improving FLEET safety

Transportation Symposium

September 12, 2007 at 1:30 and 2:55

Driver Issues: Mitigating Risk and Improving Safety

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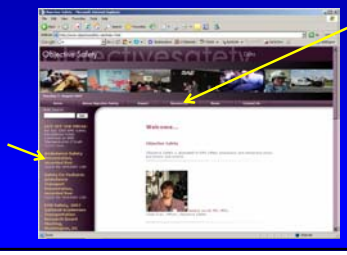
Fleet vehicles

- USA has the highest volume of fleet vehicles on planet earth – in excess of 62% of all vehicles on the road

http://www.objectivesafety.net



Wait a second…

- Why is an ER doc speaking at this seminar??
- Academic – and see the carnage of when things go wrong on the road
- Share data on the technology that has been evaluated INDEPENDANTLY
- So that you have the best information to make the roads safest

The USA Trucking Industry

- The trucking industry is an astounding $610 billion industry, 87% of the nation's freight bill (2003).
- Hauled 9.1 billion tons, 70% of all freight transported in the United States in 2003.
- Trucking collected 87 cents of every dollar spent on freight transportation.

How many vehicles?

- 24 million trucks (all classes) hauled over 9 billion tons of freight (2003).
- Of > 24 million trucks, 2.6 million were Class 8 vehicles.
- There were 4.9 million commercial trailers registered in 2003.

How far do they travel?

- All trucks, (excluding government) used for business purposes logged a total of 444 billion miles
  = 15.6% of all motor vehicle miles and 37.6% of all truck miles in 2003.
- Class 8 trucks drove a total of 114 billion miles.
- On average a Class 8 truck drove over 43,000 miles in 2003, although many long-haul Class 8 trucks travel in excess of 100,000 miles each year.

How many drivers?

- Across all industries, in 2003 > 8.6 million people were employed in trucking-related jobs.
- Over 3 million of these people were truck drivers.

Safety is Good Business

And what's really not new…

- "Fleet transport has a death toll…. "

Firstly!

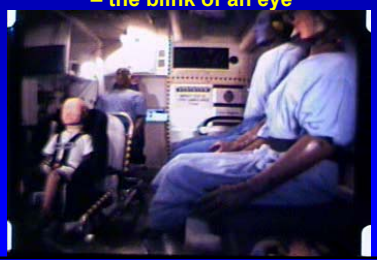
- An accident ?
- or

a predictable and preventable event

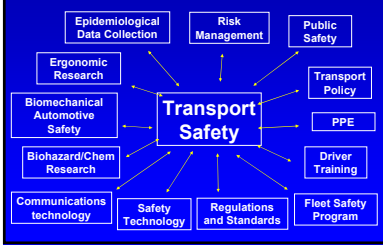
Truck Crash Fatalities

- 5,212 people were killed by trucking crashes in 2005 (almost 15% of total road toll!)
- 114,000 people were injured
- 15% of those killed, 24% of those injured were occupants of large trucks
- Fatal crashes have increased 10% in the past 10 years

And this all takes place in 60 millisecs – the blink of an eye



Transport Safety IS Complex AND Multidisciplinary



Safety Management

- A Safety Culture
- Protective Policies
- Protective Devices
  - To prevent a crash
  - In the event of a crash
- Continuous Education and Evaluation

Risk/Hazards

- Predictable risks
- Predictable fatal injuries
- Serious occupational hazard
- Public safety hazards

Creating a Safety Culture

within a company must start with upper management's commitment to safety

- Awareness
- Training
- Incentive

Benefit of Safety

- Any cost of addressing these issues is dwarfed in contrast to the huge burden of not doing so - in financial costs let alone the personal, societal, ethical and litigation costs

"Ripoff and Duplicate"

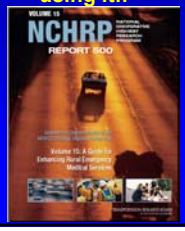
- Avoid reinventing the wheel at all costs
- Where are the best practices that we need to transfer knowledge from

Best Practice…..? The technology described in your junk mail is far more advanced than that used in your truck

What are the solutions?

- Training?
- Practice Policy?
- Transportation Systems Engineering?
- Automotive Engineering?
- Education of other road users???

Transportation Research Board is an excellent resource… we should be using it!!



Knowledge transfer

TRB TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

Active Projects

(all due 2007)

- Commercial Motor Vehicle Driver Training Curricula and Delivery Methods and Their Effectiveness
- Commercial Motor Vehicle Carrier Safety Management Certification
- The Role of Safety Culture in Preventing Commercial Vehicle Crashes
- The Impact of Behavior-Based Safety Techniques on Commercial Motor Vehicle Drivers
- Health and Wellness Programs for Commercial Motor Vehicle Drivers

The truck and bus industry is on the right track at the TRB

An opportunity for Global Best Practice

BHP - Key learnings for the organization were:

- Fatalities often have similar underlying causes
- High near miss reporting often correlates with declining injuries or fatalities
- Leadership visibility in the field is vital
- Hazard identification and risk awareness are fundamental to success.

Safety Improvement Roadmap

Valuable information from the transportation industry

FHWA/DOT 2007 report…

No need to reinvent the wheel...

July 2007 Report

The inevitable bottom line…

Safety saves time, lives AND money Canada, Nova Scotia

- Since 2000 working towards a goal of zero loss ratio with insurance provider
- 10 million kilometers per year
- 150 emergency response ambulance units
- Collision claim history measured in dollars per 100,000 kilometers traveled:
  - 2000/2001 $ 1725.00
  - 2001/2002 $ 1049.00
  - 2002/2003 $ 751.00
  - 2003/2004 $ 416.00
  - 2004/2005 $ 229.00

What do crashes really cost ?

- Loss of life and injury
- Negative impact on transport system
- Collisions are the largest liability cost and exceeds malpractice or negligence
- Besides the direct financial costs of replacing a damaged vehicle and equipment, there are additional hidden costs incurred:
  - investigating the ambulance collision
  - litigation /settlement/lawsuit
  - medical/disability costs of injured
  - hiring of new employees to replace injured personnel
  - retraining and psychological counseling of personnel involved and others
  - increased insurance rates

Policy makes a difference…

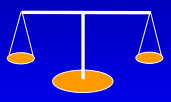
Systems Safety Engineering - Z.15…..

www.ASSE.org
http://www.objectivesafety.net/TransActions%20Z15.pdf

What Z15 encompasses

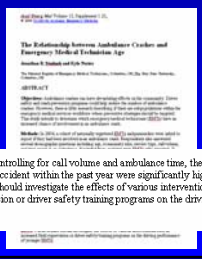
- Safety Program
- Safety Policy
- Responsibilities and Accountabilities
- Driver Recruitment, Selection and Assessment
- Organizational Safety Rules
- Orientation and Training
- Reporting Rates and Major Incidents to Executives
- Oversight

Balance of concerns and risk during transport



- Transport time
- Delivery deadlines
- Occupant safety/protection
- Public Safety

Driver issues



The Relationship between Ambulance Crashes and Emergency Medical Technician Age

ABSTRACT

Conclusions: When controlling for call volume and ambulance time, the odds of having been in an ambulance accident within the past year were significantly higher for younger EMTs. Future studies should investigate the effects of various interventions such as increased field supervision or driver safety training programs on the driving performance of younger EMTs.

The Driver

- Driver selection
- Driver monitoring and feedback
- Driver Impairment
- Driver training

Fleet Driver Training..

Dynamics of Fleet Safety - NSC

Liberty Mutual – 2006 Report

- Management Support and direction
- Safety Organization
- Employee Selection
- Employee Training
- Crash Reporting, Investigation, and Review

What about changing driver behavior??

AN OPTIMAL SOLUTION FOR ENHANCING AMBULANCE SAFETY: IMPLEMENTING A DRIVER PERFORMANCE FEEDBACK AND MONITORING DEVICE IN GROUND EMERGENCY MEDICAL SERVICE VEHICLES

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Jon Swanson
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Enhanced Safety of Vehicles, June 2007

REAL WORLD APPLICATION OF AN AFTERMARKET DRIVER HUMAN FACTORS REAL TIME AUDITORY MONITORING AND FEEDBACK DEVICE: AN EMERGENCY SERVICE PERSPECTIVE

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United States of America
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Michael E. Nagel
Cetronia Ambulance
United States of America
Paper Number 07-0254

Demonstrated Effectiveness

- Change driver behavior
- Carrot not stick
- Vehicle maintenance improvement
- Decreased administrative burden
- Insurance benefits

Technology tools

- American Transportation Research Institute (ATRI) Report – September 2006
- *Electronic On-Board Recorder (EOBR) Adoption in the Trucking Industry: Issues and Opportunities*
- Need for further documentation and justification of the relationship between EOBR and safety

Technology is a rapidly moving target

Positive attitudes

A study of Chinese truck drivers' attitudes toward feedback by technology

Abstract

Which one is best and for what environment??

Purpose of a real-time monitoring and auditory feedback program

- Enhance Safety
- Improve Driver Performance
- Save Maintenance Dollars
- Aid Accident / Incident Investigation

The ideal technology tool for improving driver behavior and enhancing safety

- Implementation of feedback and monitoring system over 2 years
- Safety performance improvement
- Cost savings
- Improved transport times

Driver behavior monitoring and feedback device

Levick NR, Swanson J, Proceedings - 49th Annual Conf. of the Assoc. for the Advancement of Automotive Med, September 2005

AMBEX-999 Research Forum 2006 – Research most likely to change practice award

Levick NR, Weirsch L, Nagel ME, International Enhanced Safety of Vehicles Technical Paper 07-0254, June 2007

How the Device Works

- Computerized monitoring device installed on each vehicle to measure parameters
- Each driver has individual key "fob"
- Data collected every second
  - including: vehicle speed and performance, driver behaviors and emergency mode
- Auditory feedback of warning 'growls', and penalty tones
- Data downloaded automatically every day

MEMS Snapshot

- Serve 500,000 people in Little Rock area
- Deploy 29 units daily
- 58,000 calls per year
- 2,400 square mile service area
- 195 full time / 75 part time uniformed employees
- 1.9 million miles annually
- Mean response time: 6 minutes

Graduated implementation for evaluation

- Phase I-
  - Blind data - no growls or tones, no ID capture
- Phase II-
  - Warning growls and penalty tones only
- Phase III-
  - Fully operational, identified data capture

Pilot 1

- Parameters monitored
  - Vehicle speed, cornering, seat belt use, back up spotters
  - Use of lights and sirens
  - Miles traveled
- Penalty counts for exceeding parameters are recorded, stored and downloaded daily for analysis and reports generated
- Response times and fiscal balances were reviewed pre and post implementation

Pilot 1

- A fleet of 36 ambulances, 250 drivers and 1.9 million miles of vehicle operations were monitored by the system for 18 months.
  - Blind data collected from March 2003 for 3/12
  - Identified data captured with the system fully operational from June 2003.
- The parameters measured are –
  - Speed against user set limits – both hot & cold
  - Cornering velocity, g-forces, hard braking/acceleration
  - Use of seat belts, lights & sirens, turn signals
  - Parking brake, back up spotters

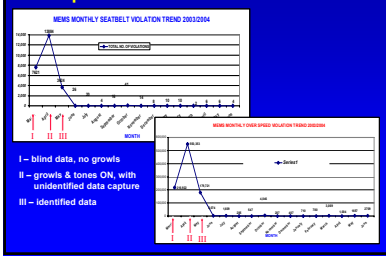
Pilot 1

- Parameters are monitored every second
  - Penalty counts for exceeding these parameters are recorded, stored on an on-board computer and downloaded daily to a base station for analysis and reports generated.
- Response times and fiscal balances were reviewed pre and post implementation of the monitoring and feedback system

MEMS Settings Pilot 1

- Speed - 15 second warning period
  - Non Emergency 74 / 78 mph
  - Emergency 84 / 88 mph
- Cornering - warning at 25%
  - Low Over Force - 39%
  - High Over Force - 55%
- Seat Belt Distance
  - 2 / 10ths mile

Monthly Seat Belt 2003-2004 and Over Speed Violation Trends 2003-2004

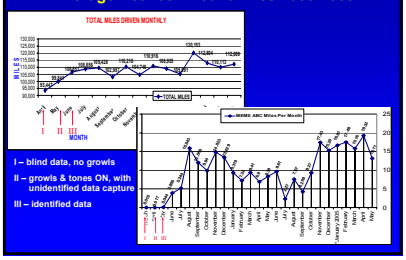


I – blind data, no growls

II – growls & tones ON, with unidentified data capture

III – identified data

Total Miles Driven Monthly 2003-2004 and Average Between Count Miles 2003-2005



I – blind data, no growls

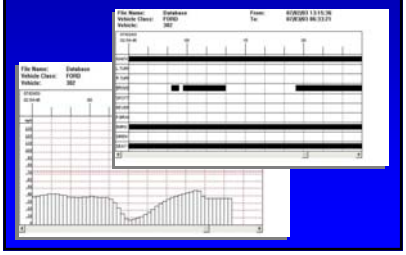
II – growls & tones ON, with unidentified data capture

III – identified data

Results Summary

- Implementation was well received by the providers.
- Over 1.9 million miles of vehicle operations recorded.
- Performance improved from a baseline low of 0.017 miles btw penalty counts (>56 counts/mile) to a high of 15.8 miles btw penalty counts.
- Seatbelt violations dropped from 13,500 to 4
- 20% cost saving in vehicle maintenance within 6 months.
- No increase in response times
- Fewer crashes and less severe crashes - Only one vehicle mishap
- Sustained improvement in safety proxies over 18 months, with no inservice or retraining after the initial introduction period.

Unit 302 Accident



Demonstrated clearly

- Driver risk behavior can be modified and improved with monitoring device, with real time auditory feedback.

Implementation Environment Pilot 2

- CAC deploys 13 units daily, covers 450,000 miles annually
- CAC has 20 Emergency Vehicles and 11 Non-emergency Vehicles
- Mean response time of 11 minutes
- 152 drivers

Graduated implementation for evaluation

- Phase I-
  - Blind data - no tones, no ID capture
  - 11/1/04 to 4/30/05
- Phase II-
  - Warning and penalty tones only
  - 5/1/05 to 6/30/06
- Phase III-
  - Fully operational, identified data capture
  - 7/1/06 to 8/31/06

Auditory alarm warning thresholds Pilot 2

Speed	10 second warning period
Low Speed (LSCOUNT)	- 73 / 78 mph
High Speed (HSCOUNT)	- >79 mph
Cornering	warning at 25%
Low Over Force (LFCOUNT)	- 38%
High Over Force (HFCOUNT)	- 48%
Reverse Count (RVCOUNT)	- 1 count for each time vehicle is placed in reverse without engaging reverse spotting switch
Seat Belt Distance (SBCOUNT)	- 1/10th mile with no belt secured

Demonstrated Results

- Over 950,000 miles of vehicle operations were recorded
- Major reduction in high over speed penalty counts
  - 14.94 penalties/mile in Phase I
  - 0.00003 penalties/mile in Phase III.
- Major reduction in seatbelt violations
  - 4.72 violations/ mile traveled in Period I
  - 0.001 violations/ mile traveled in Period III a fold reduction in seat belt violations
- Similar trends were seen in low over speed and over force parameters

Response times

- There was no increase in average response times during the study period:
  - 11:14 minutes in 2004
  - 10:36 minutes in 2005
  - 10:46 minutes in 2006

suggests a moderate overall improvement in response times during the study period.

Crashes

There were:

- 19 vehicle incidents in 2004
- 11 in 2005
- no major vehicle crash during the fully implemented phase of the study period.

Direct Cost savings

- Decreased crashes
- Cost saving in vehicle maintenance expenses:
  - $271,091in 2004
  - $242,965 in 2005
  - $237,193 in 2006

Extensive Indirect cost savings

- Fewer out of service vehicles
- Improved transport times
- Decreased administrative lost in managing unsafe behaviors
- Decreased legal burden
- Automatic system wide data
- Insurance benefits

A key to safe ambulance transport

Other monitoring devices

- Primarily to record events during and immediately preceding a crash
- Give no driver crash prevention feedback
- Administratively burdensome
- Intrusive and confidentiality issues
- Now… on you-tube at a computer near you…
- Not demonstrated to be as effective in improving vehicle maintenance costs or as effective in modifying driver behavior long term
- Stick not carrot….

This works and long term..

- Dramatic and sustained improvement in driver performance and vehicle safety in every measured area
- Decreased administrative burden
- No confidentiality issues
- Requiring minimal in-service training time and optimal safety outcome
- Cost savings in maintenance
- Implementation of system highly effective and sustainable approach to enhancing safety in transport

Designing Studies to Evaluate Technology Fleet Safety Interventions

David Bishai,MD MPH PhD
Nadine Levick MD, MPH
Johns Hopkins University

September 12, 2007

You want a system that works!!

- Does the system really work
- Is it going to be a major burden on your staff to implement
- What are the real costs
- Are you going to have video of your company vehicle on you tube??

Evaluation Questions

- Do fleet safety technology interventions improve driver performance?
- Do fleet safety technology interventions prevent crashes?
- Are fleet safety technology interventions worth the cost?

Answers to all the questions are in the data

- 1) Driver performance data
  - Machine generated
  - Supervisor generated
- 2) Vehicle event data
  - Crashes
  - Near crashes
  - Injuries
- 3)Cost data
  - Crash costs
  - Program costs
  - Insurance costs

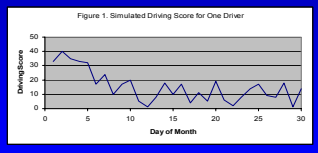
Do programs affect performance?

- How can we measure this?
- Unlikely to do a randomized trial
  - Tough to get a control group
- Pre vs. post study more doable
  - Aggregate measures before vs. after
  - New drivers can be followed to detect improvements over time
    - No program works immediately

Attributing improvements to program

- Vehicle driver feedback /monitoring devices measure speed, torque, harsh braking/acceleration, seatbelt use
  - Data trigger immediate warning beeps
  - Automatic trends generated
  - Data can be radioed to supervisor who also "beeps"
- Data can be kept for program evaluation
  - A summary score adding up counts of accels, decels and time spent speeding
  - If the program is working these performance scores will improve over days, weeks, months

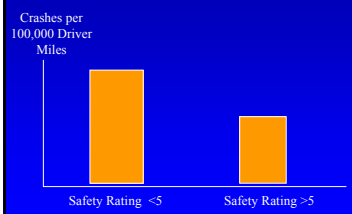
What data might look like



How to link performance to crash reduction

- Different driver-miles carry different amounts of risk
  - Night, Day, Rush hour, Shift end, Shift start, Rig size
- Data on drivers=*behavioral* data on the safety with which each mile is driven
  - As program alters behavior it alters the safety of the driver-miles being driven.
  - Compare crash rates across driver-miles of different safety ratings.

Simple Tabulation



Multivariate Approach

- Racks up all the driver-miles driven by the firm in a year
- Each driver-mile carries a small risk of a crash
- Poisson regression is a statistical tool for studying systematic differences in small risks
  - Can see how driver safety score affects crash
  - Can adjust for vehicle type, night driving, location, vehicle type etc.
  - Need lots of data

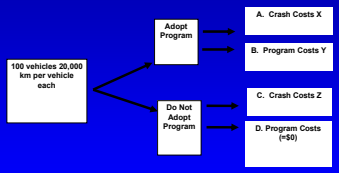
Power in a sample of 30 million vehicle miles

Effect Size*	Power**
1.3	0.48
1.5	0.84
1.7	0.99

*Effect size calibrated as the ratio of crash rate in the worst quartile/crash rate in the best quartile

**Power defined as the one minus probability of accepting a null hypothesis that is false.

Cost Benefit Analysis



Can calculate annual return on investment (ROI)

Conclusions

- Driver performance and safety improve sustainably with electronic monitoring and feedback
- Technology to save lives, time and money
- Fleet safety systems generate precious data with which one can assess
  - How well the systems work
  - How to help them work better
  - Whether they are worth the money
- The data exist - missing ingredient is outcomes research based on that data

Your opportunity to add value

- Form partnerships between industry and researchers
- Benefits to your industry in quality data analysis and enhanced decision making
- Be involved in establishing best practices for the industry
- Conclusively demonstrate lower risks and improved safety
  - Get boardroom buy in
  - Insurance premiums lower

PREDICTABLE
PREVENTABLE
and
NO ACCIDENT

Thank you!
Any Questions??
Electronic handout available online
http://www.objectivesafety.net
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