Black Box Technology Applications in Transportation Safety

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Rural matters
Roads that work for people should work for the environment, too.
Improving Safety on our Roadways
How Black Box technologies helps to close the gap ...

WTI’s Comprehensive Research Capabilities to Study Driver Behavior Factors

Driver/Traffic Fatality
Vehicle
Traffic
Infrastructure/Environment
Society

“Black Box”
Black Box Type 1: “Fully Naturalistic” Driving Data Collection

Dependent Variables:
- Digital video cameras/views
- Machine Vision Driver ID, Eyes Forward, Traffic Signal, Lane Tracker
- Accelerometers (3 axis)
- GPS
- Forward Radar
- Luminance sensor
- Passive alcohol sensor
- Vehicle network data
  - Accelerator
  - Brake
  - Gear position
  - Steering wheel angle
  - Speed
  - Seat Belt Information
  - Airbag deployment

- collects data continuously (10Hz) throughout a driving episode

Photos courtesy of: Transecurity, LLC / Virginia Tech
Black Box Type 2: “Semi-Naturalistic” Event Based Data Collection Systems

• “events” (e.g. near-crash or crash) for 10 sec before & 6 sec after an event
# Black Box Type: Advantages and Disadvantages

<table>
<thead>
<tr>
<th>Type of DAS</th>
<th>Parameters</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event-based: “semi-</td>
<td>Data collection triggered</td>
<td>Easy to use interface to analyze data</td>
<td>• Only “events” are collected (e.g. lane departure due to distraction may or may not lead to triggered event) • Only a few data metrics are collected</td>
<td>Bus fleets, trucking fleets, service fleets, teen/parents, research</td>
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<tr>
<td>naturalistic”</td>
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<tr>
<td>All time: “fully</td>
<td>Collected at 10 Hz continuously</td>
<td>All data is collected, more types of data and video available</td>
<td>• Data analysis is cumbersome • More difficult install</td>
<td>Research</td>
</tr>
<tr>
<td>naturalistic”</td>
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</tbody>
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Examples of Research Studies at WTI to Utilize these DAS systems

1. An Objective Evaluation of an Education-Based Distracted and Drowsy Driving Intervention for Teen Drivers in Rural America

2. Naturalistic Safety Evaluation of the Medic’s Work Environment During Emergency Response

3. Feedback Monitoring Systems for Improving EMS Safety
1. An Objective Evaluation of an Education-Based Distracted and Drowsy Driving Intervention for Teen Drivers in Rural America

Sponsored by: NHTSA – National Highway Traffic Safety Administration

*Key collaborators: Bozeman school district & Office of Public Instruction
The goal of this project is to quantify the behavioral effect of an education module specific to the hazards of distracted and drowsy driving for novice teen drivers in rural communities.

Only interested in “events” related to drowsy or distracted driving.
Experimental Design

Test Class

20 Students each session (N = 40)

Licensing Phase (6 months)

N = 10

Main Data Collection (6 months Session I) (<6 months Session II)

Different times of day week with same instructor

Standard Curriculum Module

Integrated distraction and fatigue content

Module 17 (long)

Module 17 (short)

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On-going Data Collection

- Passive collection
  - G-force trigger
- Video clips (8 + 4 s)
  - Context
- Automatic upload
- Events Coded (distraction, fatigue)
  - www.drivecam.com
  - Secure website
  - Anonymous
2. Naturalistic Safety Evaluation of a Medic’s Work Environment

**Objective:** A naturalistic observation of EMS personnel during emergency medical response transport -- in order to improve the safety of the occupants (medic and patient) within the ambulance as well as the traveling public.

**Partnership with:**
American Medical Response
Critical Illness & Trauma Foundation

**Funding provided by:**
WTI’s University Transportation Center
Federal Highway Administration Agreement
Research Questions that can be answered with fully naturalistic DAS:

1. What are significant driver and environmental factors contributing to crashes or near-crashes, e.g. driver distraction, speed, erratic behaviors, etc.?
2. How often are medics restrained (and why) during transport?
3. What are procedures or common actions that impose physical hardships on medics (awkward reaches, lifts, repetitive actions)?

American Medical Response
F350 Ambulance

Western Transportation Institute
3. Feedback Monitoring Systems for Improving EMS Safety

**Objective**: utilize a feedback system for behavior modifications in EMS Rural Drivers

**STEPS:**
1. Capture Risky Driving
2. Download Triggered Event
3. Review, Analyze and Score Event
4. Coach Driver (EMS Service District Managers)

Photo courtesy of DriveCam
Methodology: Participants

- 15-20 EMS volunteers from three Montana ambulance fleets:
  - Whitehall, Big Timber, and West Yellowstone
  - 15 males (mean age 42.8 yrs, std. dev. 12.7)
  - 12 females (mean age 39.8 yrs, std. dev. 14.2)
  - Ages ranged from 21 to 66 years
Methodology: Equipment

6 ambulances equipped with DriveCam units
1. Big Timber (2)
2. Whitehall (2)
3. West Yellowstone (2)

DriveCam forward and in-vehicle views, also indicating forces and speed at the time of trigger.
Conclusions

- Difficulty in determining g-force thresholds
  - \(0.4g = F-350\) model
  - \(0.2g =\) passenger cars

- After 6 months of data collection, very few events recorded in our sample
  - EMS volunteers in rural communities safe drivers in general!

- To acquire more events, need more ambulances equipped with data collection units or consider “naturalistic” data collection system.
QUESTIONS ?