Identifying and Analyzing Tire-Disablement-related Crashes in NCSA Data Systems

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National Center for Statistics and Analysis
National Highway Traffic Safety Administration
National Center for Statistics and Analysis (NCSA)

NCSA provides information, analysis, statistical support, technical assistance, and guidance.
NCSA Crash Data Systems

TOPICS:

- FARS
- NASS GES
- NASS CDS
- NMVCCS
Fatality Analysis Reporting System (FARS)

- All police-reported fatal motor vehicle traffic crashes within the U.S.
- State data recoded into a uniform national data set
- Fatality w/in 30 Days of Crash
Tire-Related Variables in FARS

Related Factors, Vehicle Level

DEF: This data element records factors related to this vehicle expressed by the investigating officer.

VEH_CF1,2 1982-2009

01=Tires (does not include wheels)

- Excludes improper tire pressure, which is due to driver irresponsibility.
- Defective tires, tread separation, sidewall failure, excessively worn or bald tires.
- Tires improperly sized for this vehicle.
- Excludes: Tire damage produced in the crash (hitting pothole, curb, etc.).
Tire-Related Variables in FARS

Contributing Circumstance, Motor Vehicle

DEF: This data element describes this vehicle’s possible pre-existing defects or maintenance conditions that may have contributed to the crash.

MFACTOR 2010-later (MARK ALL THAT APPLY)

01=Tires

include any defect of a tire. If the contributing factor is of the wheel (e.g., a lug nut comes off), then use 11 (Wheels).
Tire-Related Variables in FARS

Related Factors, Driver Level
This data element records factors related to this driver expressed by the investigating officer.

DR_CF1,2,3,4  1982-2009
DR_SF1,2,3,4   2010-later
80= Skidding, swerving or sliding due to tire blowout or failure
No additional description.

Note – an available person-level version is never used in light vehicles in FARS 1995-2012
Critical Precrash Event
DEF: This data element identifies the attribute that best describes the critical event which made this crash imminent (i.e., something occurred which made the collision possible).

P_CRASH2 (2010-later)

01=This vehicle loss of control due to blowout/flat tire is used when a vehicle in motion loses control as the result of an immediate tire disruption. Examples include blow out, rapid air loss, tread separation, etc.
## Tire-Related Variables in FARS

How the different variables contribute:

<table>
<thead>
<tr>
<th>Tire Factor in light vehicle</th>
<th>AVG. CRASHES/YEAR</th>
<th>% of all FARS crashes</th>
<th>AVG FATALITIES/YEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Factor (1995-2012)</td>
<td>496</td>
<td>1.38 %</td>
<td>600</td>
</tr>
<tr>
<td>Driver Factor (1995-2012)</td>
<td>145</td>
<td>0.40 %</td>
<td>183</td>
</tr>
<tr>
<td>Critical Precrash Event (2010-2012)</td>
<td>201</td>
<td>0.66 %</td>
<td>249</td>
</tr>
<tr>
<td>Any of the above</td>
<td>526</td>
<td>1.46 %</td>
<td>637</td>
</tr>
</tbody>
</table>

Source: FARS 1995-2012
# Tire-Related Variables in FARS

Year group breakouts, any tire factor:

<table>
<thead>
<tr>
<th>Any tire factor (VEH_CF, DR_CF, or P_CRASH2) in light vehicle</th>
<th>AVG. CRASHES/YEAR</th>
<th>% of all FARS crashes</th>
<th>AVG FATALITIES/YEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995-2006</td>
<td>543</td>
<td>1.43 %</td>
<td>662</td>
</tr>
<tr>
<td>2007-2009</td>
<td>454</td>
<td>1.33 %</td>
<td>544</td>
</tr>
<tr>
<td>2010-2012</td>
<td>530</td>
<td>1.75 %</td>
<td>630</td>
</tr>
</tbody>
</table>

Source: FARS 1995-2012
Tire-Related Variables in FARS

FARS strengths and limitations

Strengths:
• Census.
• No standard errors or estimates needed.
• Can analyze by State.
• Since 2010, variables harmonized with NASS GES variables.

Limitations:
• Fatal crashes only.
• Crash circumstances only as can be drawn from State crash report
• Information on State crash report varies by State – each State develops independently.
National Automotive Sampling System
GENERAL ESTIMATES SYSTEM (GES)

- Nationally representative sample of police reported traffic crashes
- ~50,000 crashes coded per year
- Sampled from ~5M police reported crashes
- Collected at 60 sites across the country
Tire-Related Variables in NASS-GES

Vehicle Contributing Factors

DEF: This data element describes this vehicle’s possible pre-existing defects or maintenance conditions that may have contributed to the crash.

• MFACTOR 2002-later (mark-all-that-apply)
• 2002-2009 FACTOR derived from MFACTOR
• 2010 later only MFACTOR

01=Tires includes any defect of a tire. If the contributing factor is of the wheel (e.g., a lug nut comes off), then use code “Wheels.”
Critical Precrash Event
DEF: This data element identifies the attribute that best describes the critical event which made this crash imminent (i.e., something occurred which made the collision possible).

P_CRASH2

=This vehicle loss of control due to Blowout/Flat tire.
is used when a vehicle in motion loses control as the result of an immediate tire disruption. Examples include blow out, rapid air loss, tread separation, etc.
(Same as FARS, 2010-later)
<table>
<thead>
<tr>
<th>MFACTOR= Tires or P_CRASH2= This vehicle loss of control due to blowout/flat tire</th>
<th>AVG. CRASHES/YEAR (weighted estimate) (crash has a light vehicle with at least one of the factors)</th>
<th>% of all GES crashes</th>
<th>AVG INJURED/YEAR fatal and non-fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995-2006</td>
<td>38,000 (33,000 – 44,000)</td>
<td>0.61% (0.52% - 0.69%)</td>
<td>24,000 (18,000 – 30,000)</td>
</tr>
<tr>
<td>2007-2012</td>
<td>33,000 (29,000 – 36,000)</td>
<td>0.58% (0.51% - 0.66%)</td>
<td>19,000 (14,000 – 24,000)</td>
</tr>
</tbody>
</table>

Source: NASS GES 1995-2012
**Tire-Related Variables in NASS GES**

**NASS GES strengths and limitations**

**Strengths:**
- Nationally representative sample.
- Universe includes non-fatal injury crashes and property-damage only crashes (not just fatal crashes as in FARS).
- Since 2010, variables harmonized with FARS variables.

**Limitations:**
- Not a census, so point estimates have sampling errors.
- Crash circumstances only as can be drawn from State crash report
- Information on State crash report varies by State – each State develops independently.
- Can’t make State-level estimates.
National Automotive Sampling System
CRASHWORTHINESS DATA SYSTEM (CDS)

- Detailed data on vehicle damage and the occupant outcome (crashworthiness) of *towed light passenger vehicles*
  - Approximately 3,500 sampled cases annually
- Field Investigation Based
- Over 600 CDS Data Elements Describe
  - Crash Events
  - Damage to Vehicle
  - Crash Forces Involved
  - Injuries to Victims
  - Injury Mechanisms
Critical Pre-crash Event

DEF: This variable identifies the critical event which made the crash imminent (i.e., something occurred which made the collision possible).

Source: Researcher determined — inputs include scene inspection, vehicle inspection, driver interview, and police report.

PREEVENT

1=This Vehicle Loss Of Control, Blow Out or Flat Tire

is used when a vehicle in motion loses control as the result of an immediate tire disruption. Examples include blow out, rapid air loss, tread separation, etc.
## Tire-Related Variables in NASS CDS

### CDS Point Estimates (95% Confidence Intervals)

<table>
<thead>
<tr>
<th>CRITICAL PRECRASH EVENT=1</th>
<th>AVG. CRASHES/YEAR (weighted estimate)</th>
<th>% of all CDS crashes</th>
<th>AVG INJURED/YR Using KABCO fatal+nonfatal</th>
<th>AVG KILLED/YR Using KABCO</th>
</tr>
</thead>
<tbody>
<tr>
<td>This Vehicle Loss Of Control, Blow Out or Flat Tire</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995-2006</td>
<td>17,000 (9,500 – 24,500)</td>
<td>0.68% (0.39% - 0.97%)</td>
<td>14,000 (6,000 –23,500)</td>
<td>333 (0 – 688)</td>
</tr>
<tr>
<td>2007-2010</td>
<td>9,000 (3,000 – 14,500)</td>
<td>0.42% (0.15% - 0.70%)</td>
<td>8,500 (1,500 – 15,500)</td>
<td>199 (0 – 508)</td>
</tr>
<tr>
<td>2011-2013</td>
<td>11,000 (400 – 21,500)</td>
<td>0.55% (0.08%, 1.03%)</td>
<td>4,500 (2,500 – 6,000)</td>
<td>41 (0 - 126)</td>
</tr>
</tbody>
</table>

Source: NASS CDS 1995-2012
Tire-Related Variables in NASS CDS

NASS CDS strengths and limitations

Strengths:
- Data based on NHTSA-trained crash technician findings, physical evidence, interviews etc, not just state crash reports.
- Crash research allows photos and clinical review of individual cases.
- Injury coding from medical records (not just crash report).
- Many more variables than FARS or GES.

Limitations:
- Smaller sample size means larger confidence intervals, less precision to aggregate estimates.
- Emphasis is on crashworthiness, not causation.
- Since 2009, vehicles more than 10 years old do not have full data.
National Motor Vehicle Crash Causation Survey (NMVCCS)

- On-scene crash study 2005-2007
- Detailed data on factors leading up to the crash
- Crashes with at least one towed light passenger vehicle
- 5470 weighted cases
- NMVCCS researcher traveled to crash site as soon as possible after crash
  - EMS monitoring – dispatch required
NHTSA Paper,

Tire-related Factors in the Pre-Crash Phase using NMVCCS, found:

• 5% of light vehicles in NMVCCS had some kind of tire factor present (critical event, critical reason, or presence of factor)
• 50% of crashes with a tire factor were single-vehicle crashes
• Underinflation was over-represented in tire-related factor crashes, compared to properly inflated
• Rollovers over-represented in tire factor crashes
• Wet roads, slick surfaces over-represented in tire-related factor crashes

Paper is online as DOT HS 811 617
National Motor Vehicle Crash Causation Survey (NMVCCS)

NMVCCS strengths and limitations

Strengths:
- Data based on crash technician findings, physical evidence, interviews etc, - not just state crash reports.
- Crash technicians are at the scene of the crash before it is cleared, allowing most accurate pre-crash data
- Crash research allows photos and clinical review of individual cases.
- Large assortment of specifically designed precrash variables.
- For tires, had the tires examined at the scene, pressure taken, etc.

Limitations:
- Universe did not cover overnight, and was only EMS-dispatched crashes.
- Sampling depended on notification.
Thank You

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