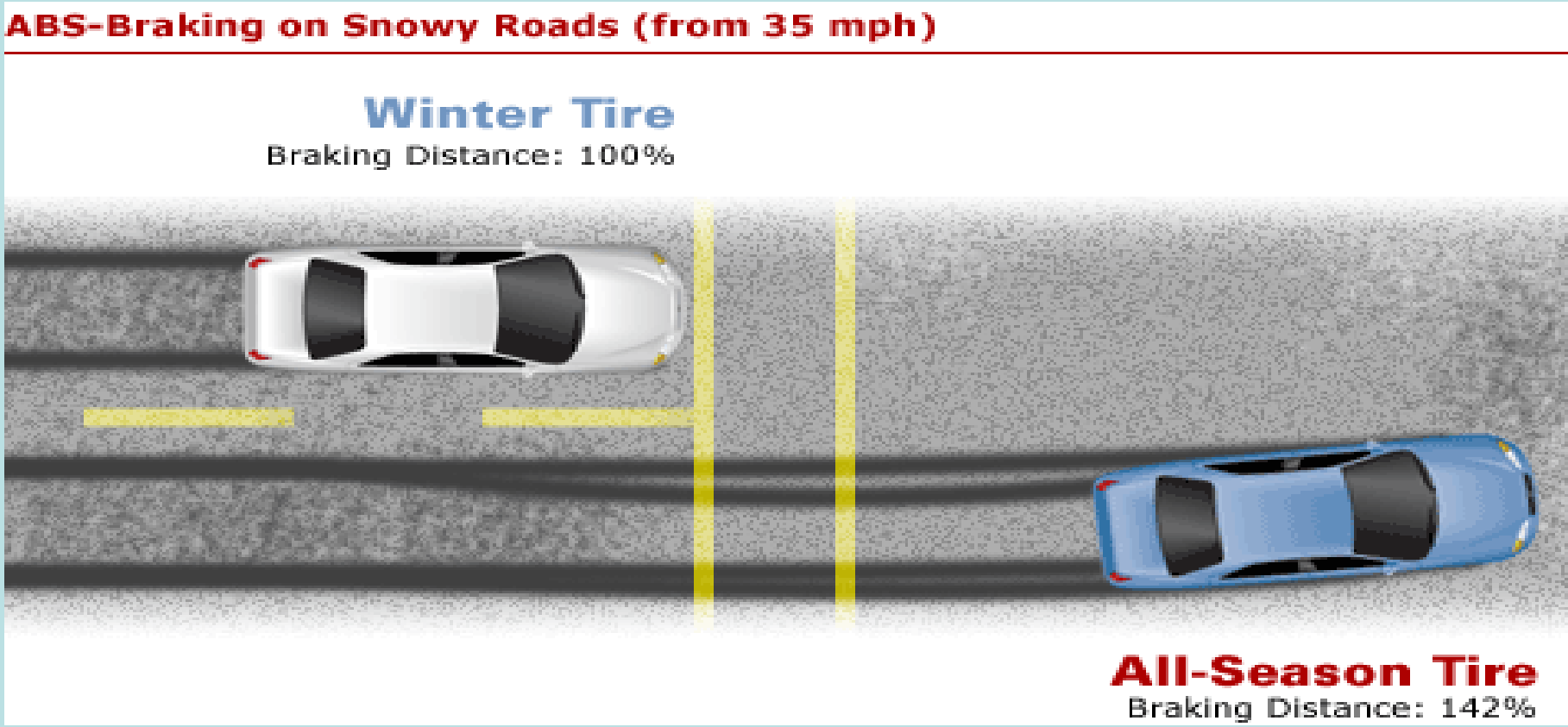
- Once you recognize a hazard, the length of time you take to execute your action is your **reaction time**.



Factors that affect braking distance

- **Speed**- the higher you 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.



Factors that affect braking distance

- **Anti-lock brake system**- If your car has an ABS System you can better control your stopping distance while turning.

Factors that affect braking distance

- **Hills-** your braking distance increases when driving downhill
- **Loads-** heavy loads increase your braking distance.

5.4 Controlling the force of impact

- **Force of impact-** the force in which a moving object hits another.

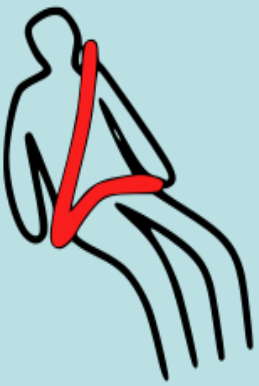
- 3 factors determine how hard something will hit another object.

Speed

Weight

Distance between impact and stopping

- **Speed-** Speed is the most important factor in determining how hard a vehicle will hit another object.
- **Weight-** the heavier the vehicle the more damage it will cause in a collision.
- **Distance between impact and stopping-** will vary.



Safety Belts

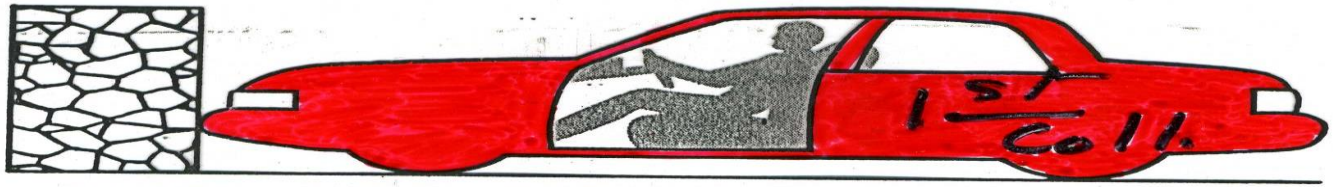
- When a vehicle hits a solid object 3 collisions occur…
- The vehicle hits the object and stops.

- The occupant/s either hit inside of the vehicle or their restraint devices.

- Occupants may suffer internal collisions as their organs impact inside their bodies.

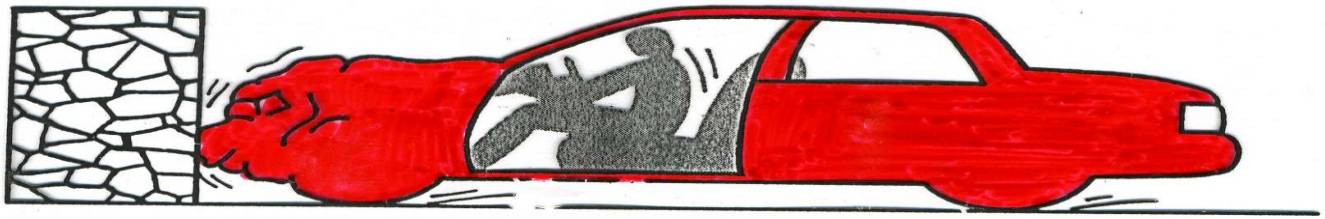
- 1st
- 2nd
- 3rd

THE 30 MPH COLLISION



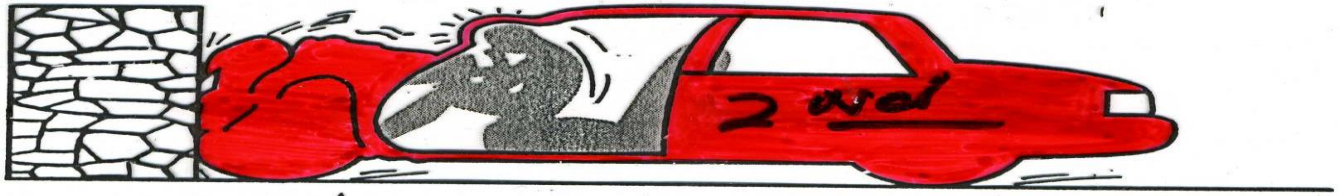
0.00 SECONDS—CAR HITS BARRIER

On impact, the car begins to crush and to slow down. The person inside the car has nothing to slow them down so they continue to move forward inside the car at 30 mph.



0.05 SECONDS—CAR CRUSHES

The car slows down as the crushing of the front end absorbs some of the force of the collision. The person inside is still moving forward at 30 mph.



0.10 SECONDS—CAR STOPS
0.12 SECONDS—PERSON HITS CAR INTERIOR

The car has come to a complete stop within one tenth of a second. However, the unbelted driver is still moving along inside the car at 30 mph. It will take the driver about one-fiftieth of a second more to hit something—say, the windshield or the steering wheel. That's the human collision. It happens about 0.02 seconds after the first collision and safety belts can mak a big difference in determining how seriou at uman collision is. A lot of people think they are strong enough to brace themselves in a crash. They aren't. Safety belts are, though. And that's why people need them, even in a low-speed crash.

- **Restraint device-** any part of a vehicle that holds an occupant in a crash.

- **Passive restraint device**- air bag (automatically)

- **Active restraint device –** safety belt (you engage)