# COMMON CAUSES & PHYSICS OF CAR CRASH

Every year, there are over 6 million car accidents in the United States alone. While some may be simply "fender benders," many others result in extensive damage, serious injury and death.

Understanding what causes most accidents, and furthermore what physical forces are at play in a crash, may help you understand how you can become a safer driver and avoid being a statistic.

## ACCIDENT AVOIDANCE

The best way to avoid being hurt in a car accident is to not be in one in the first place. If you have taken a driver education course in school, a one-day class to help reduce your insurance costs, or you've simply read the news, you are without a doubt familiar with the fact that driving while intoxicated is an extremely dangerous and criminally punishable behavior.

# COMMON CAUSES
## OF TRAFFIC ACCIDENTS

## DRUNK DRIVING

**#1** Deadliest Cause in U.S.

**29** DEATHS
**800** INJURED
Each Day in the U.S.

A blood alcohol level above **0.10** is **7X** more likely to be involved in a fatal accident.

**25%** Of All Traffic Fatalities

## THE ROLLING RIGHT TURN ON RED

**6%** OF ALL PEDESTRIAN FATALITIES

**21%** OF WHICH ARE CHILDREN

## ASLEEP AT THE WHEEL

**6%** OF ALL CAR CRASHES

**21%** OF FATAL CRASHES

Humans need **7-9 HRS** of actual sleep.

**37%** Admit falling asleep while driving at least once.

# LOSING CONTROL

**1/2** of all drivers rank themselves in the top **20%** in terms of driving safety and skill

**5%** TOO FAST ON SHARP TURNS

**2%** TOO FAST ON WET ROADS

**+ 4%** DRIVER/SUDDEN TURN SURPRISES US

**11%** OF ALL MOTOR VEHICLE CRASHES

# DRIVING BLIND

**12%** OF ALL CAR CRASHES

- Running a red light.
- Speeding & unaware of an upcoming intersection.
- Making a left turn when a large vehicle blocks your view.

## REAR-END COLLISION

**23-30%** OF ALL CRASHES

We barely save **26SEC/DAY** by hurrying.

## DISTRACTED DRIVING

**33%** OF ALL ACCIDENTS

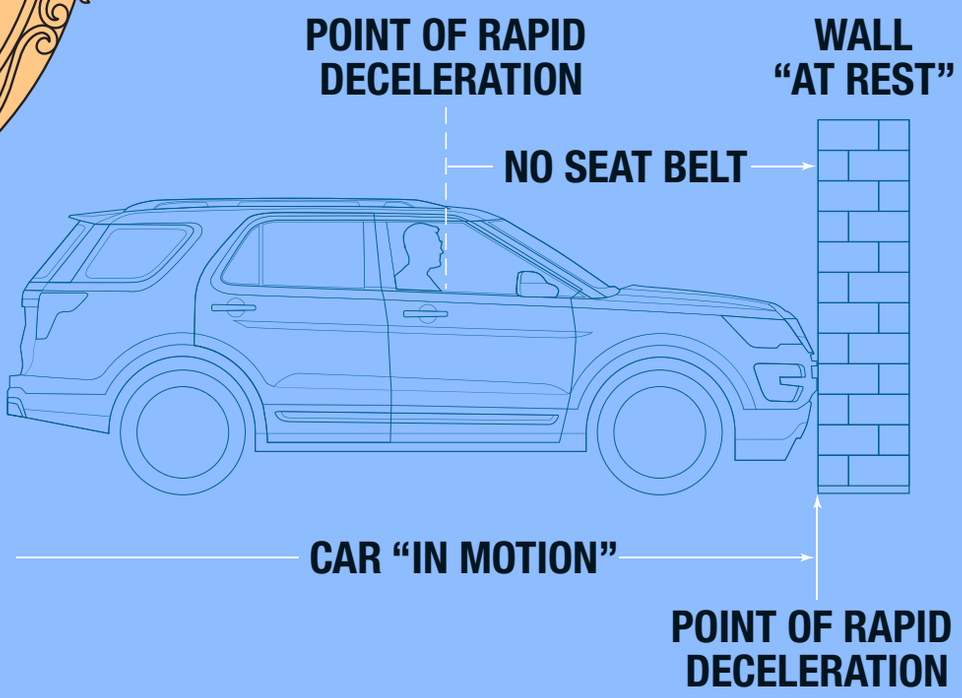
Cell Phones • Billboards • Other Accidents
Activities within the Car • Simple Mind-wandering

# CAR CRASH SCIENCE

While no two vehicle crashes are ever exactly the same, the physical laws of our universe are always the same. This was discovered, quantified and published by Sir Isaac Newton back in 1687. His formulas are still used today by crash investigators and accident reconstruction specialists.

# Newton's First Law of Motion

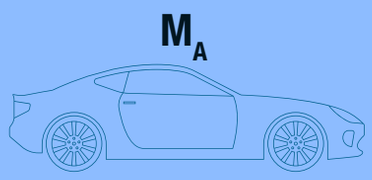
A body in motion will continue moving in the same speed or in the same direction unless or until it is acted upon by an external force. It also states that an object "at rest," (that is, not moving), will continue to be at rest until some outside force acts upon it.



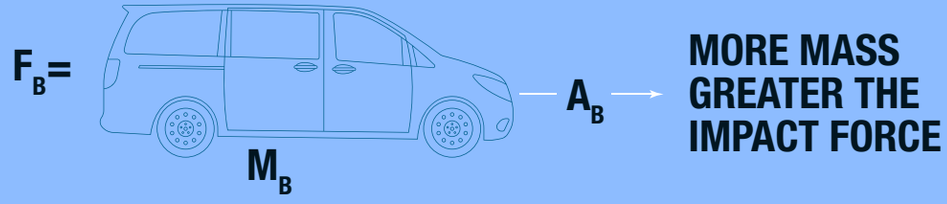
# Newton's Second Law of Motion

Acceleration is produced when a force acts upon a mass. The greater the mass of the object, the more force is required to accelerate that object. As it relates to car crashes, the impact force of a car on another object is equal to its mass multiplied by its acceleration, of which speed is part of the calculation.

**Force (F) = mass (m) x acceleration (a)**

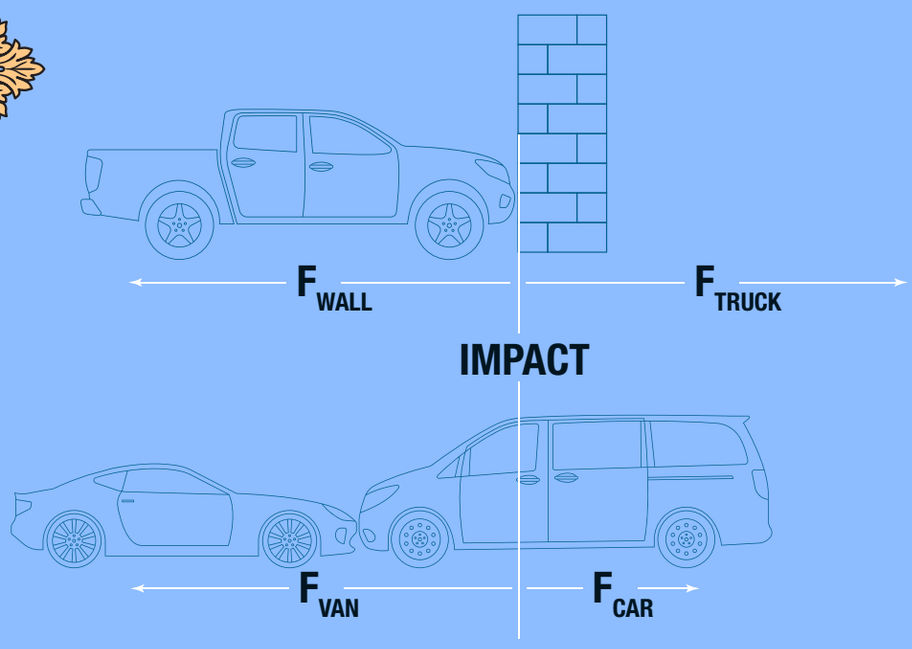
$F_A =$ 


**HIGHER THE SPEED GREATER THE IMPACT FORCE**



# Newton's Third Law of Motion

For every action, there will be an equal and opposite reaction.

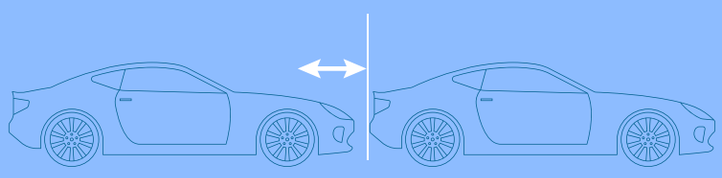



# Two Types of Collisions

While there may be an infinite way in which two vehicles can collide, in terms of physics there are only two: **elastic** and **inelastic**.

## ELASTIC

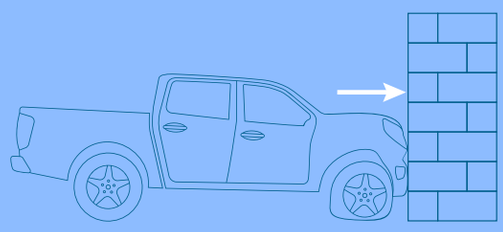
Bumper deforms and then bounces back, transferring all the energy directly back into motion.



LOW SPEED IMPACT

## INELASTIC

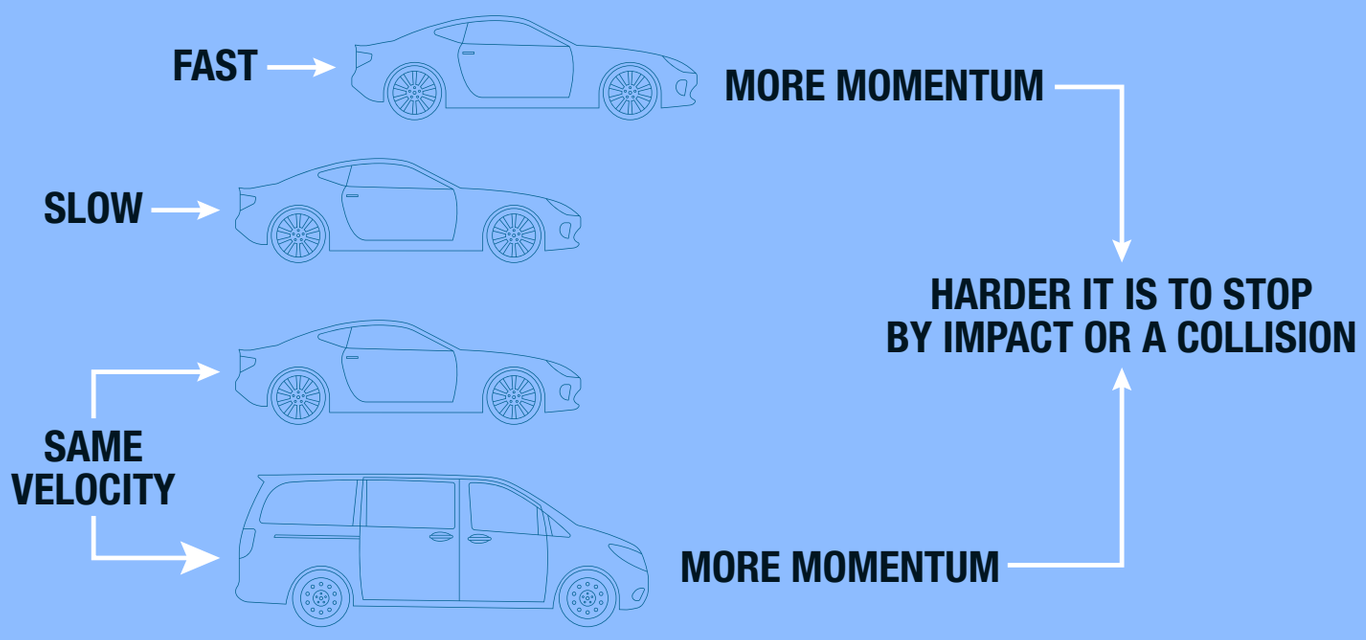
Bumper crumples but vehicle does not bounce away from other object.



HIGH SPEED IMPACT

# Momentum

Defined as "mass in motion," all moving objects have momentum.
**Momentum (p) = mass (m) x velocity (v)**




# Vehicle Features That Help In Crashes

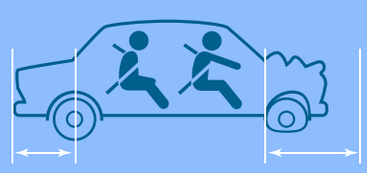
## SEAT BELTS

Connects passengers to the vehicle so their momentum is slowed down at the same speed as the car. Spreads stopping force across the sturdier parts of a person's body in order to minimize injury. Reduces chance of dying in an auto accident by at least 45%, it cannot restrain the head.

## AIRBAGS

Designed to help slow and stop vehicle occupants from continuing forward after a crash and being ejected from the vehicle or striking hard surfaces. Helps prevent damaging the neck.

## CRUMPLE ZONES



Allows the vehicle to absorb some of the initial impact and decrease the force applied to the vehicle occupants. Decelerates the car and spread its energy to other structural components of the car. The passenger compartment is built to prevent collapsing around the occupants, redirecting energy away from them to reduce injury.

Very high speed crashes effectively nullify the protections of seatbelts and airbags.

# Is Bigger A Vehicle Better Or Safer For An Accident?

Generally speaking, you are more likely to survive a car crash if you're in a bigger vehicle than the one you're in a collision with. Select a car that has performed well in dynamic crash tests, more than a single, frontal impact. Rollover testing is an example.

**ROLLOVERS**

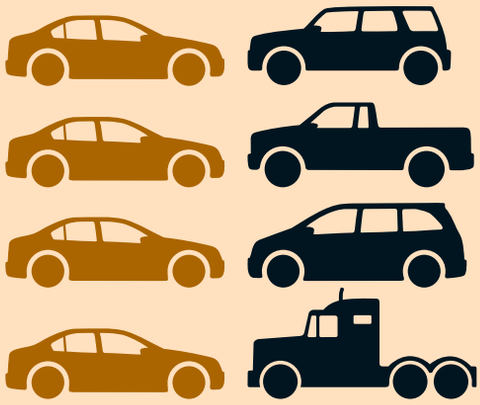
43%

40%

24%

20%

**SEDAN OCCUPANTS**

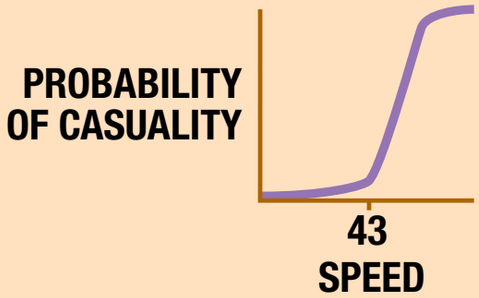


**33X** MORE LIKELY TO BE KILLED IN A HEAD-ON COLLISION

# Can You Survive a 70 mph Crash?

Theoretically, yes, but it very much depends on the type of collision and the safety features of the vehicle.

**43 MPH** Highest speed at which you are likely to survive a head on collision without serious injury in a car with crumple zones and airbags while using of safety belts.




Car manufacturers do not design their vehicles to protect occupants at speeds above this, because the kinetic forces involved are just too great.

"5-star" or "Good" frontal crash test ratings only applies if you're traveling 40 mph at the time of a frontal collision with a car of similar (or less) weight as yours.

ENERGY@ **80 MPH** **4X** MORE THAN ENERGY@ **40 MPH**

A 70-mph head on collision with four occupants in your car, odds are that only one person in the car will survive the crash. Are you willing to take a chance like that?

**25%** ODDS OF SURVIVAL @ **70 MPH**

# CONCLUSION

Common crash scenarios can easily be avoided by reducing speed, eliminating distractions and leaving extra space between you and other cars. Even though we may think we are excellent drivers, we could all use a (safe) dose of humility when it comes to operating our vehicles. Understanding some of the physics involved in a car crash can help you take precautions such as always using your seatbelt, researching safety ratings when making a vehicle purchase, driving cautiously given the size, weight and speed capabilities of the vehicles we use every day.

## Injured in an automobile accident of any kind? Contact at us today!

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