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

The bar chart shows the number of deaths by cause for individuals aged 16-20 in 2003. The causes include MV Crash, Homicide, Suicide, Poison, and Cancer. The MV Crash category has the highest number of deaths, followed by Homicide and Suicide. Cancer has the lowest number of deaths in this age group.
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

Diagram showing:
- Acceleration
- Braking
- Power While Steering
- Lateral Force
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 perception/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

Dry Pavement Braking (f=0.7)
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

\[ S = \sqrt{30dfn} \]

\[ S = 3.86\sqrt{Rf} \]

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

\[ V_2 = \frac{W_1V_3\sin\theta}{W_2\sin\phi} + \frac{V_4\sin\phi}{\sin\phi} \]
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