Evaluation of feedback to truck drivers to increase safe driving behaviors: Preliminary findings

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Justification and Need

- Roadway incidents - leading cause of workplace death
- Truck driving is among the top 10 most dangerous occupations
- Truck transportation industry – transportation incidents injuries severe enough to require time away from work
  (36.8 lost-workday incidents per 10,000 FTE per year vs. 6.1 per 10,000 FTE per year for all private industry combined, BLS 2013).
Objective

- Feedback from an onboard video recording system (OVRS) to drivers can reduce risky driving behaviors.

- A reduction in risky driving behaviors will reduce collisions, death, and injury to workers that drive on the job.

- Reduce fuel and truck maintenance costs
Onboard Video Recording System

- Collects two types of information
- Accelerometers in system monitor vehicle performance
- Video captured inside and outside vehicle
- Coded for risky driving behaviors
Risky Driving Behaviors

Fundamental Driving Errors
Unprofessional Driving
- Unsafe Backing
- Unsafe Braking
- Unsafe Lane Change / Merging / Passing
- Unsafe Railroad Crossing
- Unsafe Turning
- Lane Departure/Straddling Lanes
- Competitive/Agressive Driving
- Driving the Wrong Way - On Roadway
- Driving the Wrong Way - Off Roadway
- Curb Check/Jumped Curb

Vehicle Control
- Driving with Two Hands off Wheel
- Unattended Moving Vehicle

Stopping
- Incomplete Stop at Light
- Incomplete Stop at Stop Sign
- Failure to Attempt to Stop at Light
- Failure to Attempt to Stop at Stop Sign
- False Start
- Failure to Yield to Pedestrian(s)
- Failure to Yield to Vehicle(s)

Speeding
- Moderate Speeding (≤ 10 mph Over Limit)
- Excessive Speeding (> 10 mph Over Limit)
- Exceeded Maximum Speed

Situational Awareness
- Unsafe Following (≤ 1 second)
- Unsafe Following (1.25 - 2 seconds)
- Unsafe Following (2.25 - 3 seconds)
- Unsafe Following (3.25 - 4 seconds)
- Not Checking Mirrors
- Not Scanning Road Ahead
- Not Scanning Intersection

Distracted & Inattentive Driving
Distraction
- Mobile Phone - Texting/Dialing
- Mobile Phone - Talking (Handheld)
- Mobile Phone - Talking (Hands Free)
- Operating Other Mobile Device
- Reading Paperwork
- Grooming/Personal Hygiene
- Food
- Beverage
- Smoking
- Passenger(s)
- Other Task

Fatigue
- Drowsy/Falling Asleep
- Yawning

Other Unsafe Driving
Seatbelts
- Driver Seatbelt Unfastened (≤ 20 mph)
- Driver Seatbelt Unfastened (> 20 mph)
- Passenger Seatbelt Unfastened

Outcomes
Collision
- Collision with Pedestrian
- Collision with Vehicle in Transport
- Collision with Parked Vehicle
- Collision with Train
- Collision with Pedalcyle
- Collision with Animal
- Collision with Fixed Object
- Collision with Work Zone Equipment
- Collision with Other Movable Object
- Overturn (Rollover)

Outcomes
Near Collision
- Near Collision with Pedestrian
- Near Collision with Vehicle in Transport
- Near Collision with Parked Vehicle
- Near Collision with Train
- Near Collision with Pedalcyle
- Near Collision with Animal
- Near Collision with Fixed Object
- Near Collision with Work Zone Equipment
- Near Collision with Other Movable Object

Other Outcomes
- Ran off Road
- Crossed Median/Centerline

Non-Driver Observations
Unprofessional Conduct
- Rude Gesture
- Raised Voice

Event of Interest
- Captured Passenger Incident
- Captured Roadway Incident

Equipment
Obstructed View
- Obstructed View of Driver
- Obstructed Exterior View

Tampering
- Tampering/Abusing Equipment
- Suboptimal Camera Position
- Non-Performing Camera

4 Severity Levels

CDC Centers for Disease Control and Prevention
NIOSH
Lights-only Instant Driver Feedback

- Vehicle performance only
- Green light, yellow or red flashes
- Indicators of potentially unsafe or wasteful driving
Supervisor Coaching Feedback

- Video response center
- Supervisor coaches driver on Severity 3 and 4 events
- Reinforce company policy and safe driving
- “Going over game films to improve performance”
Industry Partner and Study Population

- General freight trucking, local
- Trucks (26,000-33,000 lb range)
- Deliveries to convenience stores
- Afternoon, evening, night, early morning work
Methods

- 7 business locations in 5 states (MA, NJ, MD, VA, WA), assigned to intervention or control group
- All trucks at each location were equipped with OVRS (152 total event recorders installed)
- Intervention sites (n=5) - instant driver feedback and supervisory coaching
- Control sites (n=2) – events recorded but no feedback
- Events were collected on a per vehicle per 24-hour day basis.
- Multiple drivers drove each vehicle in the study
### 17-month Project

<table>
<thead>
<tr>
<th>Treatment Phases</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 3 4 5 6 7 8 9 10 11 12</td>
<td>1 2 3 4 5 6 7 8</td>
</tr>
<tr>
<td><strong>Intervention Group 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3 sites, 55 trucks w/ OVRS)</td>
<td></td>
<td></td>
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<tr>
<td>Baseline</td>
<td></td>
<td></td>
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<tr>
<td>Program with lights only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program with Coaching &amp; lights</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Intervention Group 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2 sites, 47 trucks w/ OVRS)</td>
<td></td>
<td></td>
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<tr>
<td>Baseline</td>
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<td></td>
</tr>
<tr>
<td>Program with Coaching &amp; lights</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program with lights only</td>
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<td></td>
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<tr>
<td><strong>Group 3</strong></td>
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<td></td>
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<tr>
<td>(2 sites, 54 trucks w/ OVRS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
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</tbody>
</table>

*Notes:
- OVRS: On-vehicle remote monitoring system
- CDC: Centers for Disease Control and Prevention
- NIOSH: National Institute for Occupational Safety and Health*
Preliminary Data Analysis

Rate:

$N \ast H$

Rate per 100 driving hours:

$R \ast k$

Poisson regression adjusted for repeated measurements on the same vehicles over time
Preliminary Results

- 17-month observation period
  - 5 month baseline
  - 6 months first treatment
  - 6 months second treatment

Total Recorded Events: 284,899

Obstructed Camera View: 47,707 (16.75%)
Non-Obstructed Camera View: 237,192 (83.25%)

Final Dataset
## Event frequencies

<table>
<thead>
<tr>
<th>Category</th>
<th>Total</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seatbelts</td>
<td>80,896</td>
<td>39.4</td>
</tr>
<tr>
<td>Speeding</td>
<td>46,144</td>
<td>22.5</td>
</tr>
<tr>
<td>Distractions (Smoking, Eating, etc.)</td>
<td>45,378</td>
<td>22.1</td>
</tr>
<tr>
<td>Mobile Use Handheld</td>
<td>13,034</td>
<td>6.4</td>
</tr>
<tr>
<td>Mobile Use Hands Free</td>
<td>5,258</td>
<td>2.6</td>
</tr>
<tr>
<td>Fatigue</td>
<td>5,117</td>
<td>2.5</td>
</tr>
<tr>
<td>Stopping</td>
<td>4,762</td>
<td>2.3</td>
</tr>
<tr>
<td>Situational Awareness</td>
<td>1,845</td>
<td>0.9</td>
</tr>
<tr>
<td>Unprofessional Driving</td>
<td>1,610</td>
<td>0.8</td>
</tr>
<tr>
<td>Vehicle Control</td>
<td>1,077</td>
<td>0.5</td>
</tr>
<tr>
<td>Collision, Near Collision</td>
<td>86</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Other Events</td>
<td>12</td>
<td>&lt;0.1</td>
</tr>
</tbody>
</table>
Coaching Frequency

- Drivers were coached only for severity 3 and 4 events.
  - And only during a six month period.
- Of all known drivers, 84% had a severity 3 or 4 event (in the entire 17-month study period).

<table>
<thead>
<tr>
<th>Site</th>
<th>Percent of Drivers with Severity 3 and 4 Events Coached</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>51.6</td>
</tr>
<tr>
<td>2</td>
<td>90.2</td>
</tr>
<tr>
<td>3</td>
<td>90.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Site</th>
<th>Percent of Drivers with Severity 3 and 4 Events Coached</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>92.3</td>
</tr>
<tr>
<td>2</td>
<td>96.2</td>
</tr>
</tbody>
</table>
### Preliminary Results – Severity 3 and 4 Events

- **Baseline** to **Treatment**:
  - RR$_{adj}$/= 0.93, 7% Decrease, p > 0.05

- **Baseline** to **Coaching**:
  - RR$_{adj}$/= 0.47, 53% Decrease, p < 0.05
Preliminary Results – Driving Unbelted

Control

Intervention

Baseline

Treatment

Baseline

Coaching

RR_{adj} = 1.11, 11% Increase
p > 0.05

RR_{adj} = 0.46, 54% Decrease
p < 0.05

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Preliminary Results – Handheld Device Usage

Rate per 100 Driving Hours

Control

Baseline

Treatment

Intervention

Baseline

Coaching

RR_{adj}=1.28, 28\% \text{ increase}\n
p < 0.05

RR_{adj}=0.53, 47\% \text{ decrease}\n
p < 0.05

CDC

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Limitations

- Coaching frequency (52-96% of drivers)
- Variation in coaching quality and content
- Camera obstructed view
- Linking events to individual drivers (either reliable key punch or schedule upload)
Discussion and Forthcoming Analyses

- Preliminary data show that coaching plus lights feedback are effective in reducing several risky driving behaviors of key interest to fleet managers
- Examine a number of other outcomes
- Auto liability and workers’ compensation claims
- Driver-level analysis to look more closely at the effect of coaching on driver behavior
- Look at economic factors and outcomes related to fuel consumption
- Acceptance and perceptions of this technology by drivers and managers
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