A Demographic Analysis and Reconstruction of Selected Cases from the Pedestrian Crash Data Study

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Pedestrian Crash Data Study (PCDS)

- Implemented by NHTSA to Update PICS
- Obtained through NASS
- Pedestrian, Driver, and Vehicle Information in Cases
- Spans 1994-1998
- 521 Documented Cases
- Interim PCDS Analysis (292 Cases) presented in 1998

¹Jarrett, et al. 1998 ESV
Purpose of Study

Investigate the differences between pedestrian collisions involving passenger cars and light trucks (utility, vans, and pick-ups):

1) **Statistically** by analyzing the PCDS database

2) **Experimentally** by reconstructing two PCDS cases (one car, one truck) in sled tests with a pedestrian dummy
Passenger vs. Light Truck

PCDS fatality percentage of each vehicle type match their presence on U.S. roads from 1994 – 1998 (FHWA statistics)

- **Avg. Market Share (94-98)**
  - Passenger Car: 65%
  - Light Truck: 35%

- **Fatal PCDS (94-98)**
  - Passenger Car: 64%
  - Light Truck: 36%

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Post-Impact Motion

Percentage of Cases of Vehicle Type

- Passenger Car (N=355)
- Light Truck (N=166)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Passenger Car</th>
<th>Light Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bumped/Pushed Aside</td>
<td>10%</td>
<td>8%</td>
</tr>
<tr>
<td>Carried by Vehicle</td>
<td>47%</td>
<td>30%</td>
</tr>
<tr>
<td>Knocked to Pavement/Thrown Forward</td>
<td>54%</td>
<td>30%</td>
</tr>
<tr>
<td>Passed over Vehicle</td>
<td>5%</td>
<td>0%</td>
</tr>
<tr>
<td>Other</td>
<td>9%</td>
<td>9%</td>
</tr>
</tbody>
</table>
Post-Impact Motion (Fatality Rate)

Worst for Light Truck

Frequency Percentage

0% 0% 4% 7% 42% 10%

Bumped/Pushed Aside Carried by Vehicle Knocked to Pavement/Thrown Forward Passed over Vehicle Other

Passenger Car Light Truck

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Vehicle Impact Speed

Light trucks hit pedestrians at lower speeds than do passenger cars.

Approximately 75% of all pedestrians were hit at speeds below 25 MPH (40 km/hr).
Maximum AIS Injury (MAIS)

MAIS for light trucks are higher than for passenger cars

Frequency Percentage

Passenger Car
Light Truck

MAIS (Maximum Injury Severity)
Injury Region (MAIS 3-6)

Light trucks tend to injure the thorax/abdomen while passenger cars are more likely to injure the head and legs.
Wrap Around Distance (WAD)

Passenger Car  Light Truck

Head Contact

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WAD/Pedestrian Height

Difference between PC and LT statistically significant (p < 0.05)

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According to the PCDS:

- Most vehicles carry or throw pedestrians forward
  - Carrying is more likely to cause fatal injury than throwing fwd
  - LT more likely to cause fatality when pedestrian is carried
- LT hit pedestrians at lower speeds than do PC
- MAIS tends to be more severe for LT than for PC
- MAIS increases with vehicle speed for both PC and LT
- Chest/Abdomen injured more frequently in LT impacts
- WAD/height: Avg. for PC significantly > than LT
PCDS Case Reconstructions

- Honda Polar II Dummy (50th %)
- Passenger Car Case
  - 1999 Honda Civic
  - 44 year old pedestrian jogging
  - AIS 1 head injury
- Light Truck Case
  - 1999 Chevrolet Silverado
  - 77 year old pedestrian
  - Various AIS 3-5 chest/leg injuries
Full-Scale Sled Test Setup
Kinematics (PC vs. LT)

Passenger Car

Light Truck

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## Test Results

<table>
<thead>
<tr>
<th></th>
<th>Passenger Car</th>
<th>Light Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Speed</td>
<td>48 kph</td>
<td>20, 25 kph</td>
</tr>
<tr>
<td>MAIS Body Region</td>
<td>Head</td>
<td>Chest</td>
</tr>
<tr>
<td>MAIS</td>
<td>AIS 1-2</td>
<td>~ AIS 3-5</td>
</tr>
<tr>
<td>Post-Impact Motion</td>
<td>Carried</td>
<td>Thrown Fwd</td>
</tr>
<tr>
<td>WAD/Pedestrian Height</td>
<td>1.40</td>
<td>0.85</td>
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<tr>
<td>MAIS vs. Speed</td>
<td>---</td>
<td>Increased</td>
</tr>
</tbody>
</table>

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Overall Conclusions

- Two very different interactions to examine:

<table>
<thead>
<tr>
<th>Passenger Car</th>
<th>Light Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carried</td>
<td>Thrown Forward</td>
</tr>
<tr>
<td>Less Severe Injuries</td>
<td>More Severe Injuries</td>
</tr>
<tr>
<td>Higher speeds</td>
<td>Lower speeds</td>
</tr>
<tr>
<td>WAD/Height ~ 1.22</td>
<td>WAD/Height ~ 1.00</td>
</tr>
</tbody>
</table>

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- Honda R & D
- GESAC
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THANK YOU!