On-Board Safety Systems: Enabling Management and Logistics

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Outline

1. Relationship between safety technology and management practice
2. On-board safety technologies
3. Management practices reliant on safety technology
4. Driver acceptance of on-board technology
5. New roles for multi-modal freight movement related to on-board technology
6. Barriers to the deployment of transformational technologies
Relationship between safety technology and management practice
Best safety

System Integration

Sub-optimal safety performance

Independent Systems

Technology

Management
## On-board safety technologies

<table>
<thead>
<tr>
<th>Safety Technology</th>
<th>Driver + Management</th>
<th>Driver only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability control</td>
<td></td>
<td>Lane keeping/departure</td>
</tr>
<tr>
<td>Over-speed alert system</td>
<td></td>
<td>Adaptive cruise control</td>
</tr>
<tr>
<td>Forward control and crash mitigation braking</td>
<td></td>
<td>Automated transmissions</td>
</tr>
<tr>
<td>Electronic log book</td>
<td></td>
<td>Disc brakes</td>
</tr>
<tr>
<td>In-cab cameras</td>
<td></td>
<td></td>
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<tr>
<td>Forward facing cameras</td>
<td></td>
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</tbody>
</table>
Innovative evolution of safety technologies supporting management and logistics
Electronic logging devices (ELD)

• Originally conceived to track driver hours of service
• The addition of GPS and communications has upgraded it to a vehicle system reporting tool
• It will likely become the central node for truck communications due to Dec 2017 mandate

Brilliant unintended consequence
Electronic logging device capabilities

• Data keeps dispatchers up to date on driver and delivery status
• Provides early identification of potential HOS violations
• Identifies drivers who are already in violation (real time)
• Provides data on available hours left per driver to complete jobs
• Determines if driver hours contribute to inefficient vehicle use
• Supports comprehensive driver coaching programs
• Continually assess job assignments to improve efficiency
Electronic logging device capabilities

• Ability to create customizable driver task lists
• Integration with dispatch systems resulting in automatic flow of trip information, status updates, and completed forms
• Turn by turn navigation that takes into account vehicle road restrictions such as weight, length, width, and height, as well as hazardous materials (HAZMAT) routing
Management practices reliant on safety technology
Measuring fleet safety performance

• Examined six fleets heavily invested in safety technology and advanced management practice. *Safety Adoption for Economic Return (SAFER)*
  – Interviews with safety executives
  – Driver survey of safety technology and management practice

• A literature review of safety management practice was also conducted.
Safety management literature

*what does *not* work*

- A culture of fear
- Termination threats
- “Customer is always right” attitude, because sometimes the customer is wrong about safety
- Adversarial approach to training (“cop and robber”) as opposed to a coaching approach
- Incentives without recognition
- Generic safety programs
- Pretending compliance is the same thing as safety
Safety management

**what works**

- Messages from the top leadership through the departments to drivers
- Consistent verbal communication
- Participation and buy-in for all departments, not just the safety department
- Internal cooperation across departments
- Education and training on how to do things right*
- Balanced positive and negative reinforcement*
- Demonstrated management commitment to safety*
- Screening during hiring*
- Simple, consistent, repeated safety messages*
Measuring safety benefit

- Used an aggregate of the selected BASICs

Safety Score = unsafe driving + hours of service + vehicle maintenance

<table>
<thead>
<tr>
<th>Fleet</th>
<th>Safety Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>21</td>
</tr>
<tr>
<td>B</td>
<td>45</td>
</tr>
<tr>
<td>C</td>
<td>33</td>
</tr>
<tr>
<td>D</td>
<td>17</td>
</tr>
<tr>
<td>E</td>
<td>57</td>
</tr>
<tr>
<td>F</td>
<td>68</td>
</tr>
</tbody>
</table>
Number of safety technologies per truck

Safety Score vs Safety Technologies

R² = 0.7786

Better safety
Number of trucks in fleet

Number of Trucks

Safety Score

Number of Trucks
## Driver assessment of technology

<table>
<thead>
<tr>
<th>Technology</th>
<th>Accepted</th>
<th>Satisfied</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Highly Effective Technology</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disk Brakes</td>
<td>91%</td>
<td>86%</td>
<td>1</td>
</tr>
<tr>
<td>Auto Transmission</td>
<td>79%</td>
<td>71%</td>
<td>2</td>
</tr>
<tr>
<td>Electronic Log Book</td>
<td>91%</td>
<td>69%</td>
<td>3</td>
</tr>
<tr>
<td><strong>Effective Technology</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stability control</td>
<td>74%</td>
<td>59%</td>
<td>4</td>
</tr>
<tr>
<td>Adaptive cruise control</td>
<td>74%</td>
<td>57%</td>
<td>5</td>
</tr>
<tr>
<td>Forward facing Cameras</td>
<td>77%</td>
<td>55%</td>
<td>6</td>
</tr>
<tr>
<td>Speed monitoring with GPS</td>
<td>66%</td>
<td>52%</td>
<td>7</td>
</tr>
<tr>
<td>Forward collision control and braking</td>
<td>66%</td>
<td>49%</td>
<td>8</td>
</tr>
<tr>
<td>Lane keeping/departure</td>
<td>65%</td>
<td>43%</td>
<td>9</td>
</tr>
<tr>
<td><strong>Less- Effective Technology</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-Cab Facing Cameras</td>
<td>48%</td>
<td>32%</td>
<td>10</td>
</tr>
</tbody>
</table>
## Executive assessment of technology

<table>
<thead>
<tr>
<th>Safety Technology</th>
<th>Type</th>
<th>Safety effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Highly Effective Technology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stability control</td>
<td>Independent</td>
<td>High</td>
</tr>
<tr>
<td>Forward collision control and braking</td>
<td>Independent</td>
<td>High</td>
</tr>
<tr>
<td>Disk brakes</td>
<td>Independent</td>
<td>High</td>
</tr>
<tr>
<td>In-cab and forward facing cameras with coaching</td>
<td>Dependent</td>
<td>High</td>
</tr>
<tr>
<td>Adaptive cruise control</td>
<td>Dependent</td>
<td>High</td>
</tr>
<tr>
<td>Electronic log book</td>
<td>Dependent</td>
<td>High</td>
</tr>
<tr>
<td>Speed monitoring with GPS (identifies speed zones)</td>
<td>Dependent</td>
<td>High</td>
</tr>
<tr>
<td><strong>Effective Technology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lane keeping/departure</td>
<td>Independent</td>
<td>Moderate</td>
</tr>
<tr>
<td>Automatic transmission</td>
<td>Independent</td>
<td>Moderate</td>
</tr>
<tr>
<td>Forward cameras only with coaching</td>
<td>Dependent</td>
<td>Moderate</td>
</tr>
<tr>
<td><strong>Less Effective Technology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-cab and forward facing cameras no coaching</td>
<td>Independent</td>
<td>Low</td>
</tr>
<tr>
<td>Forward cameras only without coaching</td>
<td>Independent</td>
<td>Low</td>
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</table>
New roles for multi-modal freight movement related to on-board technology
National Multimodal Freight Analysis Framework data challenges

- Applying the data for reasoning, “what if?” scenario analyses, and trend or pattern analysis
- Provisional and future year estimation
- Inadequate cost and temporal factors
- Calibration and validation problems are due to a lack of reference data
- Insufficient geographic scale
- Data deficiencies of coverage, aggregation, sparseness, consistency, and accuracy
- Accurate capture of transfers among modes
Critical need for multimodal transport

Achieve an internationally compliant system

• Safe
• Compliant
• Sustainable
• Paperless
• Unencumbered by red tape
• Reliable, cost-effective, timely (fast if needed, slow if possible...).
Unified Documentation

• Standardized and interoperable systems
• Protect and secure information
• E-documents
• Increased data sharing

In 2013, the United Nations Convention on the Contract for the International Carriage of Goods by Road addressed various legal issues concerning the transportation of cargo by road including additional protocol for electronic documents.
Barriers to the deployment of transformational technologies
About barriers

• Transformational technologies tend to be inventive rather than planned
• Market place validates relevance
• Barriers include institutional and regulatory stagnation, cost and ROI
• For transformational on-board technology, the main barrier appears to be a lack of system maturity and standardized requirements due to the early stage of transport system digital integration.
Conclusions

The number of safety technologies per truck is a strong indicator of overall fleet safety performance.

Fleet size was found to have an influence on safety outcome.

Safety technologies that provide direct digital feedback to fleet safety management were found to support better safety outcome.

On-board safety technologies present new opportunities for management and logistics in the road transport industry.
Conclusions

Improvements in multi-modal freight movement related to on-board safety technology will require standardized accurate and timely data transfer.

It appears that the electronic log book (electronic logging device) platforms offer a means of enabling standardized information and data for use in multi-modal freight movement.

Barriers to deployment for enabling safety management, logistics and intermodal transport include a lack of system clarity, maturity and a lack of standardized international systems.
Thank You

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