



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~~
- ~~Driver Training~~
- **Driver Fatigue**
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- **+ Crash Causation**

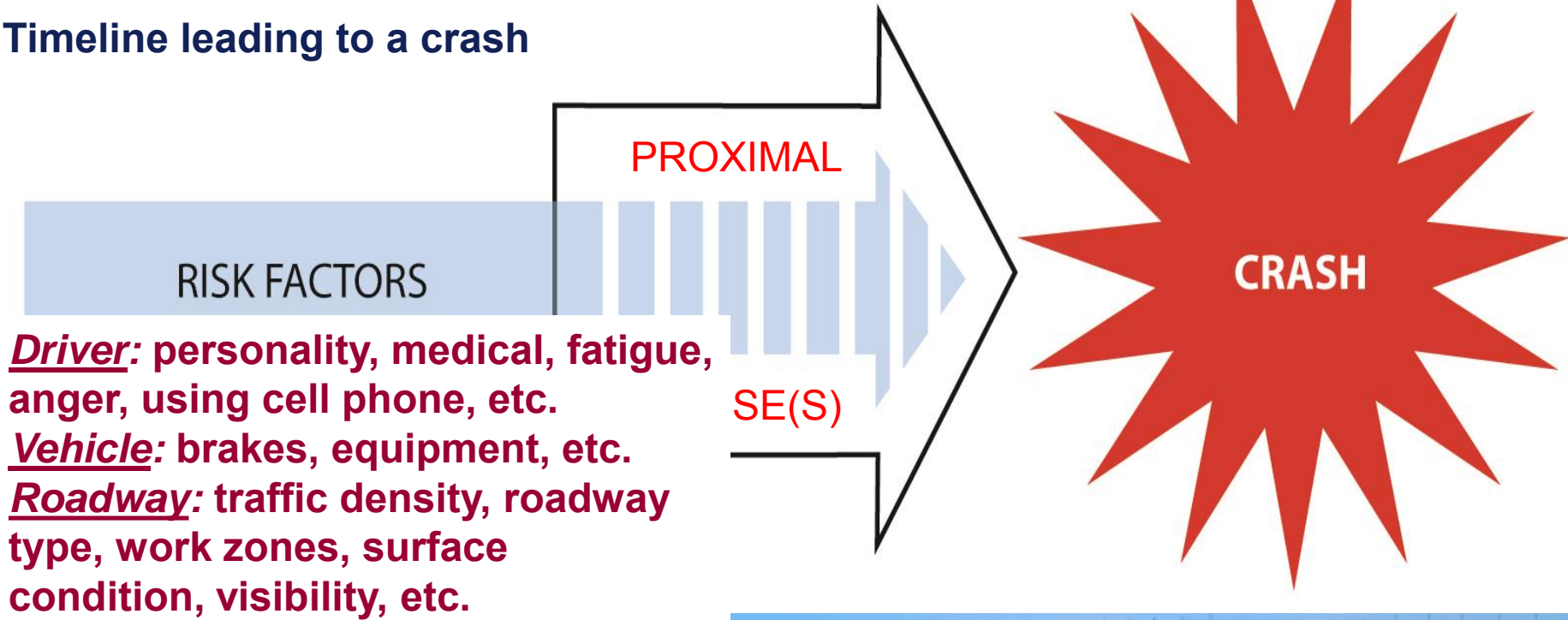
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- **Crash Causation**
- **Driver Fatigue**
- **Personal Risk**

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



Crash Causation: LTCCS Critical Reasons

| “Critical Reason Category” | Examples | % |
|--|--|------------|
| Truck Driver Physical Failure | <ul style="list-style-type: none"> • Asleep-at-the-wheel • Heart attack • Other physical impairment | 6% |
| Truck Driver Recognition Failure | <ul style="list-style-type: none"> • Inattention • Distraction (internal or external) • Inadequate surveillance (“LBDNS”) | 16% |
| Truck Driver Decision Error | <ul style="list-style-type: none"> • Too fast for conditions • Following too closely • Misjudgment/false assumption | 21% |
| Truck Driver Response Execution Error | <ul style="list-style-type: none"> • Overcompensation • “Sloppy” maneuver | 3% |
| Truck Vehicle Failure | <ul style="list-style-type: none"> • Brake failure • Tire failure • Cargo shift | 6% |
| Roadway/ Environment Affecting Truck | <ul style="list-style-type: none"> • Road signs/signals missing • Road design • Weather and/or slick roads | 1% |
| OTHER DRIVER/VEHICLE | | 45% |

Driver Human Factors Research Needs

- 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.

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Driver Fatigue & Alertness Study

Time-of-Day: “Strongest & most consistent factor . . .”

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 → 54% of all drowsy episodes.

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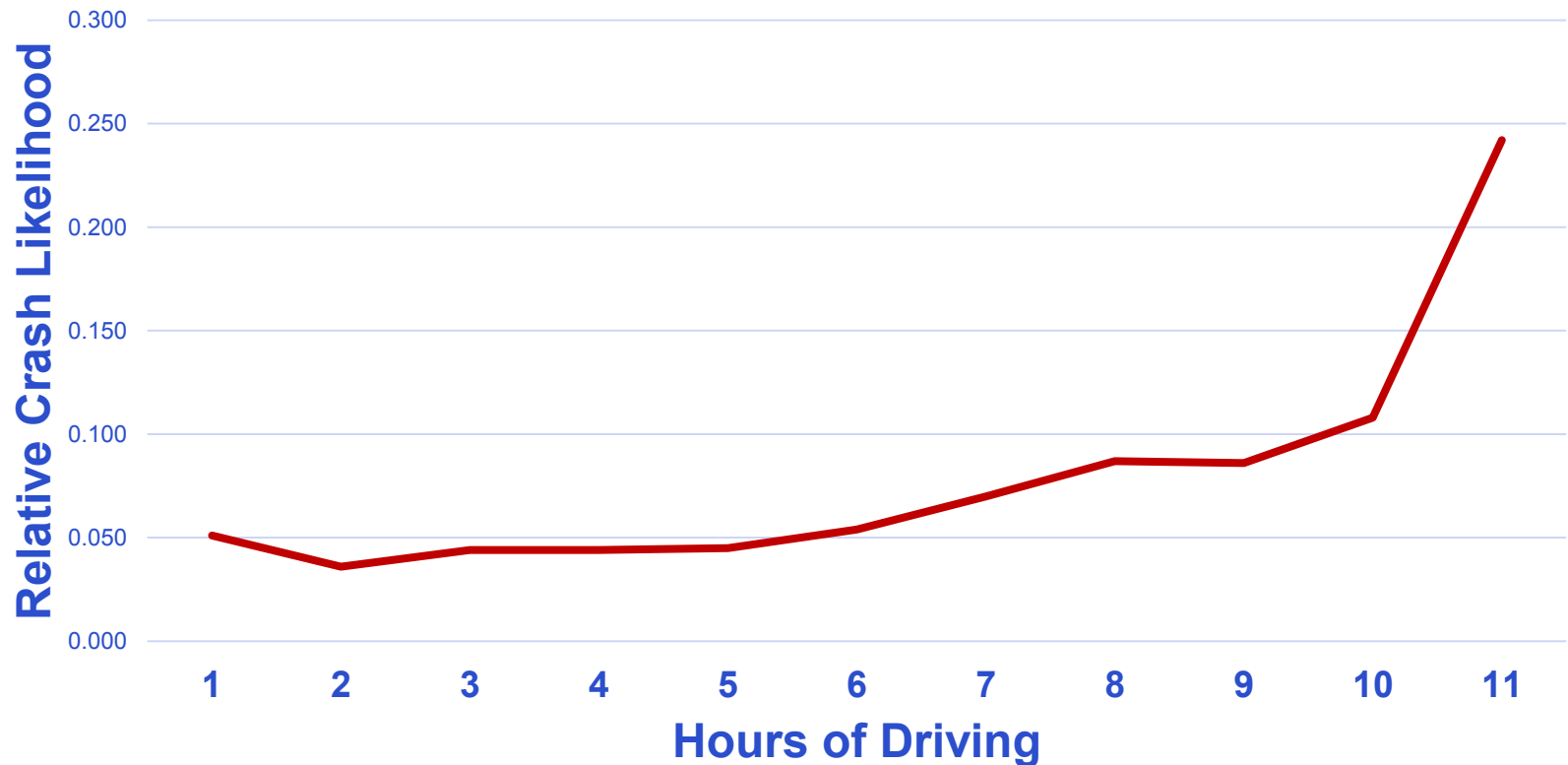
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Individual Differences in Susceptibility:

- “Wide variations”
- 14% of drivers → 54% of all drowsy episodes.

2011 HOS Studies (Crashes & SCEs)

**2011 Penn State Study:
DOT-Reported Crash Likelihood & Hours of Driving**



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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).

Personal Risk: Two Dimensions

**Performance
(Ability)**

**Behavior
(Choices)**

Mistakes vs. Misbehavior: Correlates & Implications

Driver Records

Driver Age

Driver Risk Factors

Selection

Training

Driver Experience

Observations of Driving

Onboard Monitoring

Rewards & Discipline

*Acceptance, Tolerance, &
Forgiveness*

Driver Self-Management

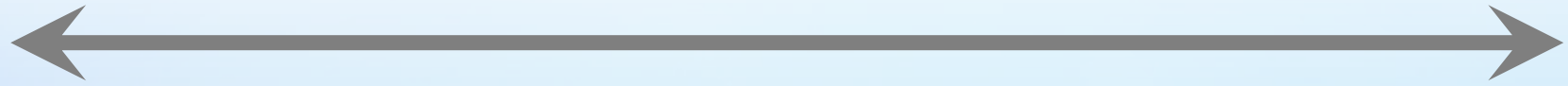
Crash Timeline

Driver Error Types

Crash Types

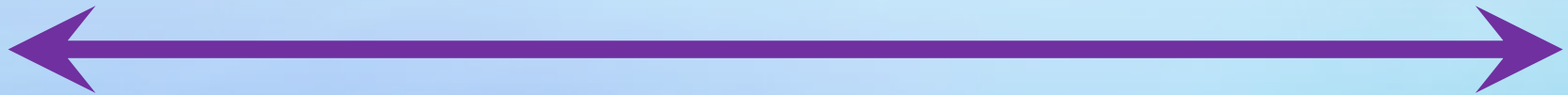
Crash Severity

Personal Risk: Two Dimensions



**Performance
(Ability)**

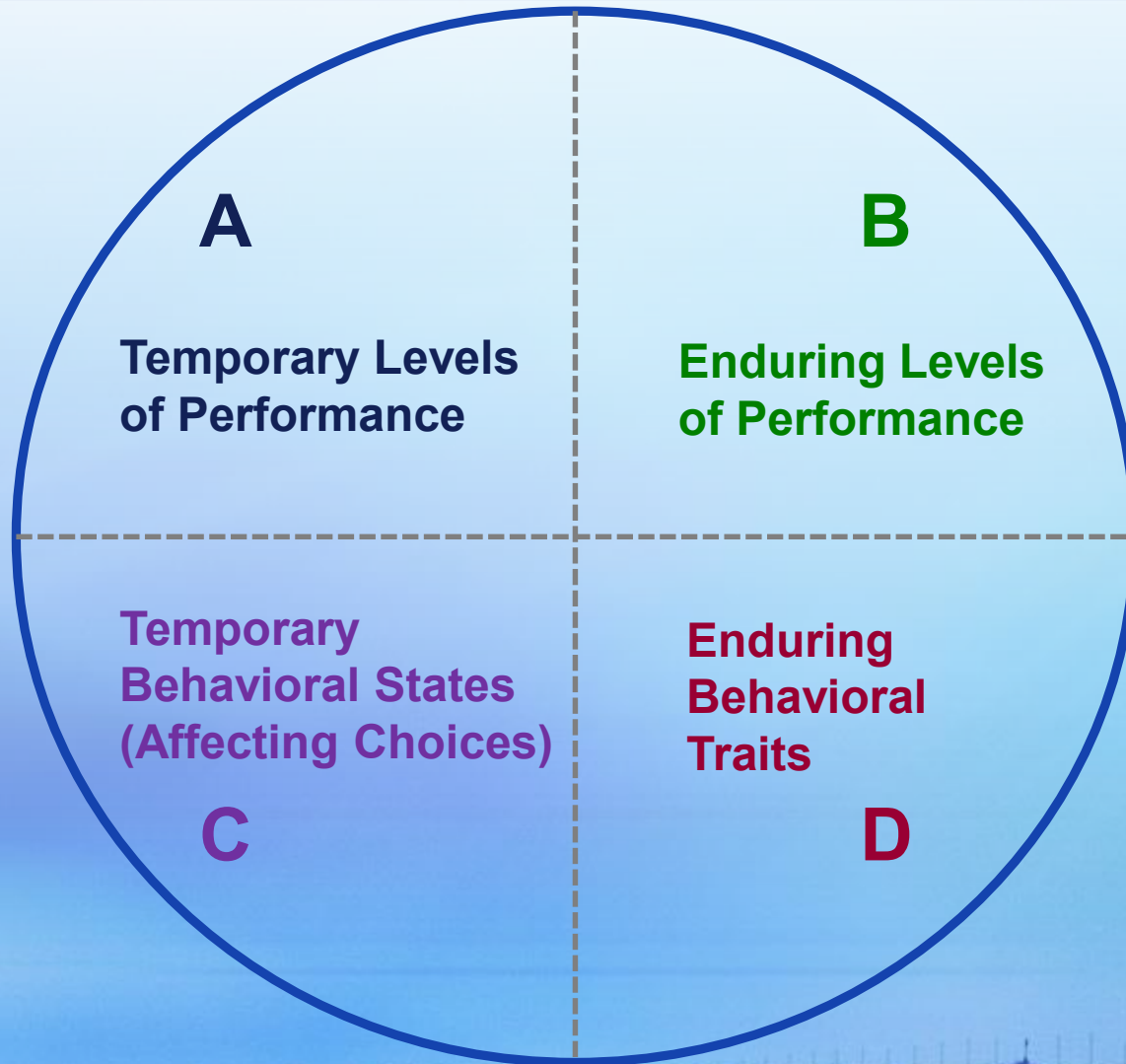
**Behavior
(Choices)**



**Temporary
States**

**Enduring
Traits**

Sources of Personal Risk: Four Categories



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.

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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. enduringDesign safety programs based on this understanding.

****And many more!!!***



Thanks for your attention!
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