

CIREN

Overview of SUV's & Safety

**Mr. Louis V. Lombardo for
Dr. H. Keith Brewer**

**September 6, 2001
Ann Arbor, MI**



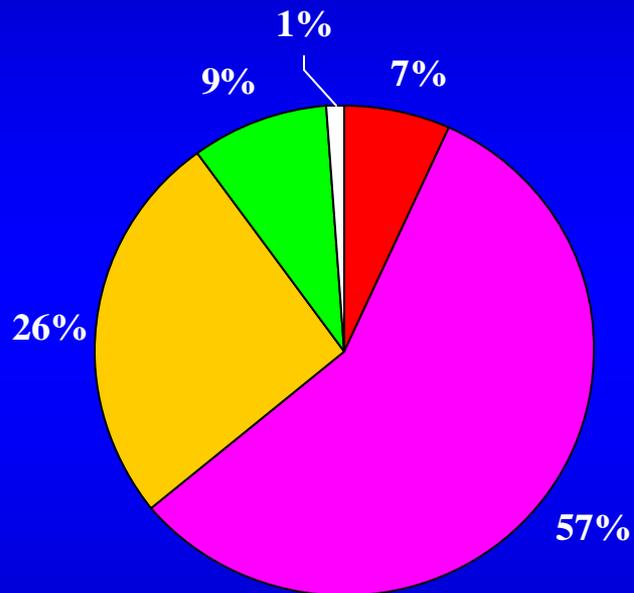
SUV's & Safety

- **Safety Overview**
- **Compatibility**
- **Rollover**
- **Treatment**

Light Vehicle Tow-away Crash Distribution

3.4 million crashes per year

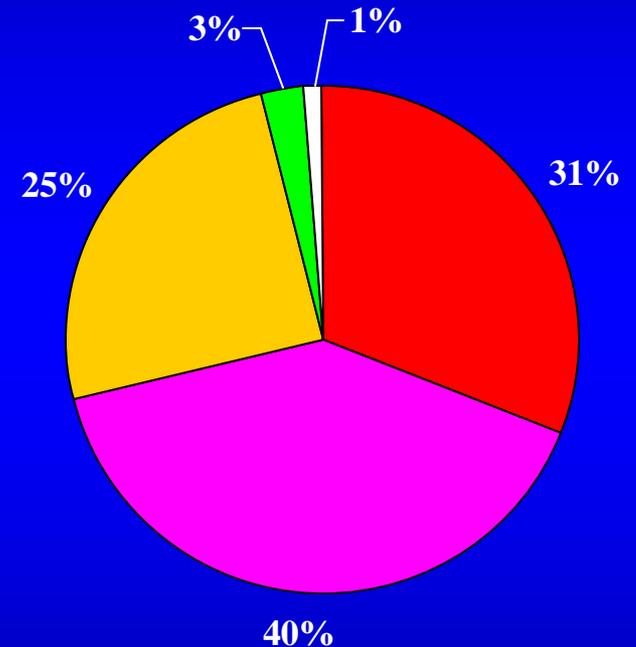
1995-1999 NASS-CDS



Light Vehicle Occupant Fatality Distribution

31,921 total occupants killed

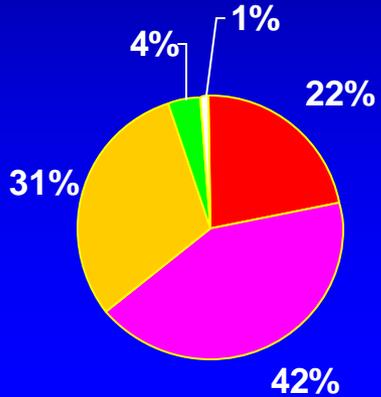
1999 FARS



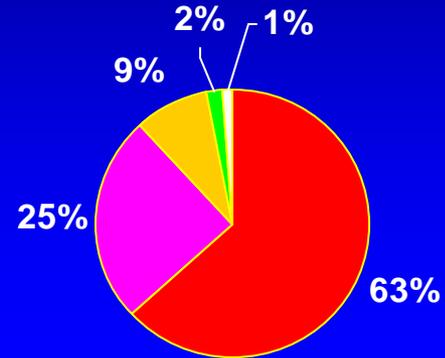
■ Rollover ■ Front ■ Side ■ Rear ■ Other

Occupant Fatality Distribution by Crash Mode 1999 FARS

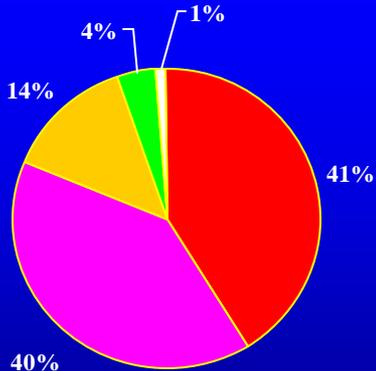
Cars



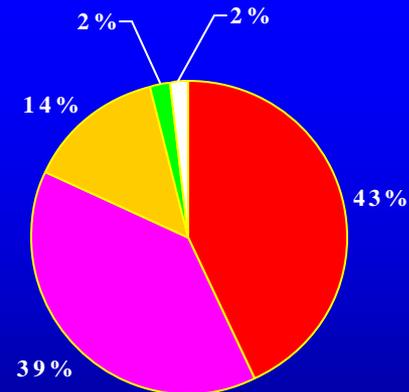
SUVs



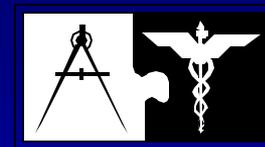
Vans



Pickups

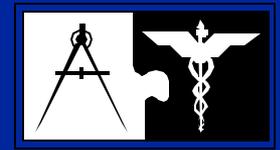


■ Rollover ■ Front ■ Side ■ Rear ■ Other

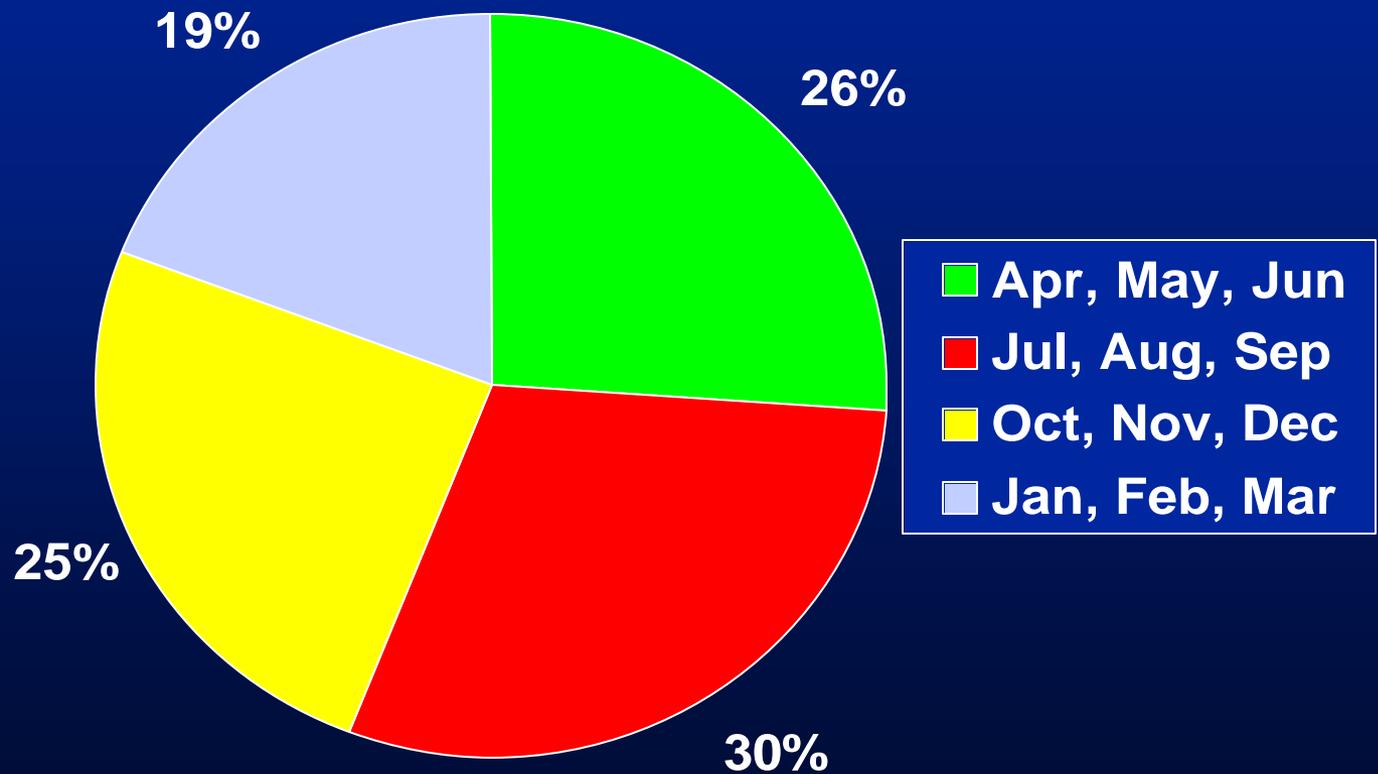


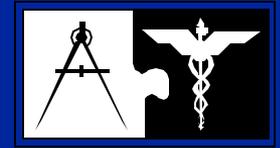
Contributing Factors

- **Weather**
- **Speed**
- **Alcohol**
- **Belt Use**
- **Age**
- **Gender**
- **Urban/Rural**

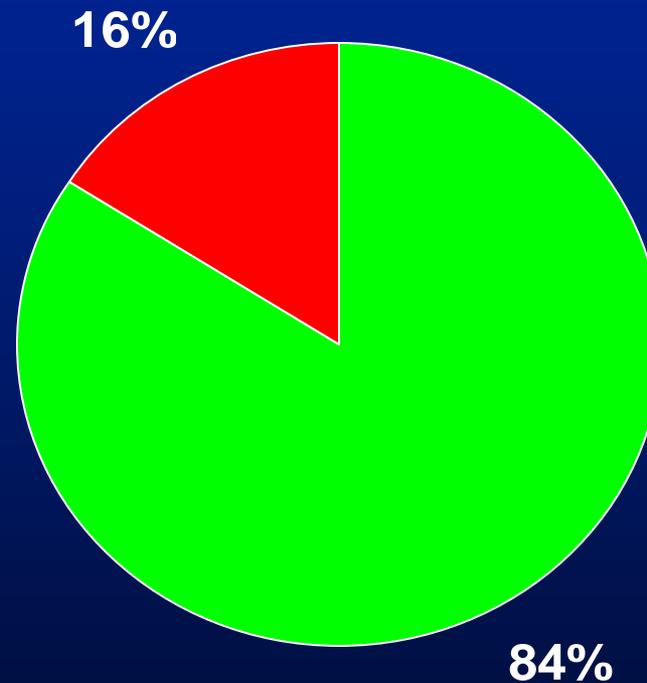


3,026 Deaths in SUV's in 1999 by Season



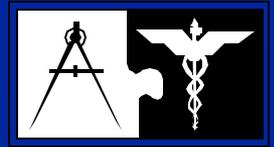


3,026 Deaths in SUV's in 1999 by Weather & Road Conditions

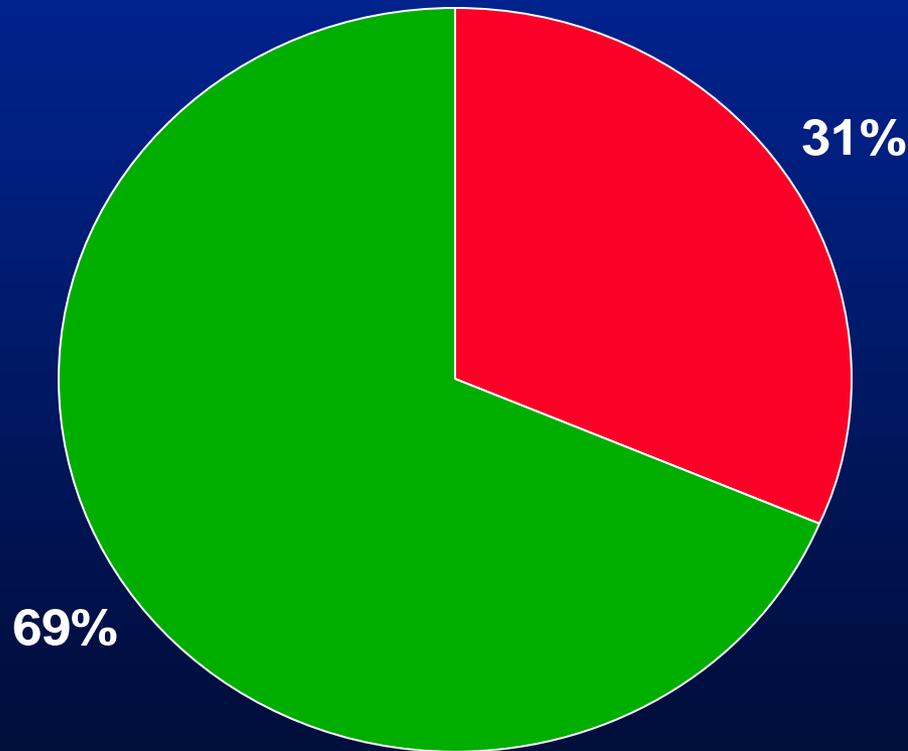


■ Normal + Unk

■ Adverse Conditions



3,026 Occupant Deaths in SUV's in 1999 Speeding vs. No Speeding (Indicated)

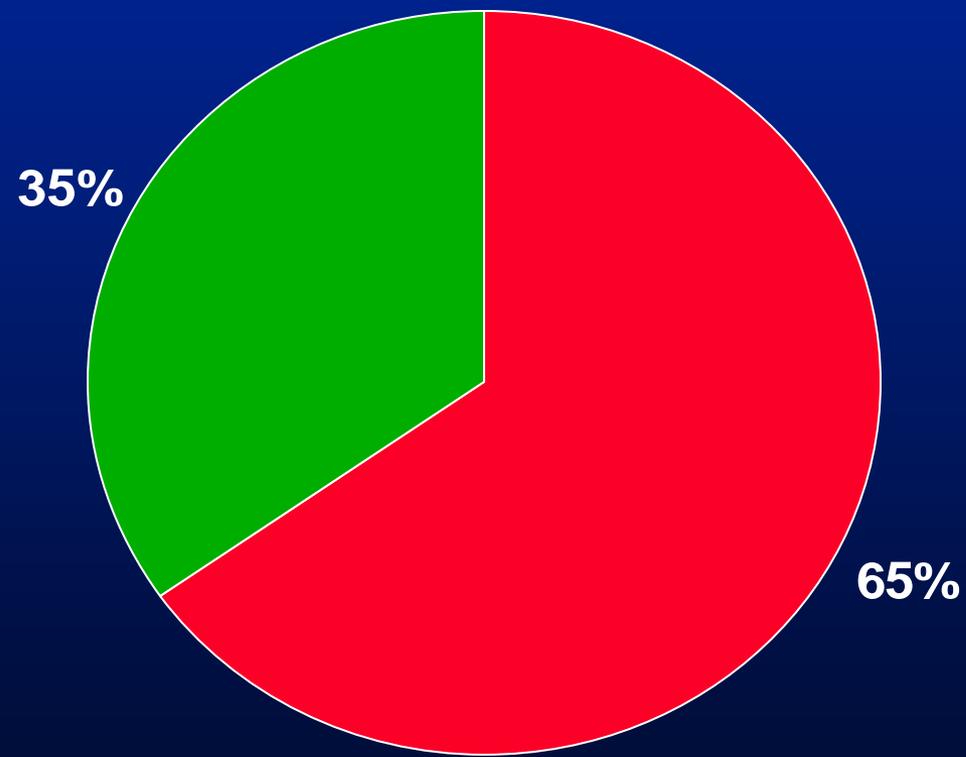


■ Speeding

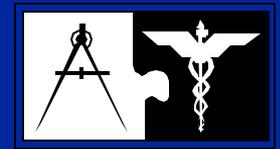
■ No Speeding



3,026 Occupant Deaths in SUV's in 1999 Alcohol vs. No Alcohol

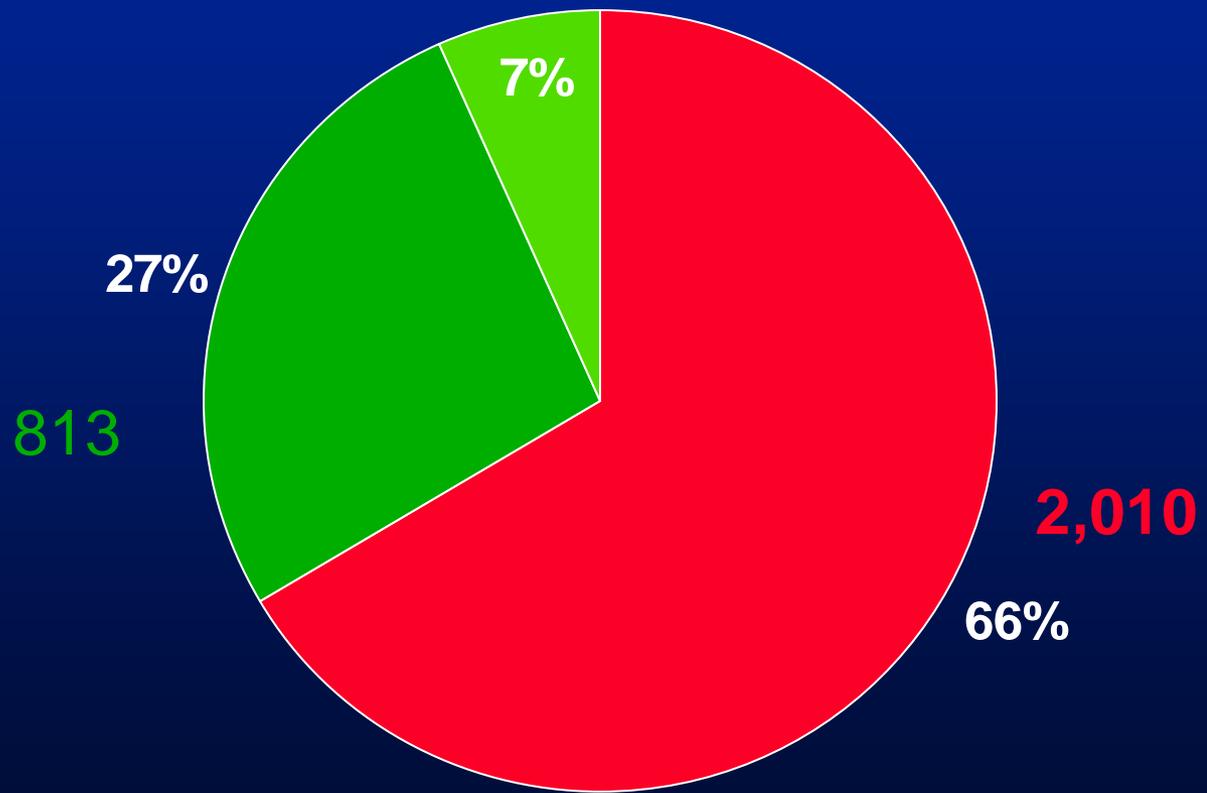


■ Alcohol ■ No Alcohol



3,026 Occupant Deaths in SUV's in 1999

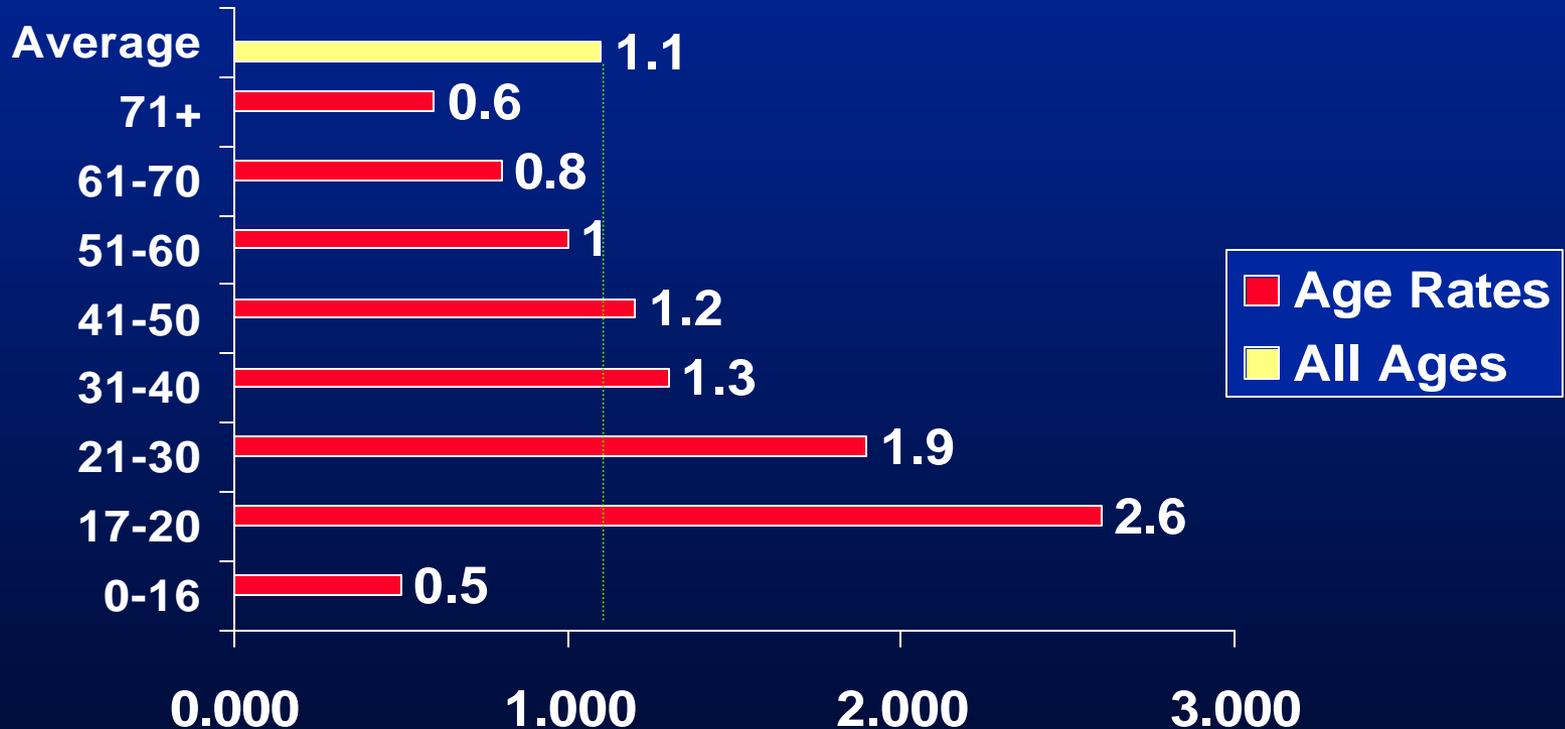
Belt Use vs. Unrestrained



■ Unrestrained ■ Restrained ■ Unknown

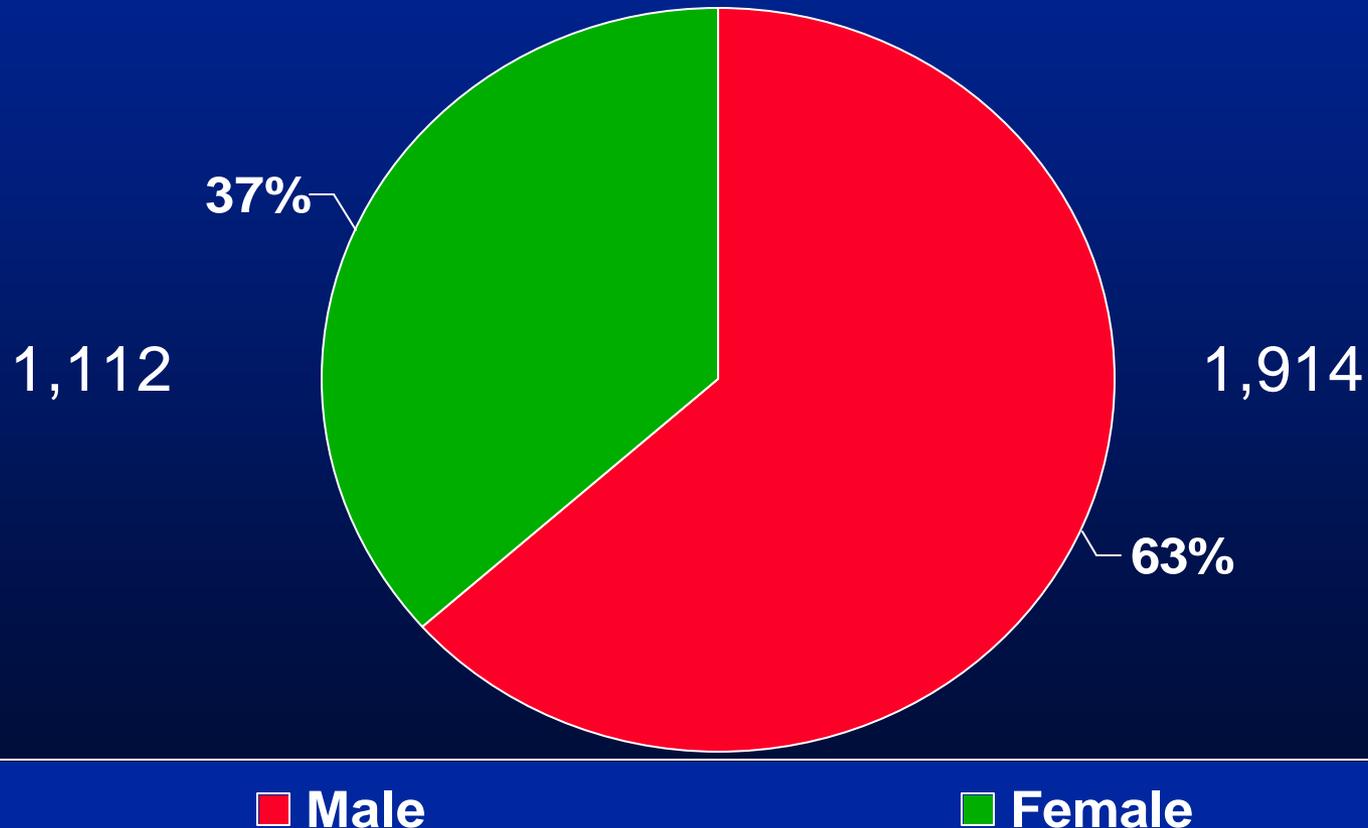


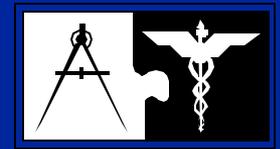
Occupant Death Rates in SUV's in 1999 by Age Groups (Deaths / 100,000 People)



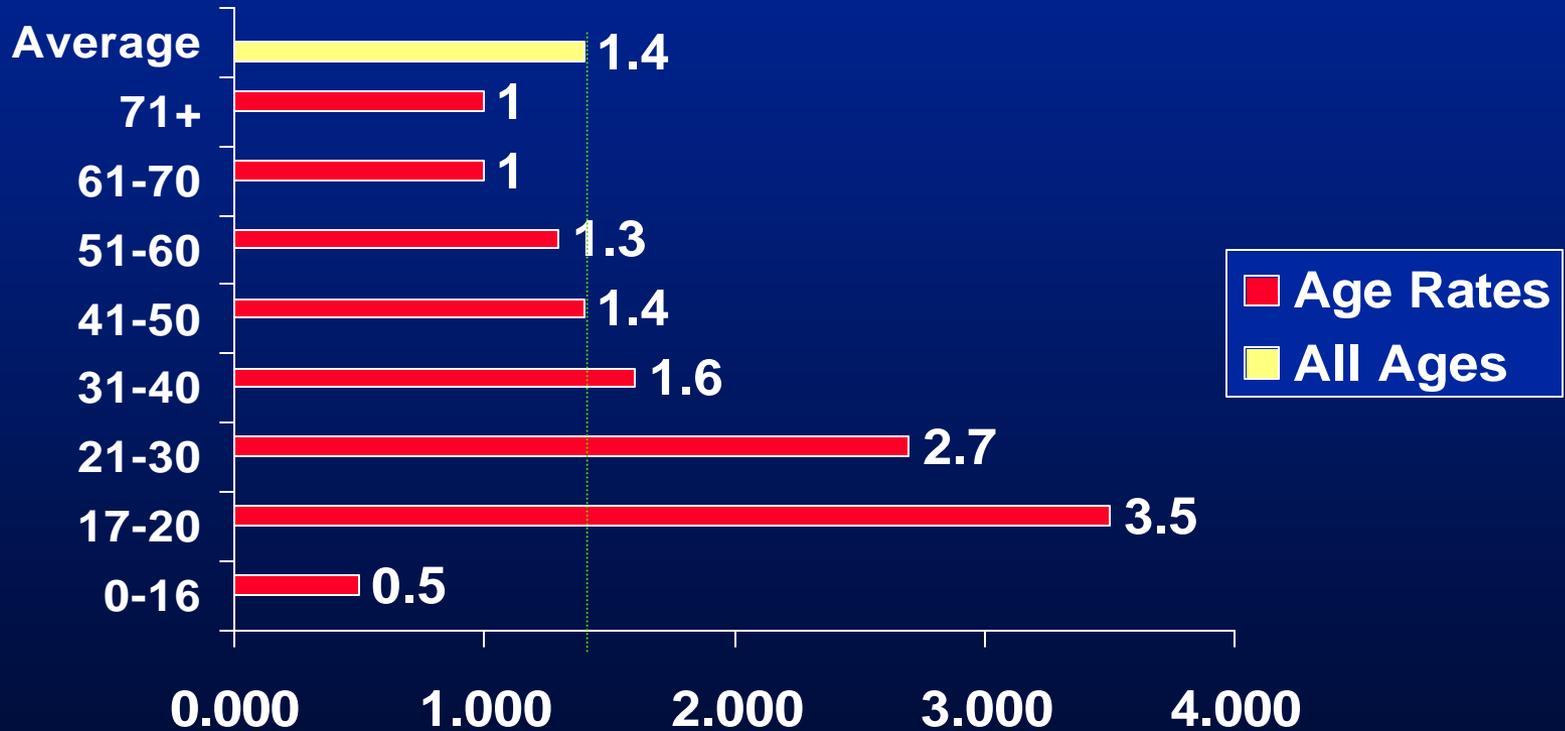


3,026 Deaths in SUV's in 1999 by Gender of Occupant Fatality



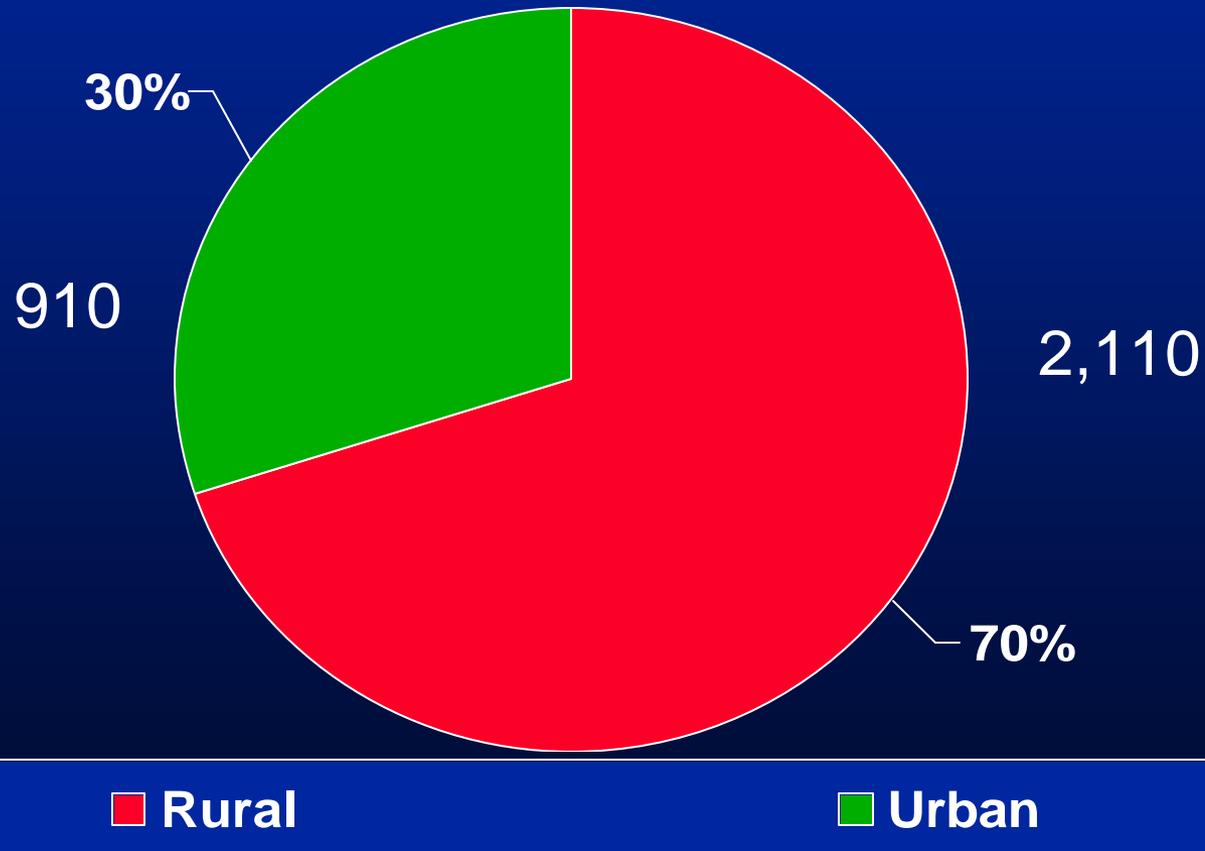


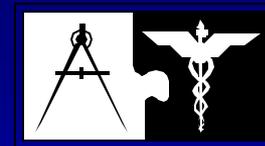
Male Occupant Death Rates in SUV's in 1999 by Age Groups (Deaths / 100,000 Males)





3,026 Deaths in SUV's in 1999





SUV's in Tow-Away Crashes

- ~225,000 Tow-Away Crashes per year
- ~36,000 Child Occupants Involved
- ~5,200 Occupants Seriously Injured
(AIS 3+)

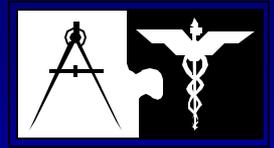
Source: NASS '95-'97



CRASH COMPATIBILITY

Sources of Incompatibility:

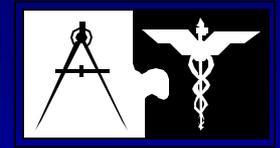
- Mass
- Structure
- Geometry



Vehicle Class Differences

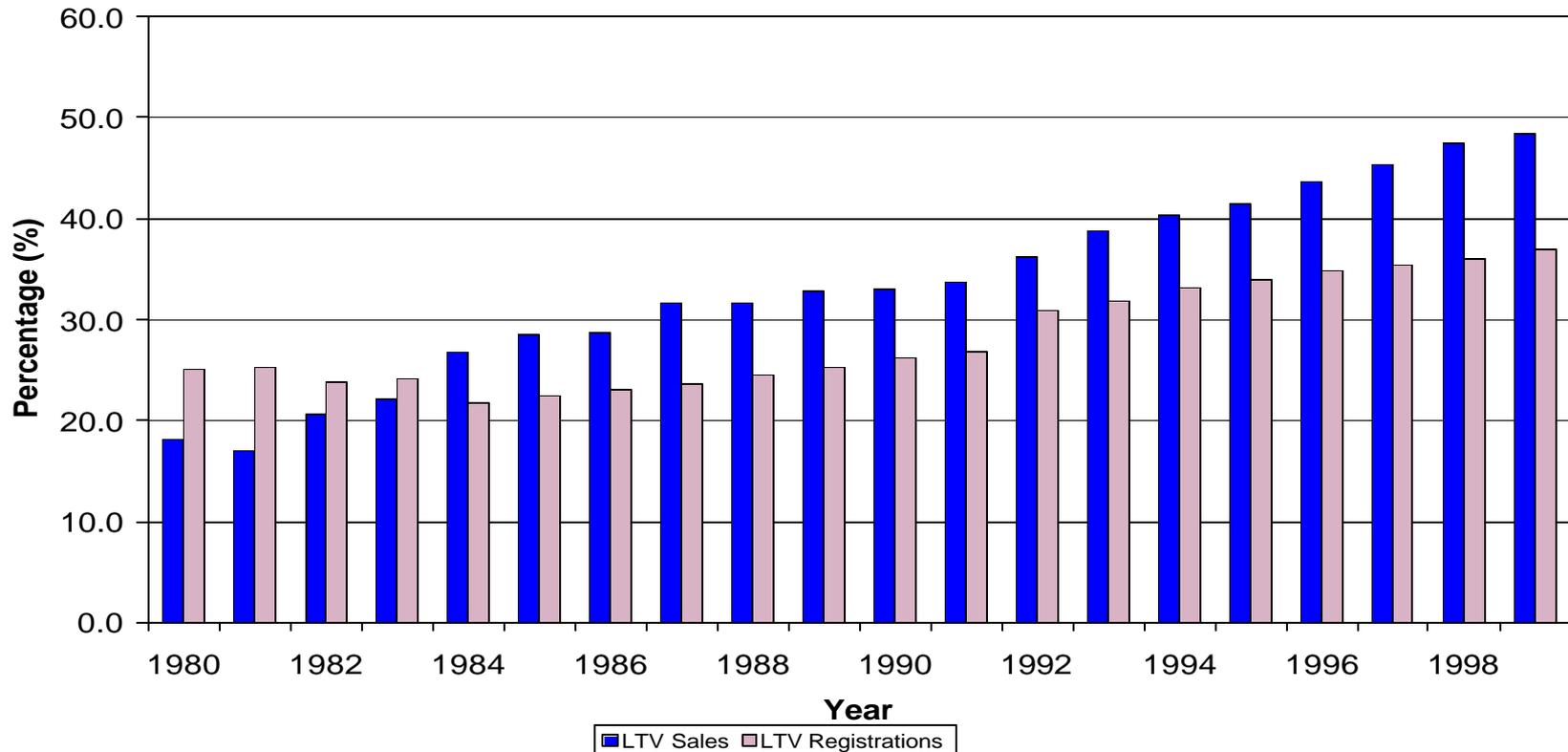
LTV's:

- **Pickups: 4,500 # - 10,000 # GVWR**
- **SUV's: 3,900 # - 10,000 # GVWR**
- **Vans: 110" – 120" Wheel Base**



Changing Fleet of Vehicles

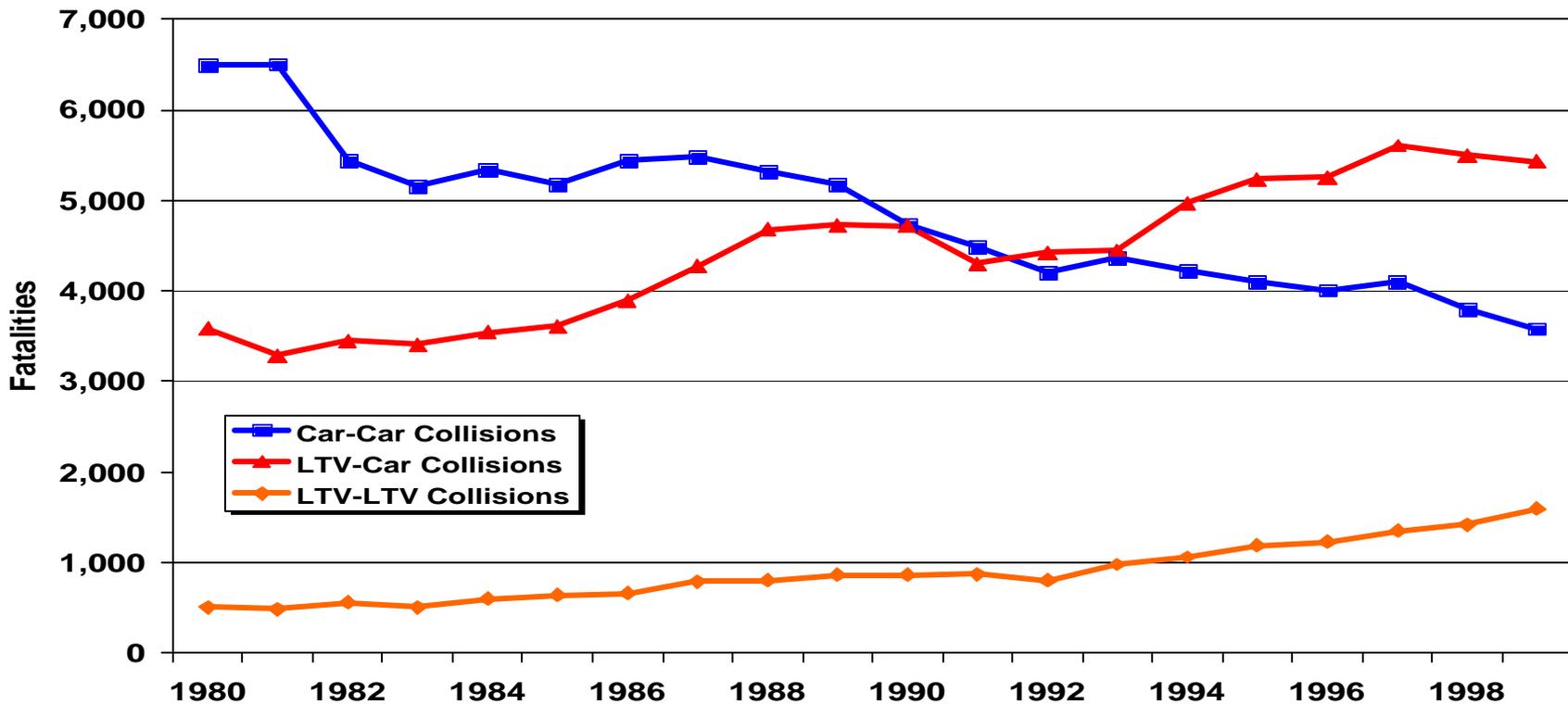
U.S. Sales and Registrations of Light Trucks and Vans





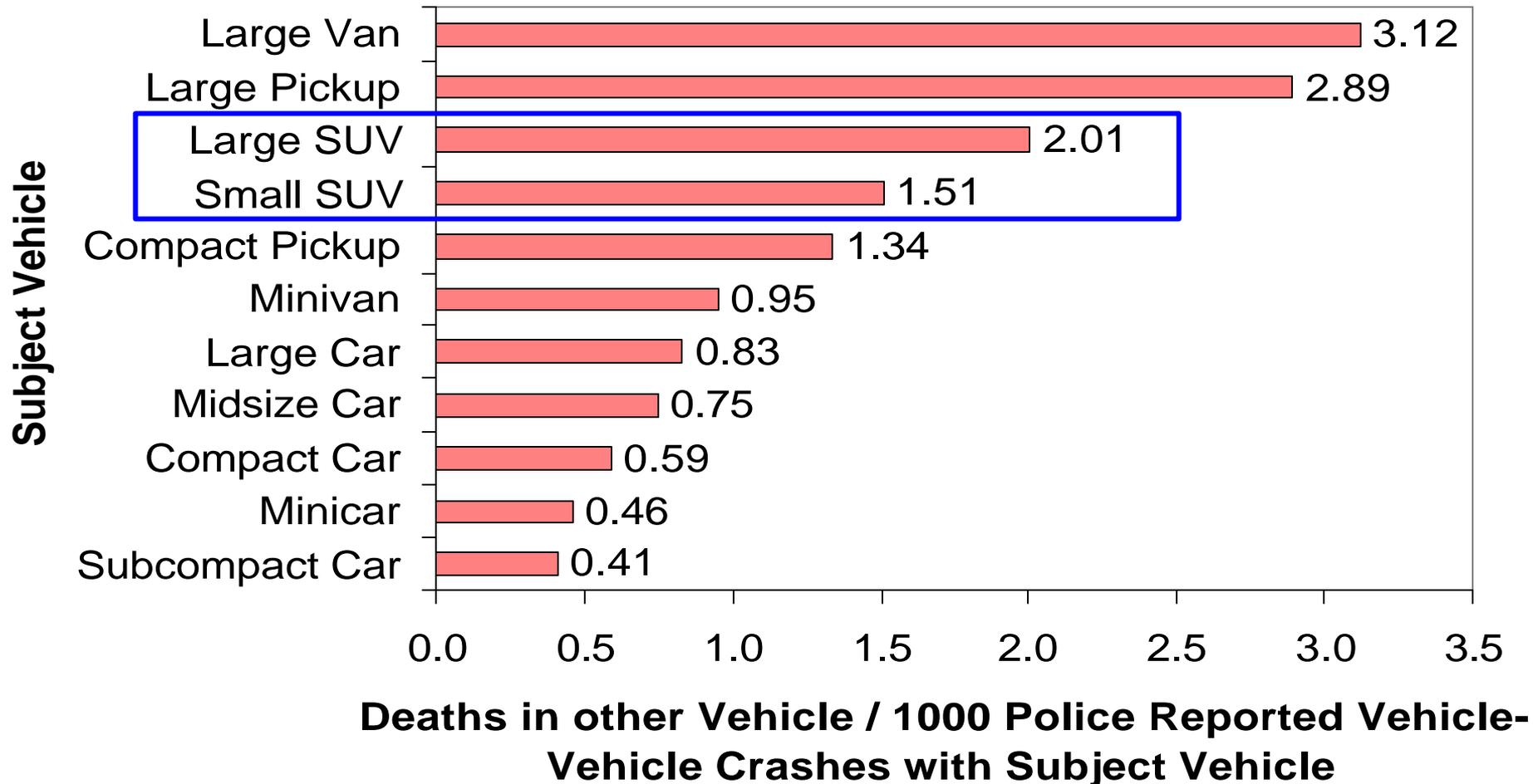
Increasing LTV-Car Fatalities

Fatalities in Vehicle-to-Vehicle Collisions



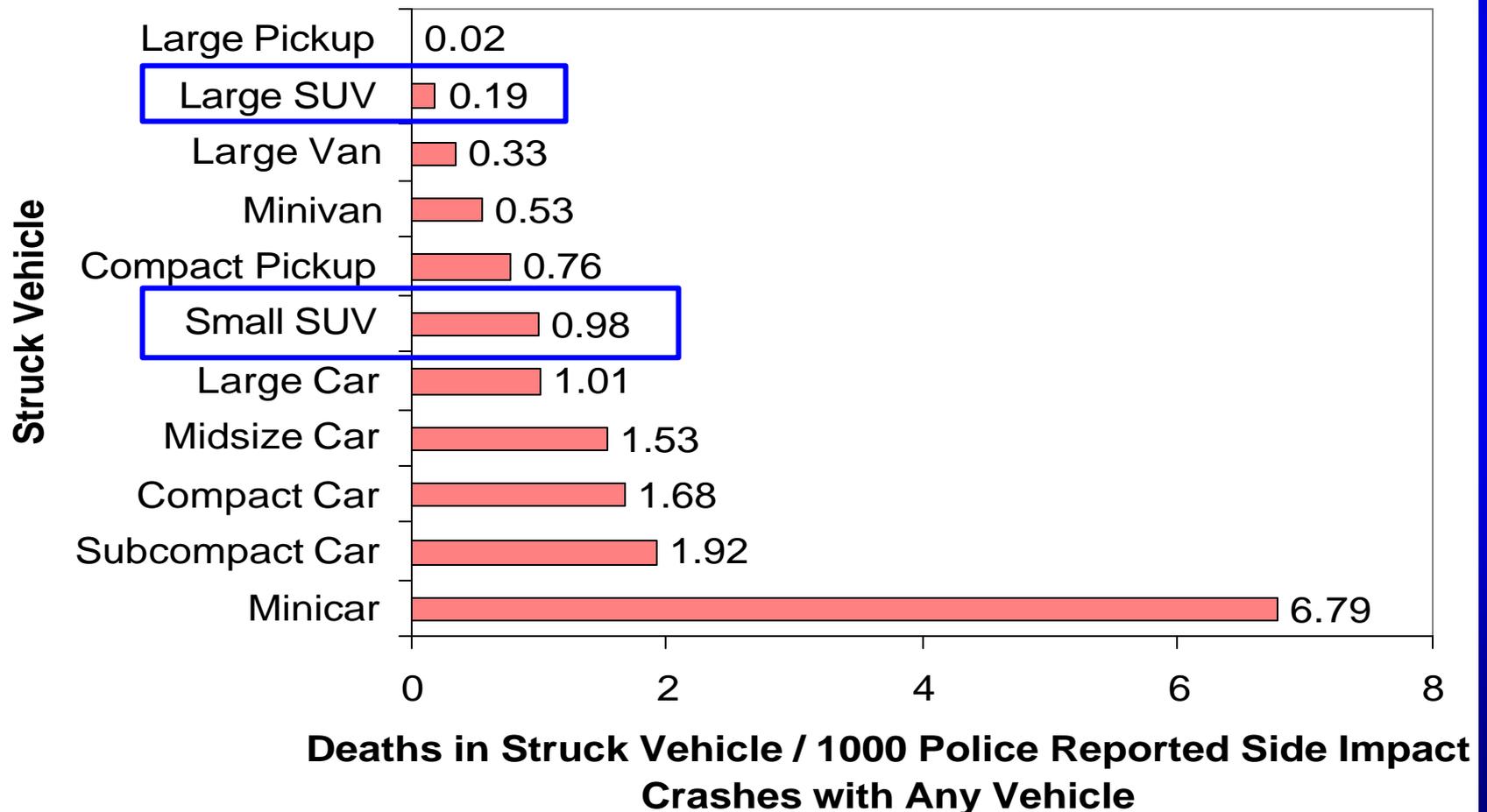


Aggressivity Metric – All Crashes





Vulnerability Metric, Frontal-Side Crashes





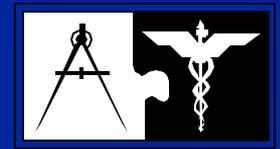
Compatibility Summary

- **Increasing fatalities in LTV-car crashes**
- **LTV's as a group present a greater risk as a collision partner**
- **Mass, structural stiffness, and geometry are three sources of vehicle incompatibility**



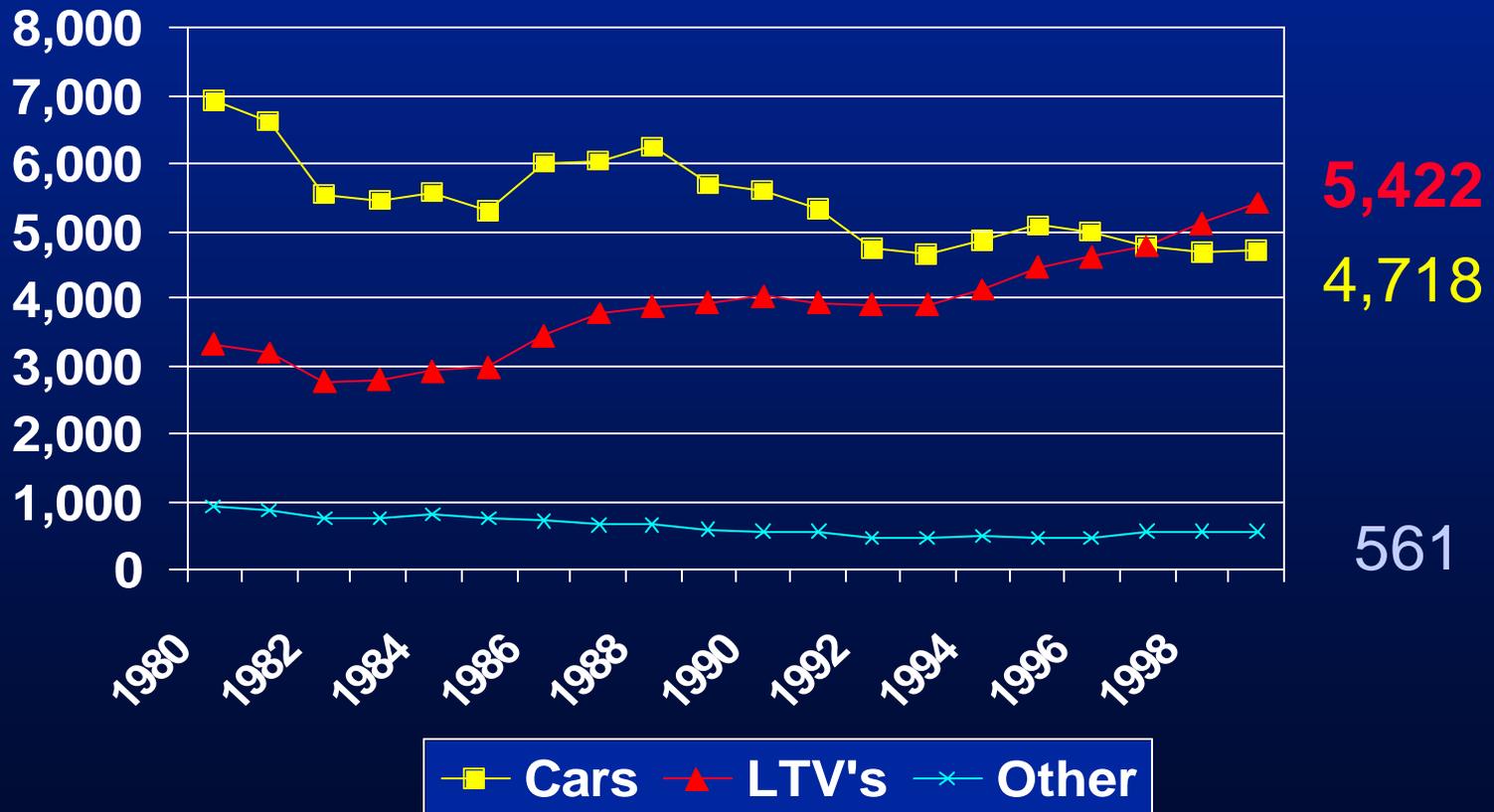
Rollover

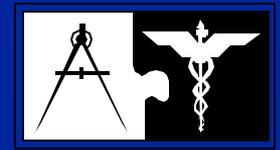
- **63% of SUV Occupant Fatalities**
- **2,000 SUV Deaths per year and growing**
- **2,000 Seriously Injured Each Year in SUV's**



Rollover Occupant Deaths

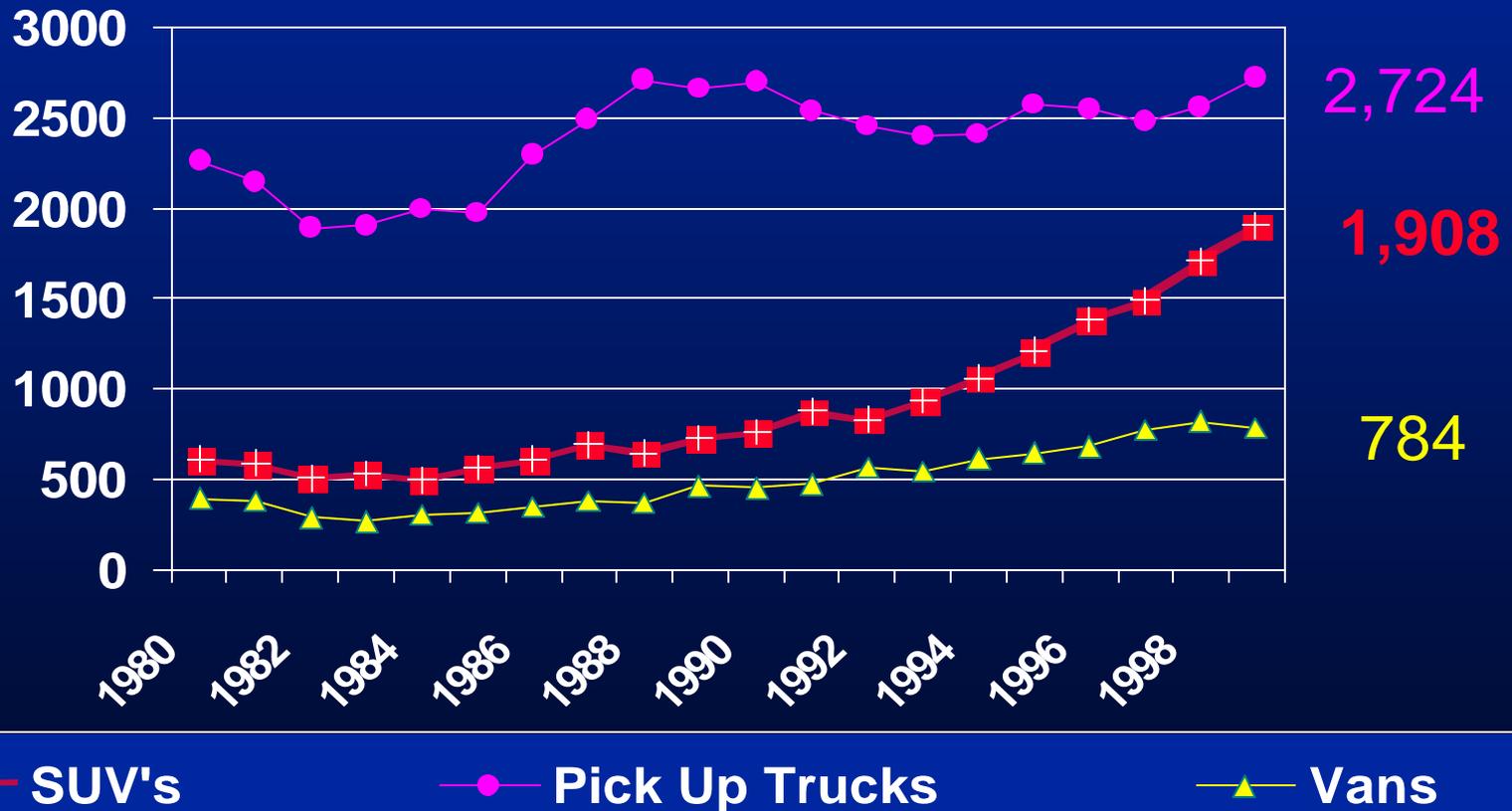
By Vehicle Type: Crashes 1980-'99, FARS





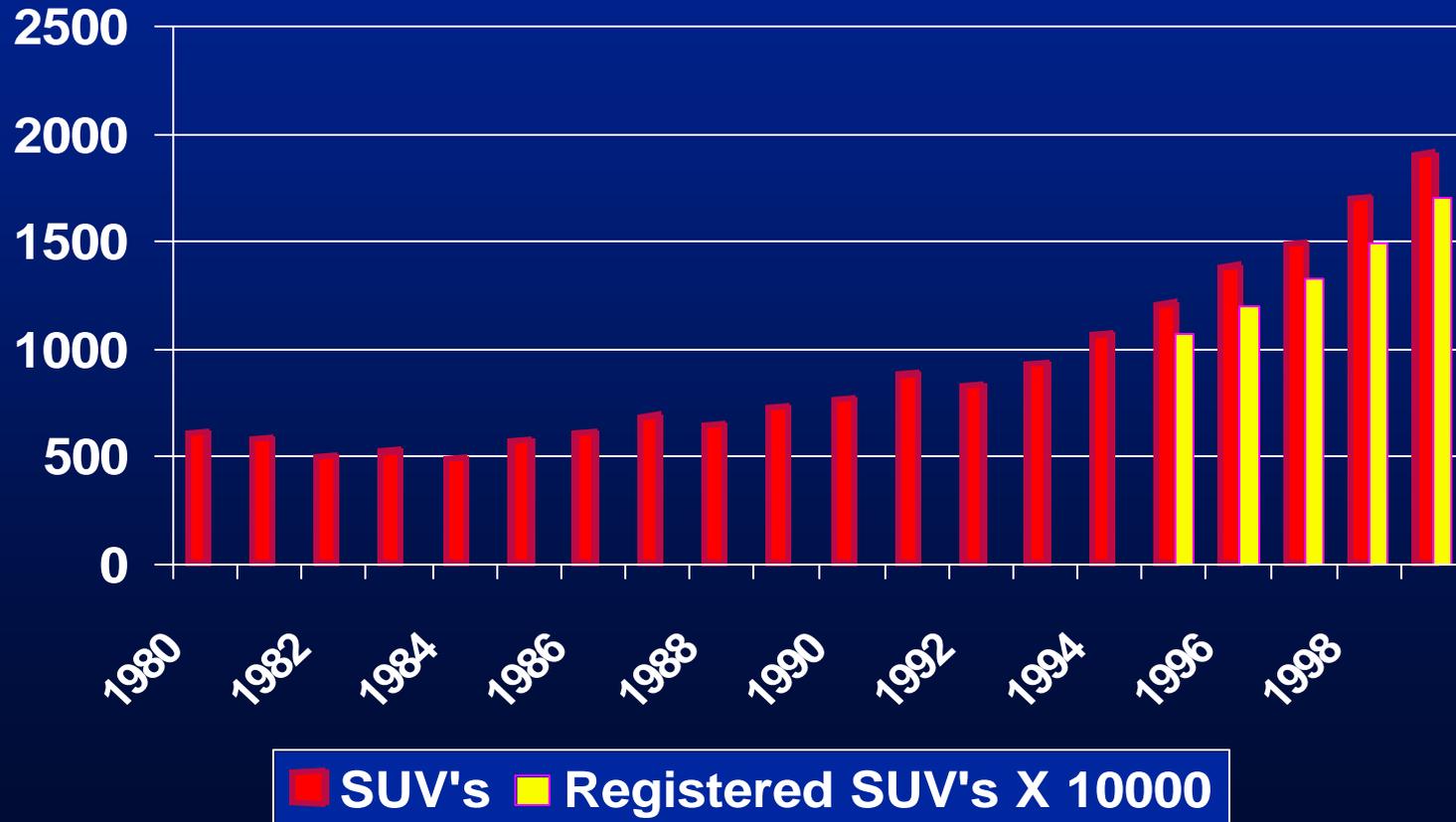
Rollover Occupant Deaths

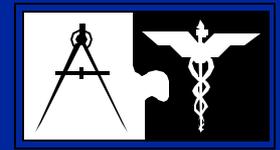
By Vehicle Type: Crashes 1980-'99, FARS



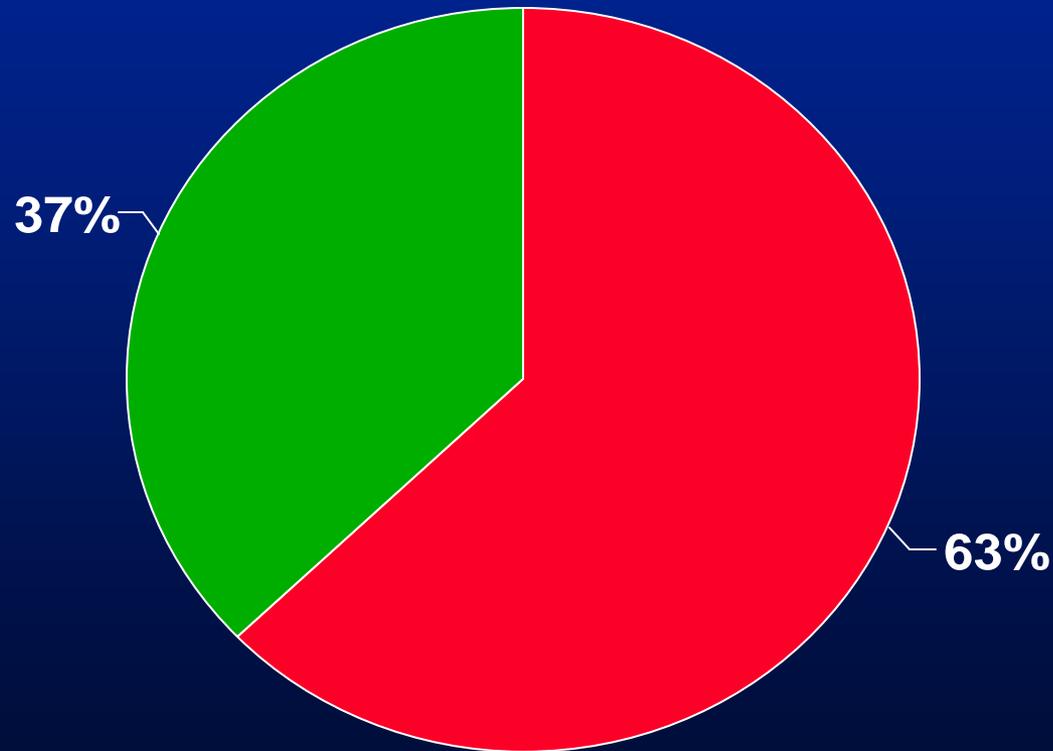


Rollover Deaths in SUV's Tracking Growth in Registrations





3,026 Deaths in SUV's in 1999 "Rollover & Non Rollover"



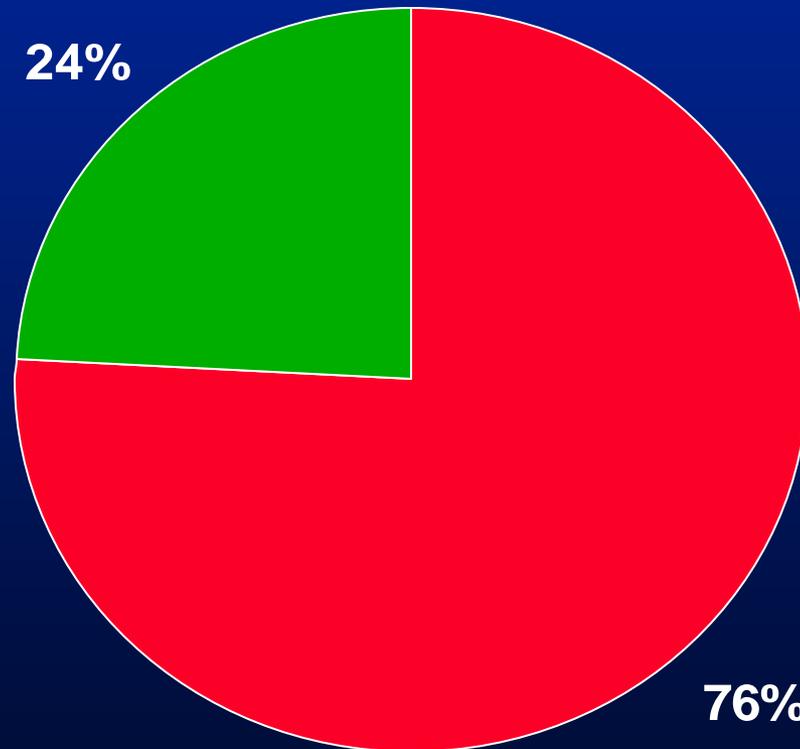
■ Rollover

■ Not Rollover



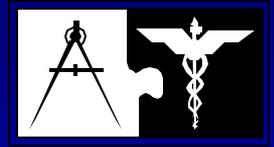
1,037 Rollover Deaths in SUV's in 1999

“Not Taken” Rural & Urban

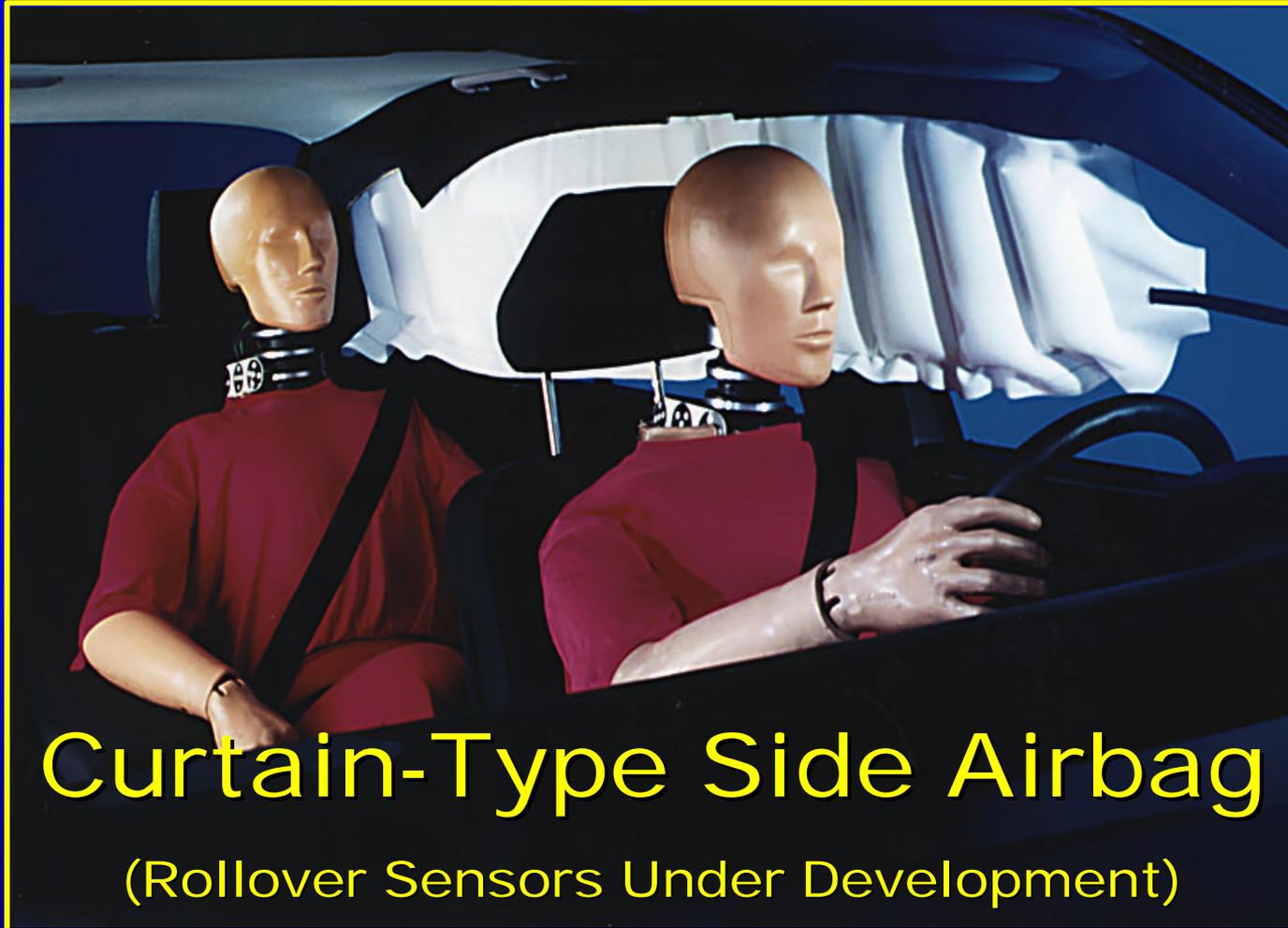


■ Rural

■ Urban



Side Airbags: Protection for Rollover & Compatibility



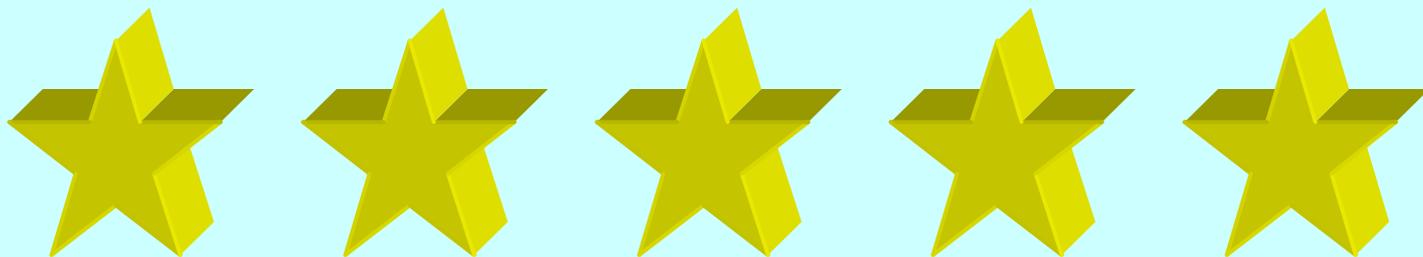
Curtain-Type Side Airbag

(Rollover Sensors Under Development)



NCAP Rollover Resistance Rating

The Rollover Resistance Rating for this Vehicle is:



Risk of RO/SV Crash: Less than 10%

Risk of RO/SV Crash: Between 10% - 20%

Risk of RO/SV Crash: Between 20% - 30%

Risk of RO/SV Crash: Between 30% - 40%

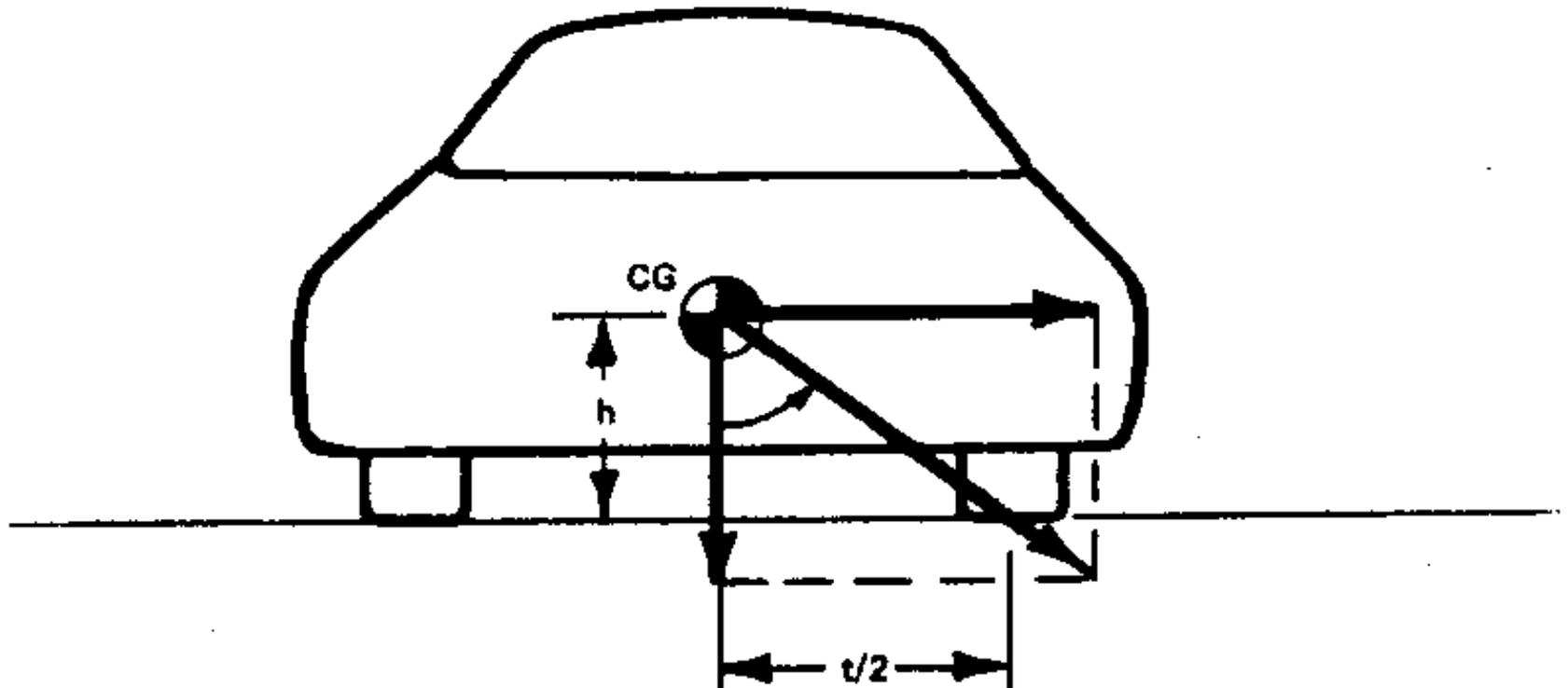
Risk of RO/SV Crash: Greater than 40%

RO/SV = Estimate of Rollover Risk if in a Single Vehicle Crash

Static Stability Factor (SSF)

$$T/2h$$

First order estimate of steady state lateral acceleration when rollover begins.



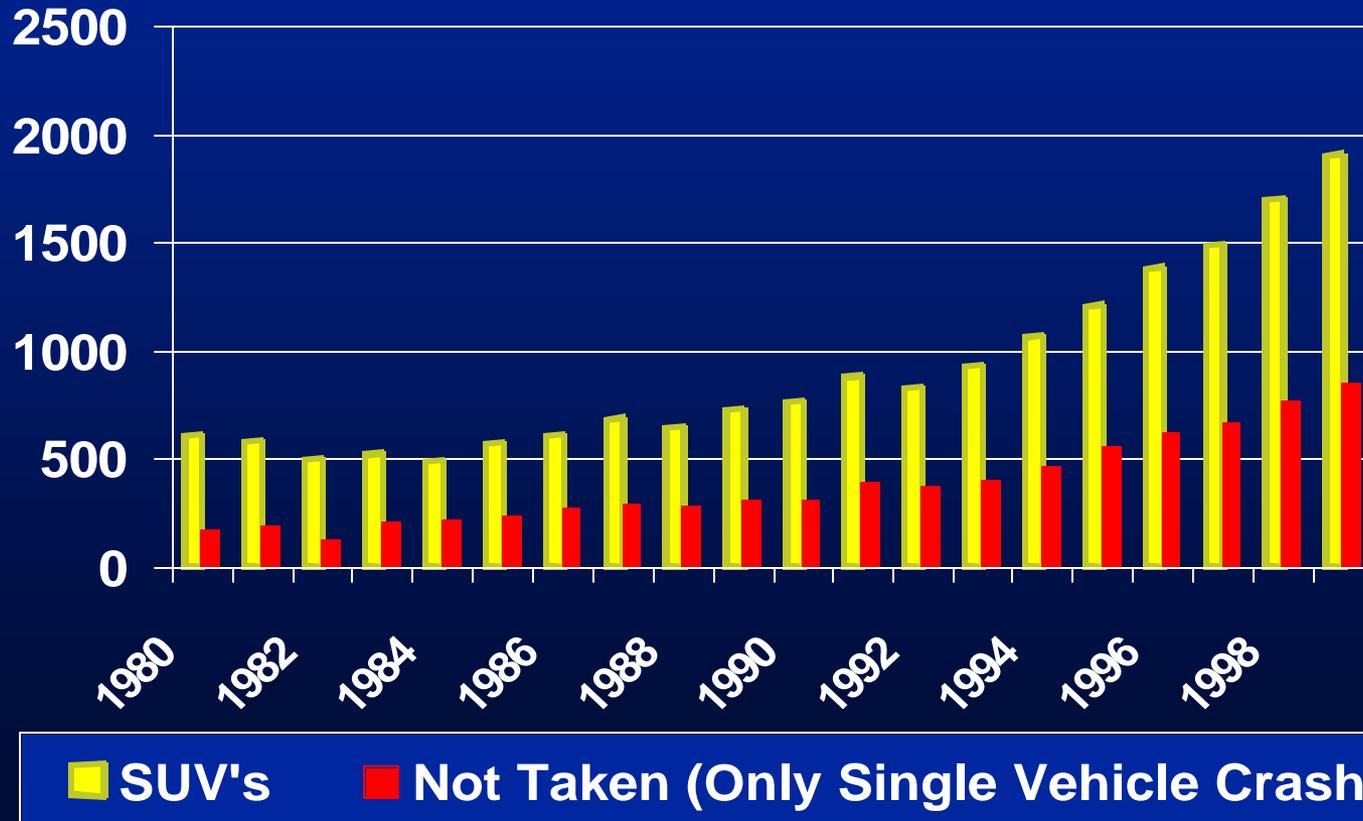


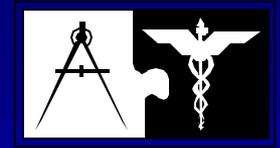
Faster & Better Treatment

- **Faster**
- **Better at Trauma Center**
- **Automatic Crash Notification**



Annual Rollover Deaths in SUV's "Not Taken for Treatment," FARS





Automatic Crash Notification

- **Crash Occurrence**
- **Crash Type**
- **Location**
- **Crash Severity**
- **LIDCENOV Serious Injury Probability**



504

Crash Information

Time of Crash

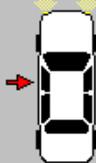
Crash Date: 11/19/98
 Crash Time: 1:55:00 PM
 Elapsed Time: 0 days 00:01:52

Impact Details:

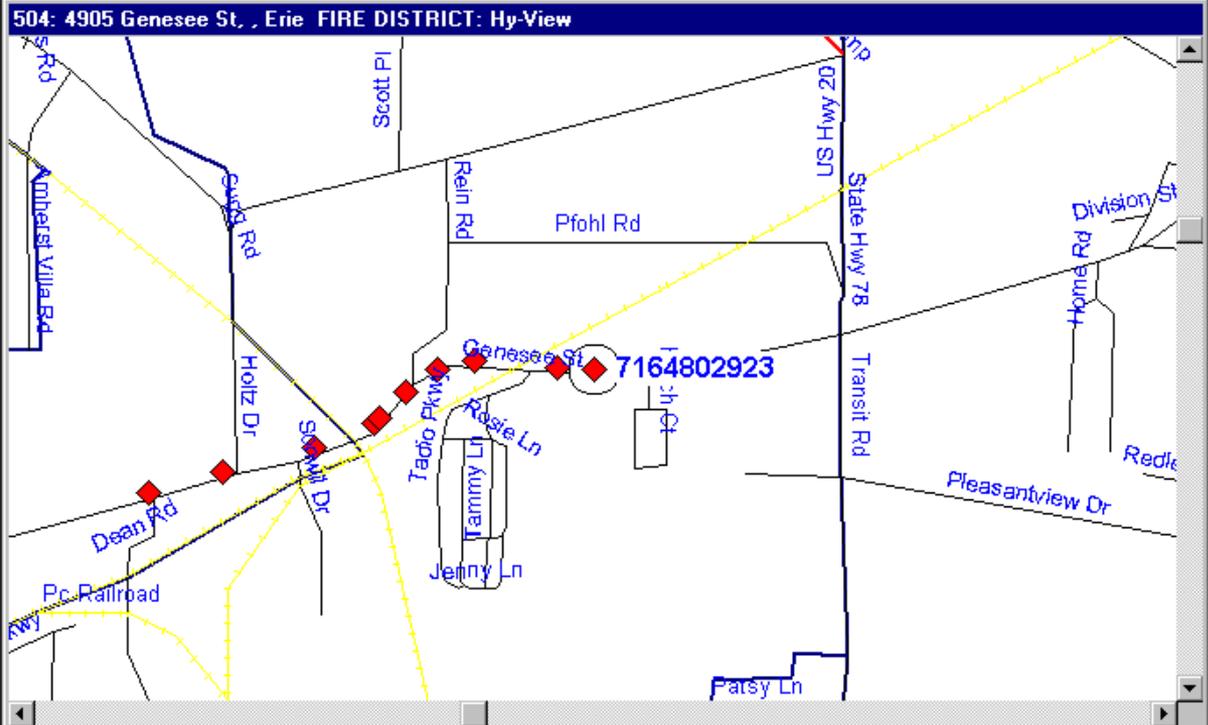
Lat/Long: N 42 56' 12.88"/W 78 42' 19.44"
 Position Error: 1.08 m



Final Resting Position:
 Left Side
Rollover



Change in Velocity = 38 mph



Communications

Vehicle	Fax	Voice	Call status	Hold	Prerec
Vehicle					
Dispatcher					
Cheektowaga Police					
Cheektowaga Fire					
ECMC					
Manual Dial:					
Manual Dial:					

Vehicle Information - 7164802923

Vehicle	Owner	Likely Occupants
Make:	Ford	
Model:	Taurus	
Color:	Blue	
Year:	1994	
Plate:	123456	

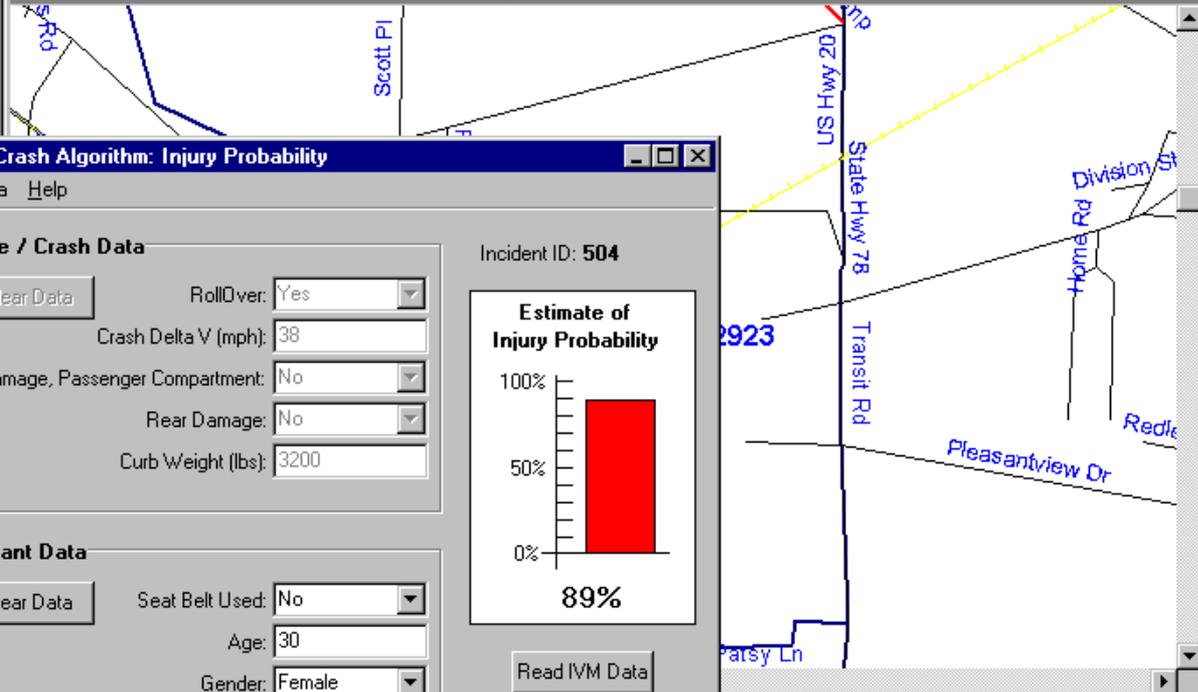




504

Crash Information

504: 4905 Genesee St., Erie FIRE DISTRICT: Hy-View

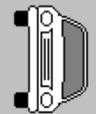


Time of Crash

Crash Date: 11/19/98
Crash Time: 1:55:00 PM
Elapsed Time: 0 days 00:06:03

Impact Details:

Lat/Long: N 42 56' 12.88"/W 78 42' 19.4
Position Error: 1.08 m



Final Resting Position:
Left Side
Rollover



Change in Velocity = 38

Post Crash Algorithm: Injury Probability

File Data Help

Incident ID: 504

Vehicle / Crash Data

Clear Data RollOver: Yes
Crash Delta V (mph): 38
Side Damage, Passenger Compartment: No
Rear Damage: No
Curb Weight (lbs): 3200

Occupant Data

Clear Data Seat Belt Used: No
Age: 30
Gender: Female
Entrapment: No
Complete Ejection: No

Estimate of Injury Probability

100%
50%
0%
89%

Read IVM Data
Override IVM
Exit

Communications

Vehicle _____ Fax _____

Dispatcher _____ Voice C _____

Cheektowaga Police _____

Cheektowaga Fire _____

ECMC _____

Manual Dial: _____

Manual Dial: _____

Year: 1994
Plate: 123456

