Teen Driving and Motor Vehicle Crashes

Crash Statistics

- 2006 – Over 43,000 Killed In Crashes Nationwide
- 2006 – Over 770 Killed In Crashes In NJ
- 2006 – Over 300,000 Crashes Reported In NJ

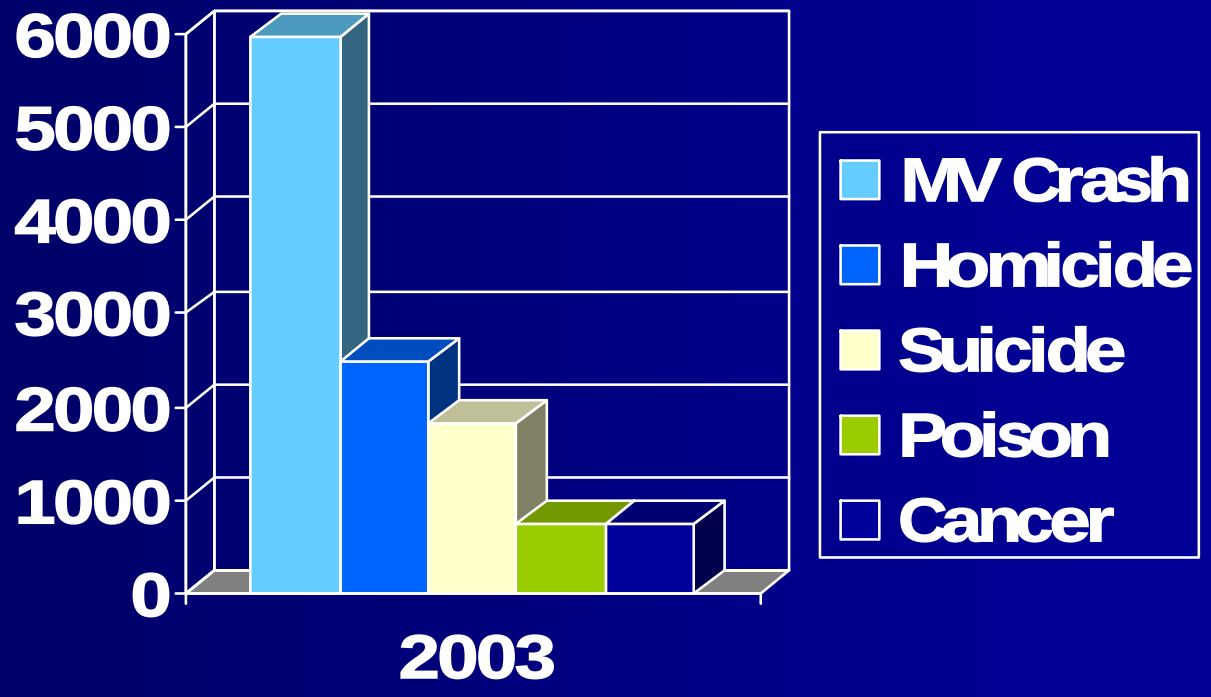
Cause of Death Age 16-20

NHTSA 2003

- #1 - MV Traffic Crashes (5,988)
- #2 – Homicide (2,489)
- #3 – Suicide (1,813)
- #4 - Accidental Poisoning (752)
- #5 – Cancer (749)

Cause of Death Age 16-20

NHTSA 2003



MV Crashes #1 Cause of Death for Youths 16-20

- Approx 1/3 Of All Deaths In This Age Group.
- More Than #2 - #5 Combined
- Why?
  - Inexperience
  - Easily Distracted
    - Driver Inattention #1 Cause Of Fatal Collisions In NJ

What Can We Do?

The Three E's

- Engineering
- Enforcement
- Education

Avoiding Crashes

- We Must Know Our Limitations
- Human Limitations
- Vehicle Limitations

Human Limitations

- Physical Limitations
- Mental Limitations

Three Collisions

Human Limitations

- Vehicle Collision
  - Initial Crash
- Human Collision
  - Body Into Interior Of Vehicle
- Internal Collision
  - Internal Injuries/Lacerations
  - Transection of Aorta
  - Brain Injuries

Cranial Cavity

Three Collisions

Three Collisions

Human Limitations

- Speed Kills?
  - Sudden Stop
  - Tremendous Forces
    - Multiply Weight By Speed
  - Delta V (Velocity Change)
  - Occupant Restraints Increase Time During Delta V

Reducing Forces of the Human Collision

- Occupant Restraints
- Seat Belts
- Air Bags

Occupant Restraints

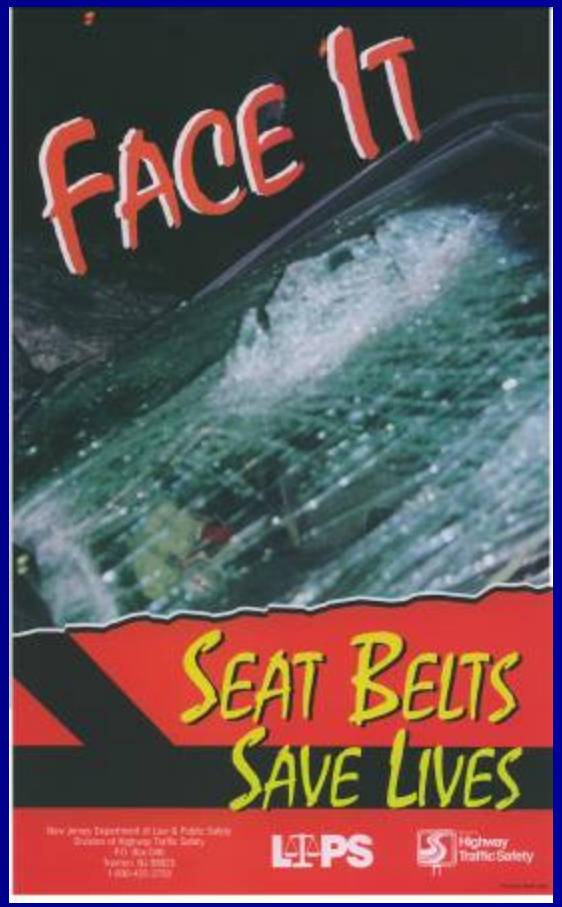
Reducing The Effect Of The Human Collision

- Decrease Injury By Increasing Delta V Time
- Hold Occupants In Place During Collision
- Unrestrained Occupants Act As Human Bullets

Occupant Restraints

Reducing The Effect Of The Human Collision

- Lap Belt
  - Hold Occupant In Position
- Shoulder Harness
  - Stops Jack Knife Effect
- Air Bag
  - Prevents Head Strikes



Perception And Reaction

Human Limitations

- What Is It?
  - Time Needed To Perceive And React
  - No Instant Reactions
- How Long?
  - 1.5 Seconds Average
    - Daytime
    - Experienced Drivers

Visual Acuity

Human Limitations

- Eye Function
  - Rods Vs Cones
    - Rods
      - Are More Sensitive
      - Not Sensitive To Color
    - Cones
      - Sensitive to Color
      - Fovea Centralis (All Cones)

Visual Acuity

Human Limitations

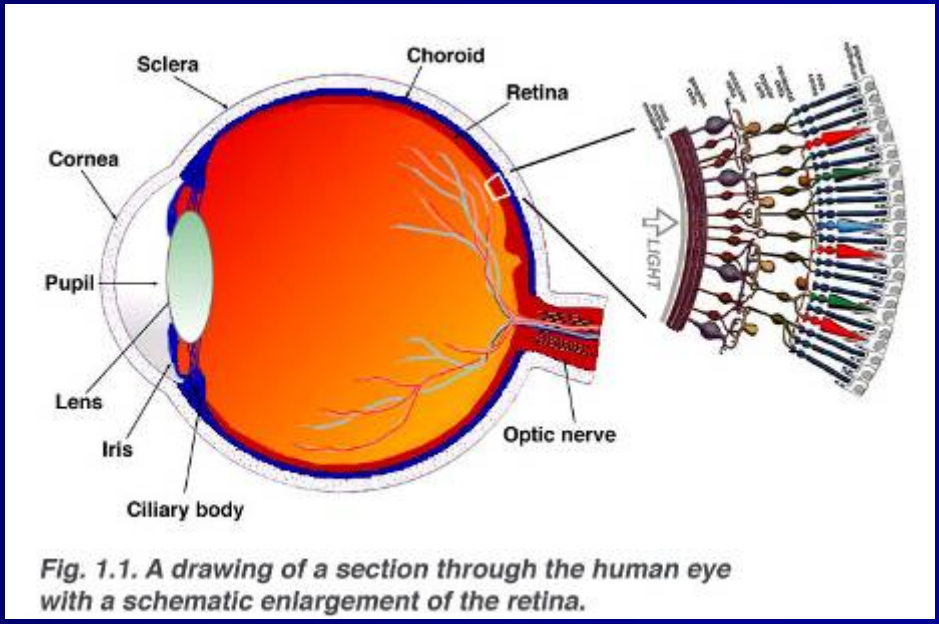


Fig. 1.1. A drawing of a section through the human eye with a schematic enlargement of the retina.

Conspicuity At Night

- Reduced Lighting
  - Shades Of Grey
  - Over Driving Headlights
  - Pedestrian Visibility

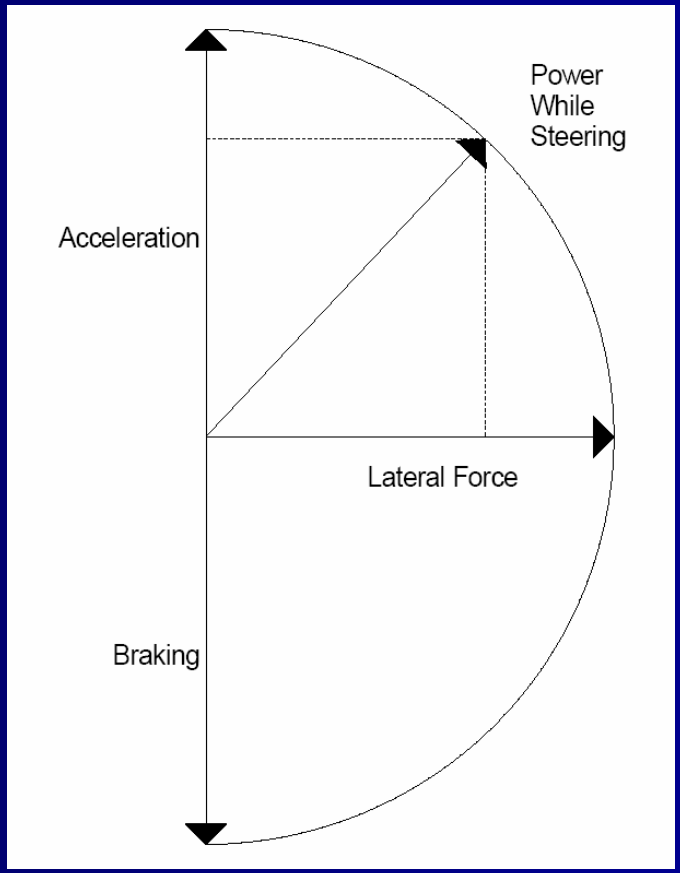
Vehicle Limitations

- Traction
- Braking
- Lateral Acceleration (Cornering)

Vehicle Handling

- Friction And Handling
  - Friction Circle
- Straight Roads
- Curves
  - Inertial Forces
  - Critical Curve Speed

Friction Circle



Limitations

- Human
- Vehicle (Mechanical)
- Driving Is A Learned Behavior
- New Drivers Need More Time To React
- More Time
  - Increased Following Distances
  - Reduced Speeds

Perception And Reaction

Human Limitations

- What Is It?
  - Time Needed To Perceive And React
  - No Instant Reactions
- How Long?
  - 1.5 Seconds Average
    - Daytime
    - Experienced Drivers

Perception And Reaction

- More Time Needed For:
  - Night
  - Inexperienced Drivers
  - Adverse Weather
- Following Distance
  - 2 Seconds
  - More For New Drivers

Speed Issues

- Speed Is A Contributing Factor In Most Serious And Fatal Crashes
- Speed Increases Stopping Distance
  - Perception/Reaction
  - Braking
- Speed Decreases Percep/React Time
- Speed + Reduced Visibility = Bad
  - Night, Rain, Snow, Fog

Speed Issues

- How Fast Are We Really Going
- MPH or FPS
- MPH * 1.466 = FPS

Speed Issues

- MPH vs. FPS
- 25mph = 36.65fps
- 35mph = 51.31fps
- 45mph = 65.97fps
- 55mph = 80.63fps
- 65mph = 95.29fps
- 75mph = 109.95fps

Speed Issues

- Perception/Reaction Distance
- Speed * 1.466 * 1.5 sec
- 25mph – 54.9 Feet
- 35mph – 76.9 Feet
- 45mph – 98.9 Feet
- 55mph – 120.9 Feet
- 65mph – 142.9 Feet
- 75mph – 164.9 Feet

Speed Issues

- Braking Distance
- Dependent on Speed and Surface Friction
- Lower Friction Increases Braking Distance
- Dry Roads Have Highest Friction

Speed Issues

- Roadway Friction Values (Approx)
- Dry Pavement f=0.6 to 0.8
- Wet Pavement f=0.45 to 0.65
- Snow Covered f=0.3 to 0.55
- Ice Covered f=0.05 to 0.2

Speed Issues

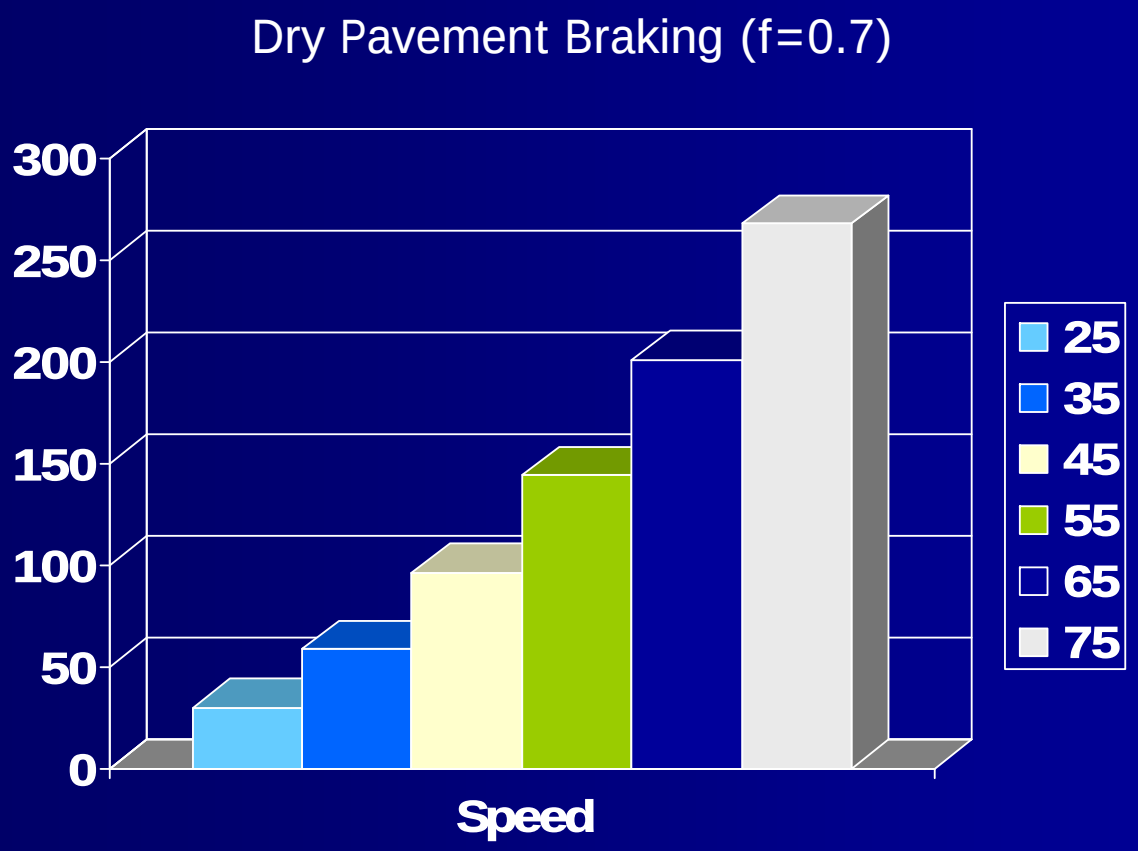
- Braking Distance Formula

$$D = \frac{S^2}{30f}$$

Speed Issues

- Dry Pavement Braking (f=0.7)
- 25mph – 29.7 Feet
- 35mph – 58.3 Feet
- 45mph – 96.4 Feet
- 55mph – 144 Feet
- 65mph – 201.1 Feet
- 75mph – 267.8 Feet

Speed Issues

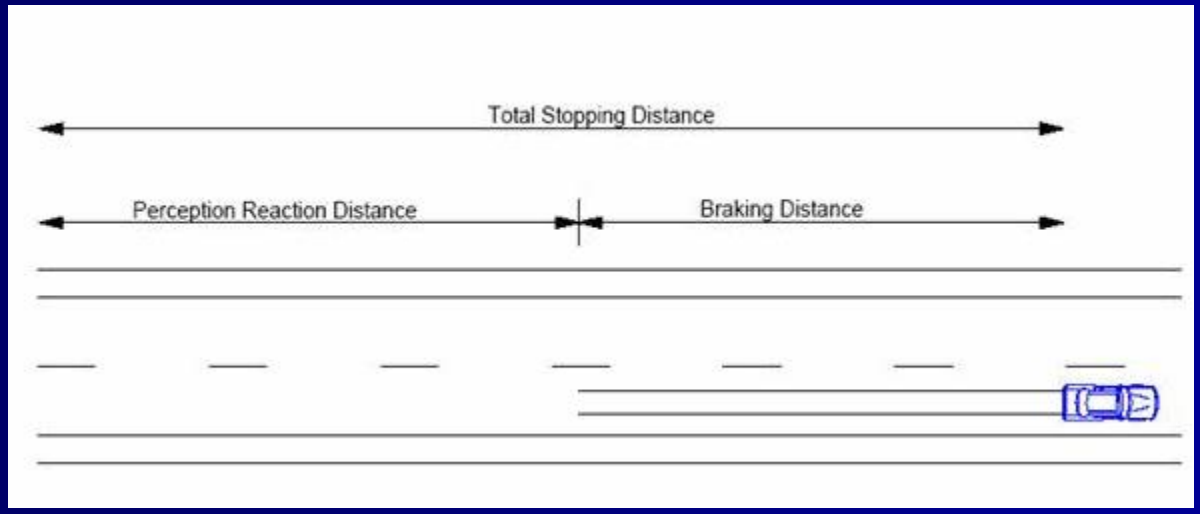


Speed Issues

- Slide to Stop
- Different Surfaces at 45mph
- Dry - 96.4 Feet (f=0.7)
- Wet – 122.7 Feet (f=0.55)
- Snow – 168.7 Feet (f=0.4)
- Ice – 337.5 Feet (f=0.2)

Total Stopping Distance

- Combine
  - Perception/Reaction Distance
  - Braking Distance



Stopping Distance

Dry Pavement

- Percep/React + Braking=Total Stop D
- 25mph – 84.6 Feet
- 35mph – 135.2 Feet
- 45mph - 195.3 Feet
- 55mph – 264.9 Feet
- 65mph – 344 Feet
- 75mph – 432.7 Feet

Big Brother Is Watching

- Crash Reconstruction
- Calculating Speed From:
  - Tire Marks
  - Crush Damage
  - Momentum Analysis
  - Computer Modeling
- Air Bag Module
- Car Chip

$$S = \sqrt{30dfn}$$

$$S = 3.86\sqrt{Rf}$$

$$R = \frac{C^2}{8M} + \frac{M}{2}$$

$$V_2 = \frac{W_1 V_3 Sin\theta}{W_2 Sin\varphi} + \frac{V_4 Sin\phi}{Sin\varphi}$$

Legal Consequences

- Tickets
- Suspension
- Increased Insurance Costs
- Criminal Consequences
  - Accident While Suspended
  - Vehicular Assault
  - Vehicular Homicide

In 2005 Over 43,200 People Were Killed In Motor Vehicle Collisions Nationwide