Preview of Costs and Benefits of Onboard Safety Systems

FMCSA Office of Analysis, Research and Technology Webinar

July 16, 2008

U.S. Department of Transportation
Federal Motor Carrier Safety Administration

Office of Analysis, Research, and Technology

Assessing OSS:
Data Acquisition Objectives & Sources

Dan Murray, Vice President
American Transportation Research Institute

ATRI

Industry's NFP research organization

- Safety and Human Factors
- Technology
- Environmental Factors
- Economic Analysis
- Transportation Security

- 60%/40% Gov't/Private Funding
- TRB Executive Committee
- Research Awards: ITSA, ITE, TIDA, TAEC

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Research Advisory Committee

Onboard Safety Systems: Responsibility-Neutral Solutions

- OSS has Potentially High Acceptance:
  - Can address irresponsible 4-wheelers
  - Can address 2 of the most costly crash types
  - Voluntary vs mandatory?
- Industry Requires:
  - Carrots?
  - Information?
  - Fast ROI?

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Data Acquisition Objectives

- Real-World Data [vs. “Societal Costs”]
  - Crash Costs: Is someone writing a check?
    - Carrier
    - Insurance Company
    - True Unit Costs
      - NDAs for carriers/insurance/vendors/OEMs

Crash Costs

- Initial Crash Cost Data
  - 6 Carriers
  - 4 Insurers
  - 2 WC firms
  - 3 Environmental Clean-up
  - 2 Legal Firms
- Crash Data Validation
  - 4 + 6 Carriers (12 total in overall process)
  - 2 + 2 Insurers (6)
  - 2 + 1 Legal Firms (3)

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Other Data

- Initial Crash Cost Data
  - 6 Carriers
  - 4 Insurers
  - 2 WC firms
  - 3 Environmental Clean-up
  - 2 Legal Firms
- Crash Data Validation
  - 4 + 6 Carriers (12 total in overall process)
  - 2 + 2 Insurers (6)
  - 2 + 1 Legal Firms (3)

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Other Data

- OSS Data
  - Historical Data
  - 5 vendors
  - 2 OEMs
  - Carriers
- Financial Calculations
  - 2 economists
  - CPA Firm
- Tangential Support
  - LOFT Industry Data

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Preview of Costs and Benefits of Onboard Safety Systems

Amy Houser

Engineer, Technology Division

July 16, 2008

U.S. Department of Transportation

Federal Motor Carrier Safety Administration

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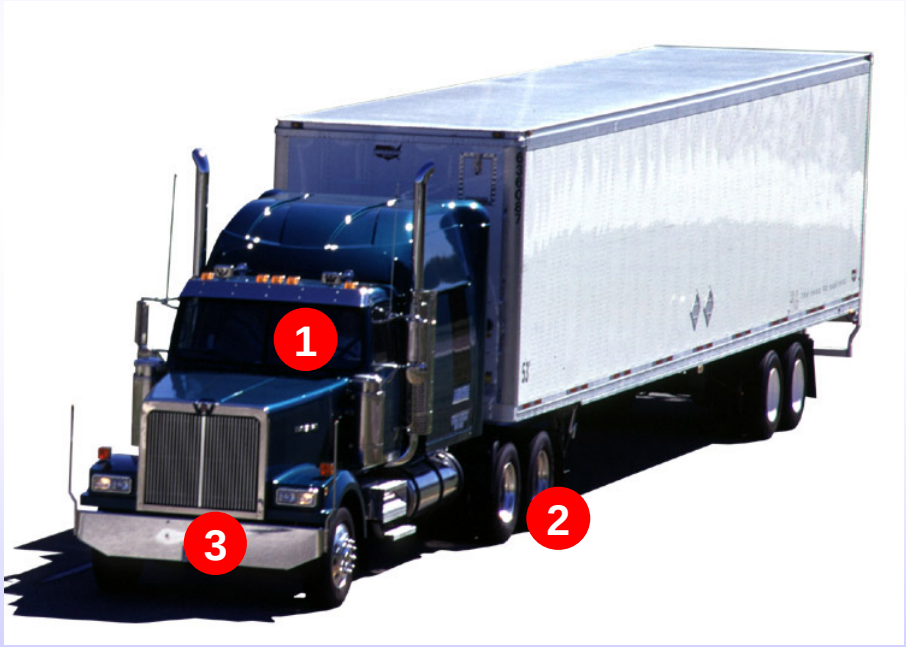
Onboard Safety Systems



1. Lane Departure Warning Systems (LDWS)
2. Roll Stability Control (RSC) Systems
3. Forward Collision Warning Systems (FCWS)



Crash Probability

"It's true that an individual's chance of crashing is small, especially on a given trip. But on a societal basis, crashes claim a huge toll in terms of deaths, injuries, and property damage."

Insurance Institute for Highway Safety Status Report, Dec. 7, 2002

Benefit Cost Analysis

- Benefits in terms of crash avoidance costs
  - Step 1: Estimate crashes preventable by the technology
    - Range of technology efficacy (Low and High)
  - Step 2: Estimate the crash costs for the crashes preventable by the technology
    - Assumption: Self-insured carrier
  - Step 3: Estimate crash costs based on vehicle miles traveled and expected crash reduction
    - Range: 80,000–160,000 VMT
    - Typical Long Haul: 100,000 VMT



Benefit Cost Analysis

- Technology costs
  - Step 4: Estimate the technology and deployment costs
    - Assumption: 5-year technology life
- Benefit-cost analysis calculations
  - Step 5: Calculate net present values, ROI, and payback period of benefits and costs
    - Discount rates of 3% and 7%
- Sensitivity analysis
  - Insurance implications



Benefits in Terms of Crash Avoidance Costs

- Crash prevention
  - General estimates system crash data: 2001-2005
  - Motor carrier and field operational test (FOT) technology efficacy data
- Crash cost savings from avoided crashes
  - Motor carrier data
  - Insurance industry data
  - Legal firm data



Lane Departure Warning Systems

- Camera watches road ahead-not driver
- Tracks road and vehicle position in lane
- Monitors for weaving and lane drifts
- Alerts driver before road departure
- Blocks warnings automatically if:
  - Turn signal is used
  - Speed is less than threshold (approximately 35 mph)



Single Vehicle Roadway Departure Crashes Preventable by LDWS

Rollovers	PDO	Injury	Fatal	TOTAL
24% Efficacy	275	343	9	627
50% Efficacy	573	715	19	1,307

Collisions	PDO	Injury	Fatal	TOTAL
23% Efficacy	828	226	15	1,069
53% Efficacy	1909	520	34	2,463



Same and Opposite Direction Lane Departure Sideswipes Preventable by LDWS

	PDO	Injury	Fatal	TOTAL
23% Efficacy	1,842	257	9	2,108
46% Efficacy	3,682	515	18	4,215



Opposite Direction Lane Departure Head-on Crashes Preventable by LDWS

	PDO	Injury	Fatal	TOTAL
23% Efficacy	23	22	14	59
46% Efficacy	45	44	29	118

Roll Stability Control System

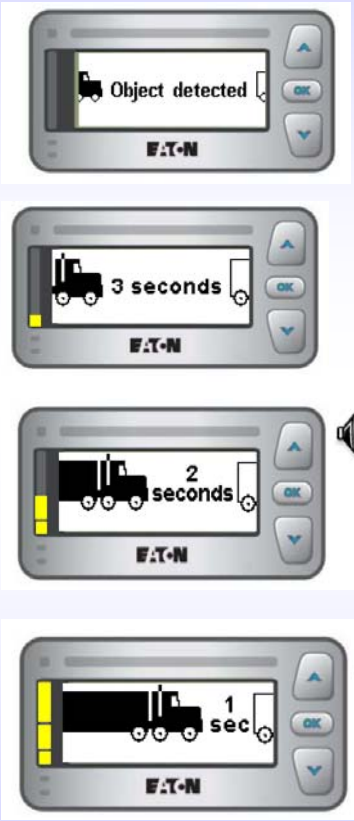


Rollovers due to Excessive Speed in a Curve Preventable by RSC

	PDO	Injury	Fatal	TOTAL
37% Efficacy	602	769	51	1,422
53% Efficacy	862	1,102	73	2,037

Collision Warning Systems

- Detect objects and vehicles within 350’
- Provide progressive visual and audible warnings about unsafe following distances



Adaptive Cruise Control

- Uses data from the CWS
- Works to maintain separation of 2 1/4 - 3 1/4 seconds behind followed vehicle
- Decelerates the vehicle by:
  - De-fueling the engine
  - Engaging the engine retarder
  - Allowing an automated transmission to downshift (if equipped)



Rear End Crashes Preventable by FCWS

	PDO	Injury	Fatal	TOTAL
21% Efficacy	5,813	2,735	49	8,597
44% Efficacy	12,180	5,730	103	18,013



Is It Worth the Individual Risk?



Typical Rear End Crash Costs

- Labor (Training, testing, hiring, orientation, recruitment): $7,000
- Workers' Compensation (Medical expense, disability pay, vocational rehabilitation): $62,728
  - Average Annual Percentage of Truck Driver Injuries per Crash: 10%
  - Average Annual Percentage of Truck Driver Fatalities per Fatal Crash: 40%

	Injury Crash	Fatality Crash
Driver Replacement	$700	$2,800
Workers' Compensation	$6,273	$25,091



Typical Rear End Crash Costs

- Operational: $11,150
  - Cargo damage: $2,500
  - Delivery delays: $750
  - Loading and unloading cargo: $2,500
  - Towing, inventory, storage, miscellaneous: $5,400
- Environmental (Fines, clean-up): $14,000
- Property damage to vehicles and surrounding infrastructure: $27,500
- These costs can vary substantially



Typical Rear End Crash Costs

- Court costs and other legal fees
- Average settlement cost of an injury in a rear-end crash preventable by FCWS: $68,800
  - Average annual number of injuries per injury crash: 1.3
  - Average annual number of injuries per fatal crash: 1.1
- Average settlement cost of a fatality in a rear-end crash preventable by FCWS: $700,000
  - Average annual number of fatalities per fatal crash: 1

	PDO	Injury	Fatal
Court Costs and Other Legal Fees	$70,000	$90,000	$200,000
Out-of-Pocket Costs per Injury		$89,440	$75,680
Out-of-Pocket per Fatality			$700,000

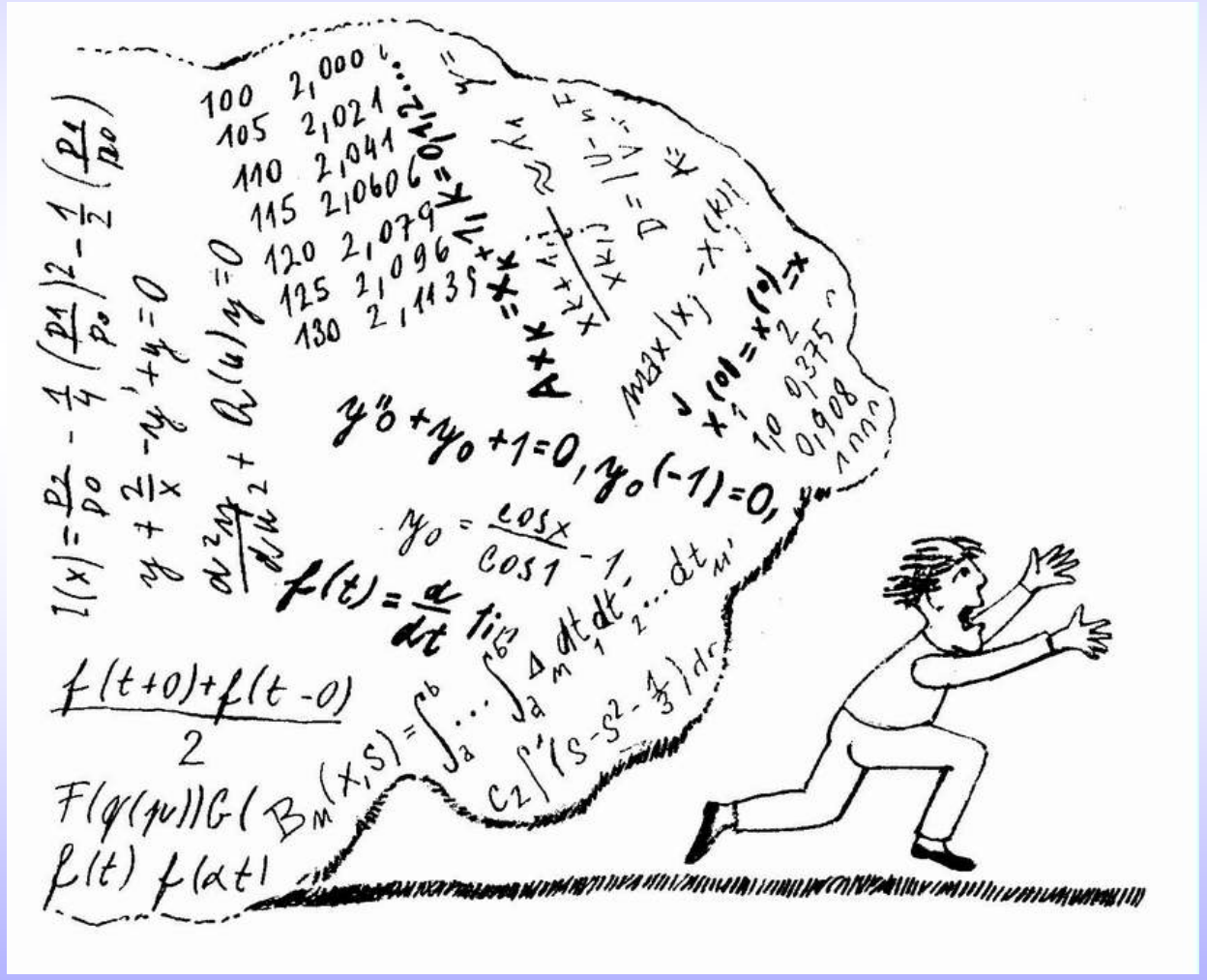


Typical Rear End Crash Costs

	PDO	Injury	Fatal
Labor and Workers' Compensation		$6,973	$27,891
Operational	$11,150	$11,150	$11,150
Environmental	$14,000	$14,000	$14,000
Property Damage	$27,500	$27,500	$27,500
Legal Settlement		$89,440	$775,680
Court Costs and Other Legal Fees	$70,000	$90,000	$200,000
Total	$122,650	$239,063	$1,056,221



More Numbers...



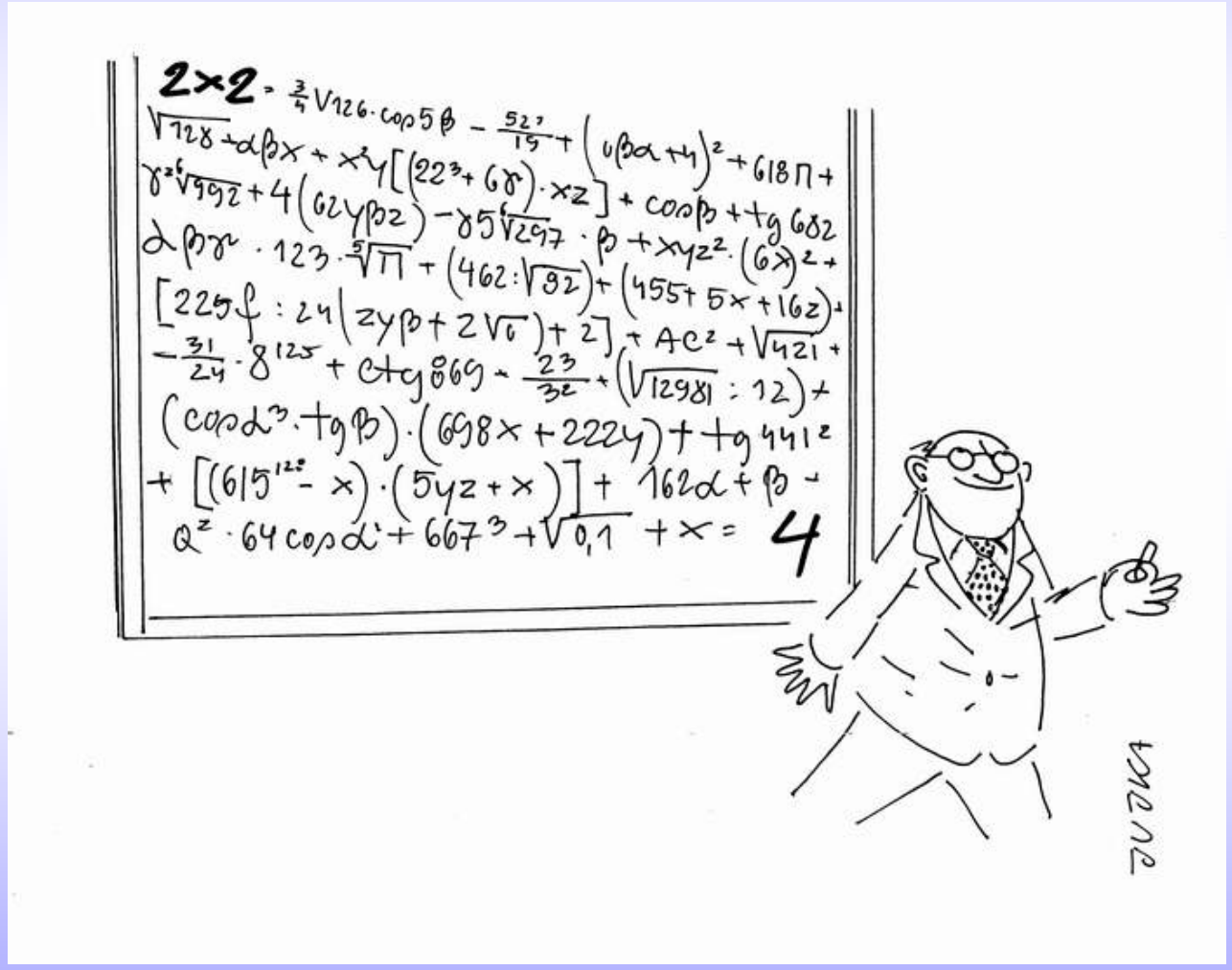


FCWS Typical Costs

- Estimated price: $2,000
  - Minimal maintenance over normal vehicle operating expenses
- 2 Conditions
  - No Financing
  - Financing at an average interest rate of 6.38% over 5 years
- Federal tax savings due to depreciation at a tax rate of 35%
- Annual driver training: $23



Answers . . .





FCWS Benefits versus Costs Example

- Assumptions:
  - Technology Life: 5 years
  - Technology Cost: $2,000
  - Carriers purchasing the technology put 100,000 VMT on trucks with the technology
  - Carrier is self-insured and pays all crash costs
  - Discount Rate = 3%
- ROI: For each $1 Spent, return is $1.98 at 21% Efficacy
- Payback period: 26 months



RSC Benefits versus Costs Example

- Assumptions:
  - Technology Life: 5 years
  - Technology Cost: $1,000
  - Carriers purchasing the technology put 100,000 VMT on trucks with the technology
  - Carrier is self-insured and pays all crash costs
  - Discount Rate = 3%
- ROI: For each $1 Spent, return is $2.33 at 37% Efficacy
- Payback period: 24 months

LDWS Benefits versus Costs Example

- Assumptions:
  - Technology Life: 5 years
  - Technology Cost: $1,000
  - Carriers purchasing the technology put 100,000 VMT on trucks with the technology
  - Carrier is self-insured and pays all crash costs
  - Discount Rate = 3%
- ROI: For each $1 Spent, return is $1.93 at 23% Efficacy
- Payback period: 29 months

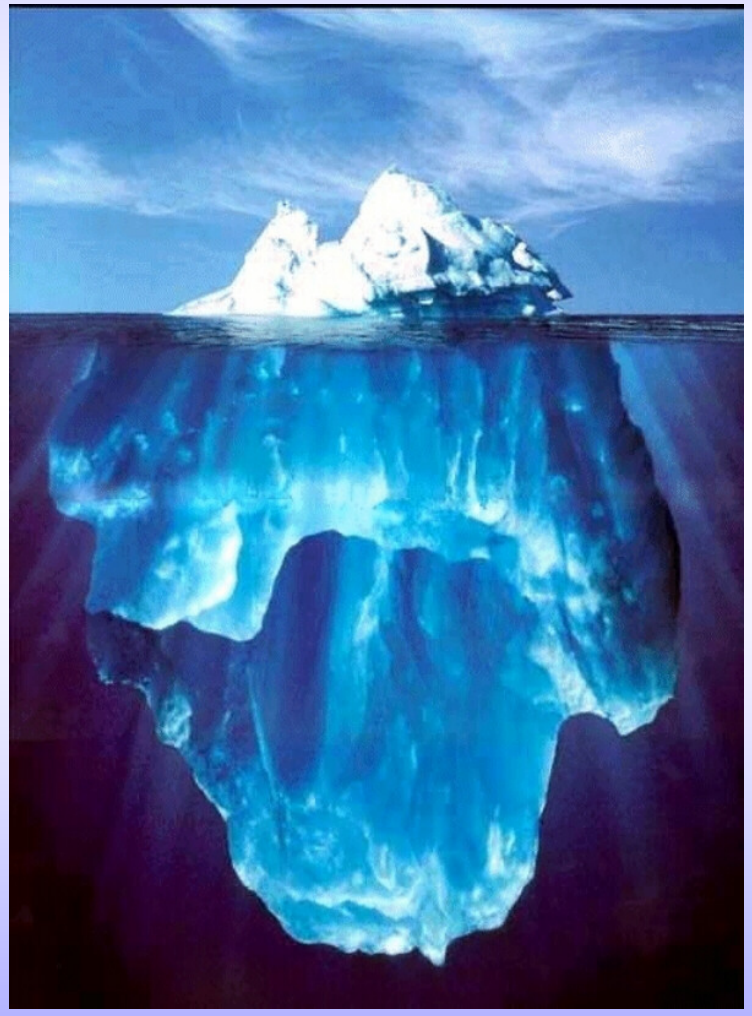


Insurance Implications

- Based on the overall probability of involvement in a crash, carriers that have low deductibles, such as $5,000 per truck, may not achieve a break-even point
- As the number of crashes and/or their severity increases, insurance premium costs will increase until the carrier's insurance costs equal or exceed the investment costs of the technology, or the carrier is dropped altogether by the insurance provider



Quantifiable Crash Costs are the "Tip of the Iceberg"





Indirect Costs of Crashes

- Insurance and workers' compensation rate increases
- Federal safety rating impacts
- Loss of customer goodwill and/or business effects
- Public image impacts
- Employee morale effects

  Ranked in the top 12 significant costs out of 21 different costs from a survey of 56 motor carriers expressing that these crash cost items have the greatest near- and long-term effects on revenues and operating costs



Next up . . .

Amy.Houser@dot.gov

(202) 385-2382

Onboard Safety Systems

Andrew Boyle
Boyle Transportation
July 16, 2008

BOYLE
We deliver security.

Our Approach to Safety Technology

- Mitigate the risk of an accident
- Provide professional drivers the tools to do their jobs as safely as possible
- Sell our safety technology commitment to customers, insurers, creditors and employees
- "Back of the envelope" cost analysis
  - Weigh investment vs. potential accident costs
  - Apply probability of serious accidents

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Safety Technologies We Employ

- Automated Transmissions
- Collision Warning System with Side Sensor and SmartCruise
- Roll Stability Control (Tractors & Trailers)
- Sidetracker Video Camera
- Lane Departure Warning

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Professional Driver Survey*
Automated Transmission

	Is a Valuable Tool	Reduces Fatigue	Helps Make Me a Safer Driver
Agree/Strongly Agree	86%	88%	57%
Neither Agree nor Disagree	4%	2%	25%
Disagree/Strongly Disagree	11%	11%	18%

*70 Respondents

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Collision Warning System

	Is a Valuable Tool	Can Prevent Accidents	Helps Make Me a Safer Driver
VORAD CWS			
Agree/Strongly Agree	75%	81%	53%
Disagree/Strongly Disagree	18%	19%	25%
SmartCruise			
Agree/Strongly Agree	82%	72%	50%
Disagree/Strongly Disagree	12%	14%	25%
Side Sensor			
Agree/Strongly Agree	77%	84%	58%
Disagree/Strongly Disagree	14%	13%	25%

Tractor Roll Stability Advisor & Control

	Has Enabled Me to Prevent a Rollover	Can Prevent Accidents
Agree/Strongly Agree	31%	54%
Neither Agree nor Disagree	31%	14%
Disagree/Strongly Disagree	39%	32%

Passenger Side Video Camera with Dash-Mounted Monitor

	Enhances Visibility	Can Prevent Accidents
Agree/Strongly Agree	64%	68%
Neither Agree nor Disagree	15%	9%
Disagree/Strongly Disagree	24%	24%

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Moving Forward

- Recommend OEM installation to avoid warranty problems and supplier finger pointing
- Many devices now have behavior monitoring capabilities to manage driver performance
- Several vendors want to get into wireless utility business—crowded space
- Sell safety technologies as “tools” to encourage driver adoption

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