Commercial Driver Human Factors

Session 848: Truck & Bus Safety
Key Research – Past, Present, Future

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“Domain” Human Factors Topic Headings

• Driver Functional Capabilities
• Driver Age (Young & Old)
• Demographic Trends and the Driver Shortage
• Driver Training
• Driver Fatigue
  – Factors affecting alertness
  – How many fatigue crashes?
  – Alertness monitoring
• HF Research Needs
2007 TRB Human Factors Workshop Topics

- Driver Functional Capabilities
- Driver Age (Young & Old)
- Demographic Trends and the Driver Shortage
- Driver Training
- Driver Fatigue
- Differential Driver Risk (High-Risk Drivers)
- Personality & Risk
- Driver-Vehicle Interaction
- Car-Truck Interaction
- Crash Avoidance Technologies
- Carrier Operations & Safety Management
- Macroergonomics and Driver Safety Motivation
- Human Resource Management
- Onboard Monitoring & Behavioral Safety Management
What Shall We Talk About Today?

- Driver Functional Capabilities
- Driver Age (Young & Old)
- Demographic Trends and the Driver Shortage
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- + Crash Causation
What Shall We Talk About Today?

- Crash Causation
- Driver Fatigue
- Personal Risk
Crash Causation: “Risk-Cause” Model

1. Factors affecting the risk of a crash
2. Driver errors & other failures precipitating crashes

Timeline leading to a crash

RISK FACTORS

**Driver:** personality, medical, fatigue, anger, using cell phone, etc.

**Vehicle:** brakes, equipment, etc.

**Roadway:** traffic density, roadway type, work zones, surface condition, visibility, etc.

PROXIMAL

SE(S)

CRASH
## Crash Causation: LTCCS Critical Reasons

<table>
<thead>
<tr>
<th>“Critical Reason Category”</th>
<th>Examples</th>
<th>%</th>
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<tbody>
<tr>
<td><strong>Truck Driver Physical Failure</strong></td>
<td>• Asleep-at-the-wheel</td>
<td>6%</td>
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<tr>
<td></td>
<td>• Heart attack</td>
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<td>• Other physical impairment</td>
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<td>• Inattention</td>
<td>16%</td>
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<td></td>
<td>• Distraction (internal or external)</td>
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<td>• Inadequate surveillance (“LBDNS”)</td>
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<tr>
<td><strong>Truck Driver Decision Error</strong></td>
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<td>21%</td>
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<td>• Following too closely</td>
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<td>• Misjudgment/false assumption</td>
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<td>• “Sloppy” maneuver</td>
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<td>• Brake failure</td>
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<td>• Tire failure</td>
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<td></td>
<td>• Cargo shift</td>
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<tr>
<td><strong>Roadway/ Environment Affecting Truck</strong></td>
<td>• Road signs/signals missing</td>
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<td>• Road design</td>
<td></td>
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<tr>
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<td>• Weather and/or slick roads</td>
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Hours of Driving (Time-on-Task): “Not a strong or consistent predictor of observed fatigue."

Daily Sleep:
- Ideal: 7.2 hours
- Actual: 5.2 hours

Driver Self-Awareness of Fatigue: “Little correlation” between subjective and concurrent objective measures

Large Individual Differences in Susceptibility:
- 14% of drivers $\rightarrow$ 54% of all drowsy episodes.
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Hours of Driving (Time-on-Task): “Not a strong or consistent predictor of observed fatigue.“

Daily Sleep:
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Driver Self-Awareness of Fatigue: “Little correlation” between subjective and concurrent objective measures

Individual Differences in Susceptibility:
- “Wide variations”
- 14% of drivers → 54% of all drowsy episodes.
2011 Penn State Study: DOT-Reported Crash Likelihood & Hours of Driving
1) Conduct a comprehensive, top-down review of truck and bus safety efforts (Federal, State, industry, public education, etc.) as related to our knowledge of crash causation and characteristics. Identify under-addressed causes & under-supported countermeasures.

2) Identify, validate, & elucidate the driver performance mechanisms underlying time-on-task and other schedule-related associations with crashes and safety-critical events (SCEs).
Personal Risk: Two Dimensions

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<td>Mistakes vs. Misbehavior: Correlates &amp; Implications</td>
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<td>Driver Records</td>
<td>Rewards &amp; Discipline</td>
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<td>Driver Age</td>
<td>Acceptance, Tolerance, &amp; Forgiveness</td>
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<td>Driver Risk Factors</td>
<td>Driver Self-Management</td>
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<td>Selection</td>
<td>Crash Timeline</td>
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<td>Training</td>
<td>Driver Error Types</td>
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Personal Risk: Two Dimensions

Performance
(Ability)

Temporary
States

Behavior
(Choices)

Enduring
Traits
Sources of Personal Risk: Four Categories

A: Temporary Levels of Performance

B: Enduring Levels of Performance

C: Temporary Behavioral States (Affecting Choices)

D: Enduring Behavioral Traits
Enduring Behavior Traits: The Evidence

• **High differential risk** seen in naturalistic driving and simulator studies (both with many data points); e.g., 19% of drivers → 53% of at-fault risk.

• **Surveys** of safety managers & others:
  – High differential risk
  – High individual consistency of risk
  – Related to personality, attitudes, at-risk behaviors

• **Literature** on personality, values, & safety attitudes

• **Physiological correlates:**
  – Testosterone, other hormones
  – Brain scans
  – Heritabilities of risk-related traits; e.g., sensation-seeking, impulsivity, aggression, criminality.
Driver Human Factors Research Needs

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2) Identify, validate, & elucidate the driver performance mechanisms underlying time-on-task and other schedule-related associations with crashes and safety-critical events (SCEs).

3) Validate & elucidate personal risk dimensions:
   – Performance vs. behavior
   – Temporary vs. enduring

Design safety programs based on this understanding.

*And many more!!!*
Thanks for your attention!
Ron Knipling
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