



**Presentation on DriveCam Analytics and Data  
Findings Related to In-Cab Driver Distraction**

# My Background



- DriveCam:
  - Joined DriveCam in January, 2006 (4.5 Year Tenure)
  - VP, Product Management and Analytics for 2 years
  - VP, Operations and Analytics for 2.5 years
  - Developed first three iterations of intelligent triaging algorithms as well as multiple business intelligence studies for internal and external uses
- Prior Work:
  - 10 Years in Software and Service Development Prior to DriveCam (15 Years Technology / Service Experience Overall)
    - 3 Years in ERP, CRM, Project Management Applications with Business Intelligence Tools On Each System (Dataworks – Now Epicor, Equative)
    - 2 Years in Workers Compensation and Automobile Medical Claims and Bill Review Systems with Business Intelligence Tools on Each System (HNC Software: Insurance Solutions Group – Now Fair Isaac).
    - 5 Years in Automobile Medical and Physical Damage Claims and Bill Review Systems with Business Intelligence Tools on Each System (5 Years with Mitchell International)
  - Researched, designed and developed 27 mission-critical B2B products over the past 15 years encompassing over 200 functional releases and 500 data updates in a multitude of environments including financial, insurance, and IT sectors.
- Education:
  - BSBA / MBA: Washington University in St. Louis

# Agenda

- Who is DriveCam?
- How Does the Technology and Service Work?
- Why is Video Important?
- Employee Acceptance
- What data is collected and how is it collected?
- Analytics Strategy and Data Sets
- Distracted Driving
  - What is Distracted Driving?
  - Distracted Driving Behaviors Captured
  - Distracted Driving Analytics / Results
  - Impact of Coaching Behaviors
- Summary / Q&A



# Who is DriveCam?

# Why does DriveCam exist?



Front FWD -0.04 LAT +0.06 Time -10.00 Rear

## Historically ...

Fleets have improved risky driving through:

- Training
- DMV Record Checks
- Safety Meetings
- Ride Alongs

## However ...

- Over 43,000 people continue to lose their lives in vehicle crashes every year
- \$245 billion are wasted annually
- Traditional fleet safety efforts rely on lagging indicators
- By the time you know there's a problem ... it's too late

# In Vehicle Video is Knowing the Truth

[Open Directory](#)



Following too Close



Drowsy Driving



Distracted Driving



Cut Off in Traffic

# DriveCam FactSheet

- **Headquarters: San Diego, USA**
- **Founded: 1998**
  - Privately held
  - 10 years in business with significant, consistent growth
  - Funded by 4 leading capital funding firms: Insight Venture Partners, Integral Capital Partners, JMI Equity and Menlo Ventures
- **Milestones**
  - Installed Base: 135,000 (55,000 Under Managed Service)
  - Risky Event Database: 17.7 million events
  - Collisions Captured: 18,500 Minor to Severe Collisions
  - 3 years on *INC's* list of 500 fastest growing, private U.S. companies
  - #30 on Wall Street Journal's List of Top 50 Venture Backed Companies
- **Best of Breed Technology & Service Partners**

# Major Players in Major Industries





# How Does the Technology and Service Work?

# How the Video is Captured

- Video Event Recorder
  - Mounts on windshield
  - VER Continuously Monitoring and Providing Feedback to Driver
  - Events Triggered by excessive forces
    - Erratic driving
    - Collisions
- Digital looping memory captures before and after event
- Documents force and records video and audio looking forward and inside the vehicle
- Downloads to DriveCam via Cell



# How DriveCam Works



# DriveCam Online

Dashboard

Bedrock Slate & Gravel

Region	Event Recorders	Unassigned / Unknown Drivers	Overdue for Download	Overdue for Coaching	Coaching Effectiveness	Program Effectiveness
Level 1	520	20%	10%	12%	C	★★★★☆
Level 2	125	25%	6%	2%	B	★★★★☆
Level 2	75	55%	4%	11%	F	★★★★☆
Level 2	102	72%	30%	1%	A	★★★★☆
Level 2	135	15%	15%	9%	A	★★★★☆
Level 2	925	12%	2%	4%		★★★★☆
Level 2	75	55%	4%	11%		★★★★☆
Level 2	102	72%	30%	1%		★★★★☆
Level 2	135	15%	15%	9%		★★★★☆
Level 2	925	12%	2%	4%		★★★★☆
<b>Fleet Total</b>	<b>2154</b>	<b>19%</b>	<b>18%</b>	<b>17%</b>		

Connect to

Event Coaching | Event Score: 5 | Vehicle ID: Truck854 | Driver: T.Butch | Group: Fenway 9 | This event is: Resolved

ER# 3235233  
12/12/09  
12:44:46PM EST

Front View | FWD: -0.5 | LAT: +0.1 | Time: +0.00 | 45 MPH | GPS | Rear View

00:00 | 4:00 | 8:00

Driver: T.Butch | Change Status to: Resolved

Comments

Told driver to slow down for yield signs in the future.

OK | Cancel

Bedrock Slate | empowered by DRIVECAM

HOME | REPORTS | SETUP | Welcome Adam, you have 35 events overdue for coaching.

Select Region or data for

Events Overdue for Coaching

Coaching Timeliness

Your Average: 2 Days  
Region Average: 4 Days  
Company Average: 4 Days

COACH NOW

Event Recorders Installed & Overdue for Download

Total EEs Overdue

Average Risk Score per Vehicle

Company | My Site

Top 80% Root Causes for the last 7 Days

Driving Too Close (7)  
Seatbelt (5)  
Cell Phone (2)  
Eating (1)  
Speeding (1)  
Failure to Stop (1)

Click on pie slice to coach events corresponding with that root cause

# Why is Video Important?



# Can you predict without video validation?

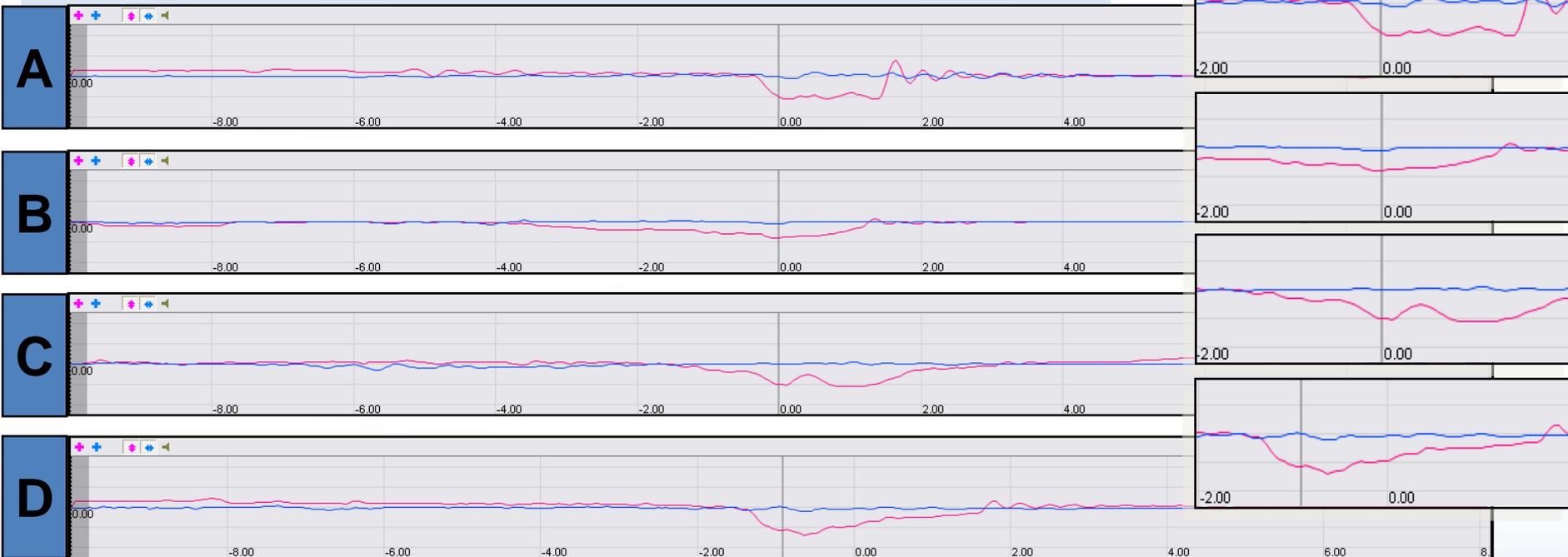
Below are four 'Hard Braking' events as determined solely by the vehicle information and accelerometer data. All of these would be considered 'Risky' from a black-box perspective and considered correlative and possibly predictive of risky driving behaviors.

Which ones do you feel are the most predictive of risky driving?

Which one is the most severe?

What behaviors did these drivers exhibit?

How would you correct that drivers behavior?



# Can you predict without video validation?

**A**

The screenshot displays the DriveCam Event Player interface. At the top, a graph shows two data series (pink and blue) over a time range from -8.00 to 8.00. A zoomed-in inset of this graph shows a sharp dip in the pink line at approximately 0.00. Below this is a second, identical graph. At the bottom, two video windows are shown: 'Front View' on the left and 'Rear View' on the right. The 'Front View' shows a street scene with a car. The 'Rear View' shows the interior of a bus with a driver. Below the video windows, a status bar displays 'FWD +0.15', 'LAT +0.00', and 'Time -10.00'. A volume slider and playback controls (stop, play, next) are visible at the bottom.

Many of our customers do **BRAKE TESTS EVERY Morning and Before shifts** as part of typical vehicle maintenance and testing. These come through as severe events, but are actually good safety checks and **NOT considered risky driving.**



# Can you predict without video validation?



Many of our commercial vehicles make **FREQUENT STOPS** (eg. Buses, waste trucks, distribution vehicles). While the driver stopped a little abruptly, this event is considered 'wear and tear' on the vehicle, but it is **NOT considered risky driving.**

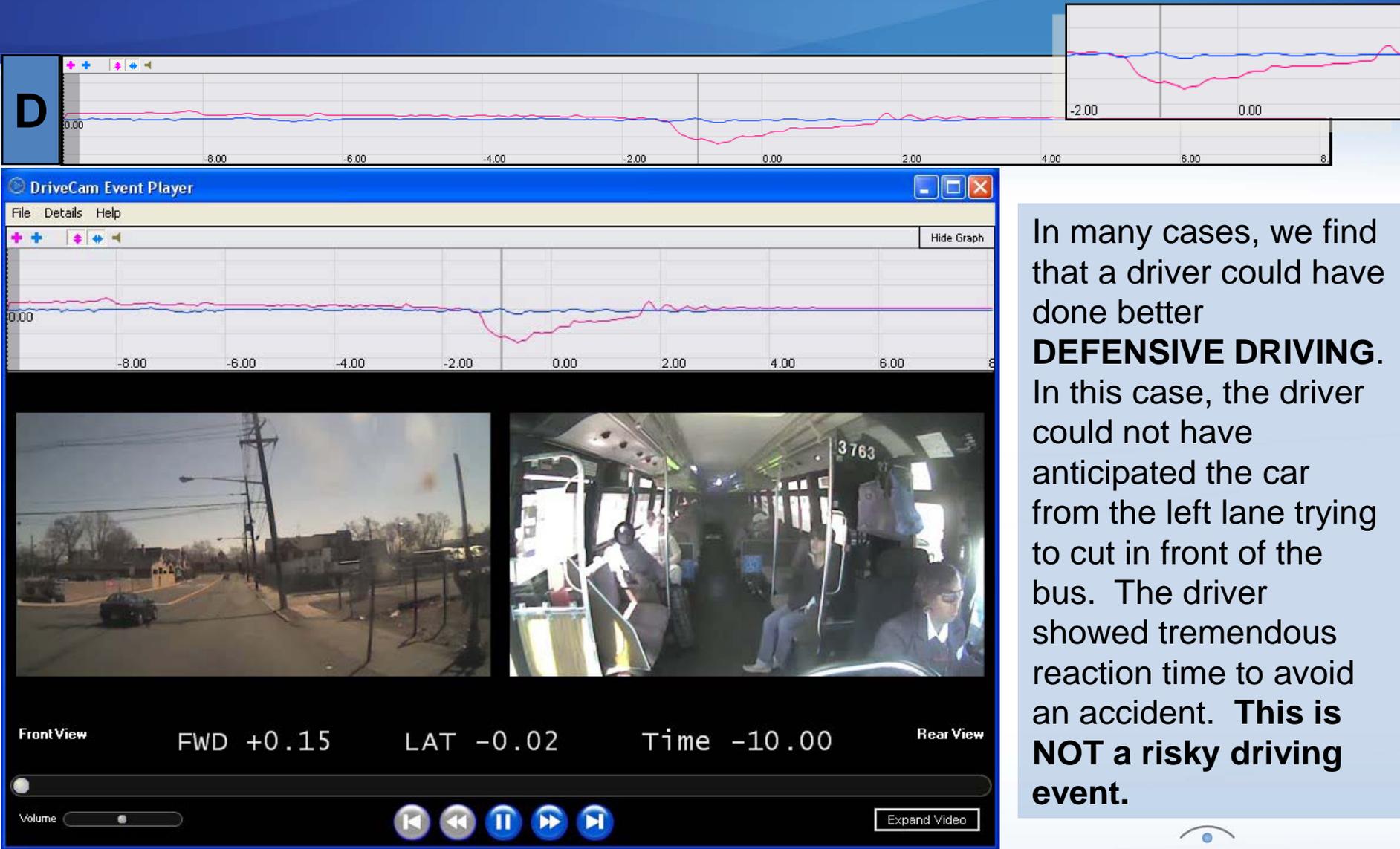


# Can you predict without video validation?



The driver in this event was only maintaining a 1.25 second **FOLLOWING DISTANCE**. This is not enough time to see a problem and smoothly respond to it. The driver had to react abruptly to avoid a collision. **This IS considered a risky driving event.**

# Can you predict without video validation?



In many cases, we find that a driver could have done better **DEFENSIVE DRIVING**. In this case, the driver could not have anticipated the car from the left lane trying to cut in front of the bus. The driver showed tremendous reaction time to avoid an accident. **This is NOT a risky driving event.**

# Can you predict without video validation?

Only one of the four events would have been considered 'RISKY DRIVING'. The other three events are 'Wear and Tear' on the vehicle, but not considered risky driving.



# Why would an accelerometer detect high g's?

There are many reasons why a device might trigger:

- Pot holes
- Unpaved roads
- Rail road tracks
- Turning hard in a large vehicle
- Rocking an unloaded tractor-trailer
- Waste truck throwing a trash bin into the vehicle hard
- Jack-rabbit start
- Vehicle Maintenance
- Defensive Driving / Evasive Maneuver
- Risky driving maneuver
- Collision
- etc.

# Combination of Science and Humans is Required to Identify Risk!!!

- Driver risk management systems require audio / video and human review to verify:
  - Why the device triggered
  - Who triggered the device
  - How to improve on future triggering algorithms
  - Identify risky behaviors so they can be corrected
  - Provide a cost effective solution
- Our event analysis consists of three key elements
  - **Trigger Algorithms** (Accelerometer Based Algorithms)
    - System monitors 24x7 and looks at G-Force data continuously.
    - Multi-Axis Accelerometer Systems to Identify High g-Force Events.
    - System filters out obvious road-noise and identifies potentially risky maneuvers (Accelerations, Braking, Cornering, Collisions, etc).
  - **Wave Form Analysis** (Decision Tree Algorithms)
    - System evaluates wave-forms to detect what type of event occurred and filters out obvious noise and non-driving events (eg. Maintenance events).
  - **Human Review** (Human Analysis)
    - Evaluates remaining events to separate out high g-force noise events from risky events / collisions.
    - Isolates root behaviors and causes of risky events.
- Overall, this three step process ensures that we capture the risky clips and collisions while providing a cost-effective solution for our customers.

# Employee Acceptance

How do we deal with employee concerns?



# Employee Acceptance

It's natural for employees to be uncomfortable with DriveCam coming to their worksite...

- Most concerns are based on misconception, misinformation or lack of experience with the program

Left unaddressed, these concerns can fester into employee resistance that can impede program success...

- Open, early communication is the key to gaining employee success

DriveCam has the experience and the tools to help you successfully introduce the program to your employees...

- Orientation video, guide book on how to introduce the program, driver & supervisor FAQ handouts, onsite assistance

# Driver Acceptance

Common Concern	Details
It's Big Brother	Manager's can look in live or can activate it remotely. <u>Technology does not have this capability.</u> On average less than 10 seconds of video are captured per day per vehicle.
Video will be used to embarrass me	Website is secure. Only those with proper permissions can access. Coaching will take place in a private place
The video is just an excuse to get me fired	There are no new disciplinary policies. Program intention is to improve safety. Video often exonerates driver.
It's an illegal invasion of privacy	Employer does have the right to monitor the workplace. Video cannot be covert and without employee knowledge

# Driver Acceptance

- Best Practices:
  - Communicate the program early to all stake holders
  - Emphasize benefits (protects drivers, improves safety)
  - Include DriveCam in management vehicles
  - Don't forget positive reinforcement!
  - After deployment, communicate, communicate, communicate!

# | What Data is Collected and How is it Collected?



# Event Review Process

- A certified DRA reviews and analyzes each event for potential risk
- Once meaningful behaviors are identified they are validated using the DriveCam behavior definitions and rules
- Finally the event's status is set to Face-to-Face Coaching when the selected behaviors meet certain thresholds of concern
  - Collisions and extremely concerning events are escalated to the Client for prompt notification



Analysis	Details	Location
Event Trigger:	<b>Braking</b>	
Outcome:	<b>Near Collision - Avoidable</b>	
Poor Awareness:	<b>Not Looking Far Ahead</b>	
Traffic Violations:	<b>Red Light</b> <b>Other Unsafe/Risky Violation</b>	

Comments
This event was triggered by the vehicle braking.
This event resulted in a Near Collision that could have been reasonably avoided.
The driver was late in responding to the traffic situation ahead. By projecting eyes further ahead the driver would recognize the problem earlier and have the opportunity to adjust sooner and more gradually.
The driver ran a red light. Running red lights is a high risk behavior that significantly
Add your comments here...

# Sample Guidelines for DRAs

## Distractions

While distractions are common, it is usually when they contribute to an event trigger or significantly increase risk that we score them. Activities such as checking a mirror or scanning to the side or glances in the vehicle such as looking at the instrument panel for 1 second or less are normal driving activities and should not be considered as distractions.

There are 3 situations in which a distraction should be selected:

1. If the behavior is noticed during the event.
2. If the distraction was the cause of the event being triggered. If the driver reaction is within 1 second of the risky situation, this is not considered to be the cause of the trigger.
3. If the duration of the distraction is exposing the driver to substantially increased risk. \* Guidelines to aid in qualifying as a distraction exposing the driver to substantially increased risk are: eyes are off the road while moving for 2.5 consecutive seconds, 4 or more seconds in the first or last half of the clip or a total of 6 seconds or more throughout the clip.

**Cell Phone** –Anytime a driver is using a hand-held or hands-free cell phone select this behavior. Under all circumstances, cell phone should be marked as risky when the use of the cell phone and the associated inattention led to an abrupt action or clearly increased risk. Follow the same guidelines listed in “Root Cause – Distractions” above.

### General guidance to determine if the use of the cell phone is risky.

- **Hand-held:** If driver is holding the cell phone up to the ear **or** they are actively using the phone/speakerphone (texting, dialing, obviously in a phone conversation).
- **Hands-free:** If you can see the driver wearing the device **and** they appear to be in a phone conversation.

Select Cell Phone Hands-free if you cannot see the device yet the driver is obviously in a phone conversation (clearly responding to a caller). Indications of this can be: the driver has conversational pauses and/or verbal acknowledgements such as uh-huh,hmm, yes, no, etc.

# Human Review

- Certified Analysts Review All of the Events that Pass the Wave Form Analysis
  - New Analysts must pass a certification test to review driving events
  - After they pass the test, there is a probationary period where they review clips with a certified analyst
  - Once the analyst has shown proficiency, they will become certified
  - Over 30% of our initial hires do not pass the screening process as we have strict guidelines that all clips are reviewed to our standards
- Analysts will review the event and identify the trigger, root cause, and risky behaviors within the event
  - Reviewing for commonly accepted safe driving practices based on Smith Systems

# Analytics Strategy / Data Sets



# Analytics Strategy

## Classifying Risk

- Trigger Algorithms
- Wave Form Analysis
- Additional Sensors (Speed, GPS, Vehicle Information)
- Neural Networks for Vehicle Specific Information
- Human Review

## Identify

## Profile

- Profile Non-Collision vs Collision Drivers Against Leading Risk Indicators (Frequency & Severity) and Claims
- Report on Drivers that Meet the Profiles

- Predictive Models to Identify Underlying Driving Patterns and Changes in Driving
- Predict Collisions Based on Real-Time Driver Performance Against the Profiles (Which Driver?, When?, Probable Cause?, Collision Severity?, Estimated Claims?)

## Predict

Improves Ability to Predict

Improves Ability to Profile

# Analytics Strategy: Key Partners

## Academic

- VTTI, Univ. of Iowa, Univ. of Montana's Western Transportation institute, Univ. of Michigan, Univ. of California – San Diego

## Government

- FMCSA, CVSA

## Commercial

- Major auto manufacturers, Analytics experts, suppliers and fleet operators (confidential)

## Insurance

- Major industry service providers, brokers and carriers (confidential)

# Analytics Strategy: Industry Associations

- American Trucking Association (ATA) – \* Recent Study Being Handed Out (Fatigue)
- Truckload Carriers Association (TCA)
- National Private Truck Council (NPTC)
- National Tank Truck Carriers (NTTC)
- American Public Transit Association (APTA)
- American Gas Association (AGA)
- Edison Electric Institute (EEI)
- Environmental Industry Association (EIA)
- National Ready Mix Concrete Association (NRMCA)
- National Retail Federation (NRF)
- American Society of Safety Engineers (ASSE)

# Data Set

- Triggered Events: 27.7 Million (10 Million VER Reviewed Events)
- Human Reviewed Driving Events: 17.7 Million (15.5 Million Behaviors)
- Distracted Driving Events:

– Breakdown:

Behavior	Records
Cell Phone - Handheld	37,142
Cell Phone - Handheld [Risky]	159,417
Cell Phone - Hands Free	22,709
Cell Phone - Hands Free [Risky]	3,510
Electronic Device	2,701
Food/Drink	18,379
Food/Drink [Risky]	21,304
Other	139,150
Other Communication Device	16,053
Other Communication Device [Risky]	1,584
Passenger	3,766
<b>TOTALS</b>	<b>425,715</b>

- Growth
  - Driving Events: 425,000 Events Each Month (5.1 Million Annual Run Rate at Current Base)
  - Distracted Driving Behaviors: 14,500 Events Each Month (174,000 Annual Run Rate at Current Base)

# Distracted Driving



# What is Distracted Driving?

- **Definition:** Diversion of attention away from activities critical for safe driving toward a competing activity

1

- Comes in 3 different forms:
  - **Visual:** Eyes off the road
  - **Physical:** Hands off the wheel
  - **Cognitive:** Mind off of driving



- Distracted driving has always been an issue but mobile technologies have upped the ante

# Distracted Driving

- Drivers texting take their eyes off the road nearly 5 seconds
- At 60 miles per hour a vehicle has traveled about 147 Yards (1.5 Football Fields)

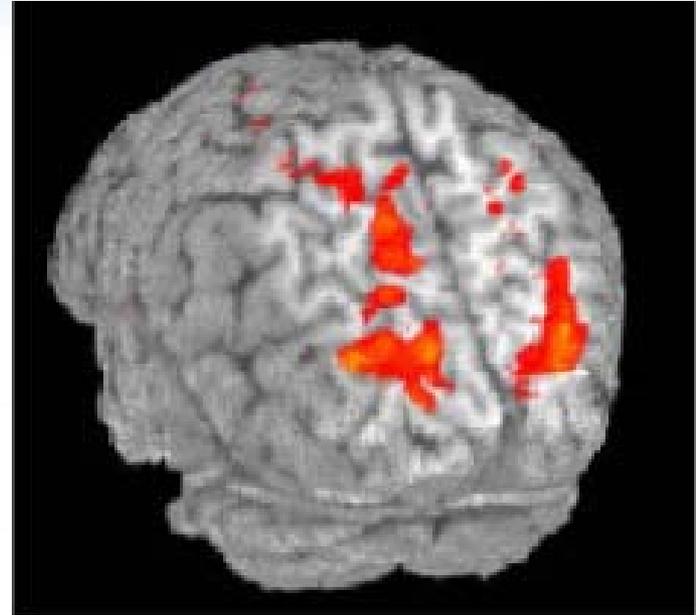


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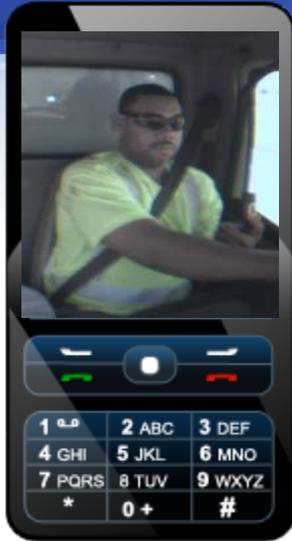


# The Myth of Multi-Tasking

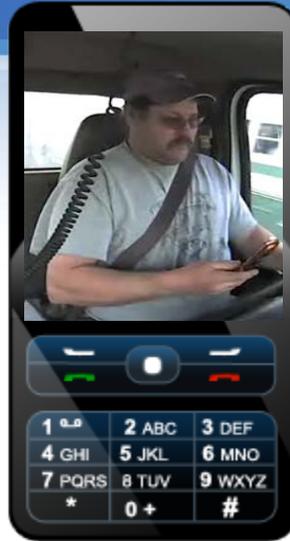
- Brain does not perform 2 tasks at the same time – it switches from one to the other
- When overloaded, brain selects what to pay attention to – incomplete information
- And reaction time slows due to switching



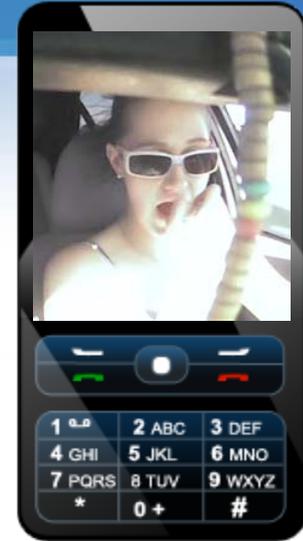
# Distracted Driving Examples



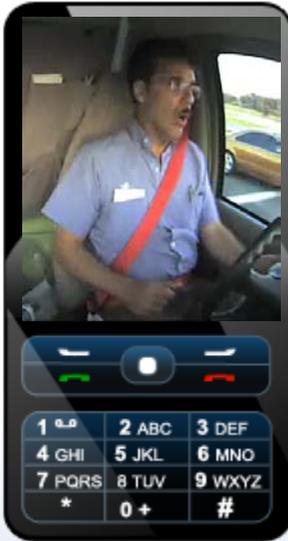
Cell Phone – Roll Over



Texting- Almost Head on



Other Distraction: Lipstick - Spinout



Hands Free – Traffic Violation

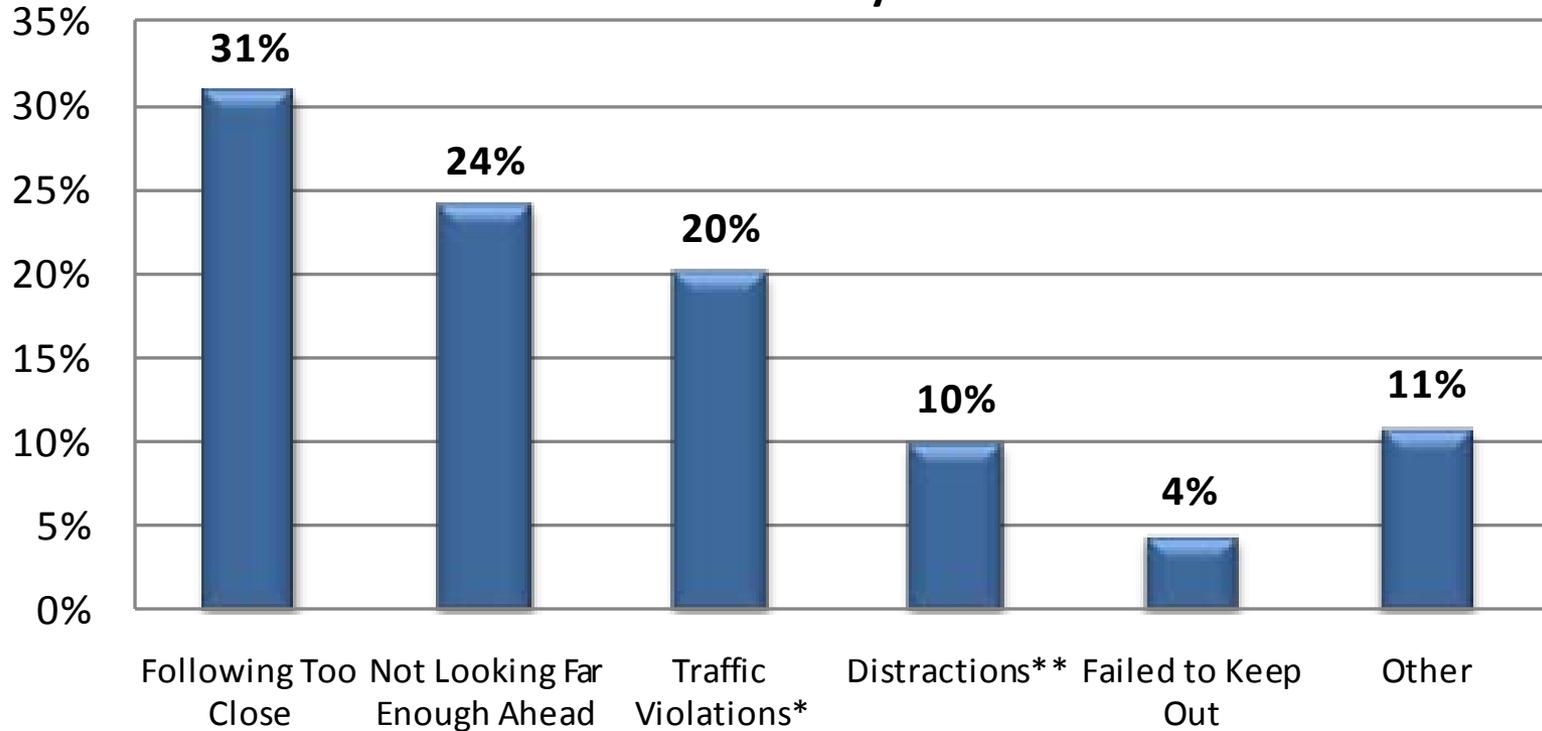


Food / Drink – Near Collision

# Distracted Driving –What We've Learned

## Top Behaviors

Last 365 Days



\*Traffic Violations include Speeding, Running a Stop Light/Sign, Rolling Stops, and Other Unsafe/Risky Violations

\*\*Distractions include Hand-held Cellular Phones, Hands-free Cellular Devices, Food/Drink, Passengers, and other Electronic Devices (GPS, etc.).

# DriveCam Analytics

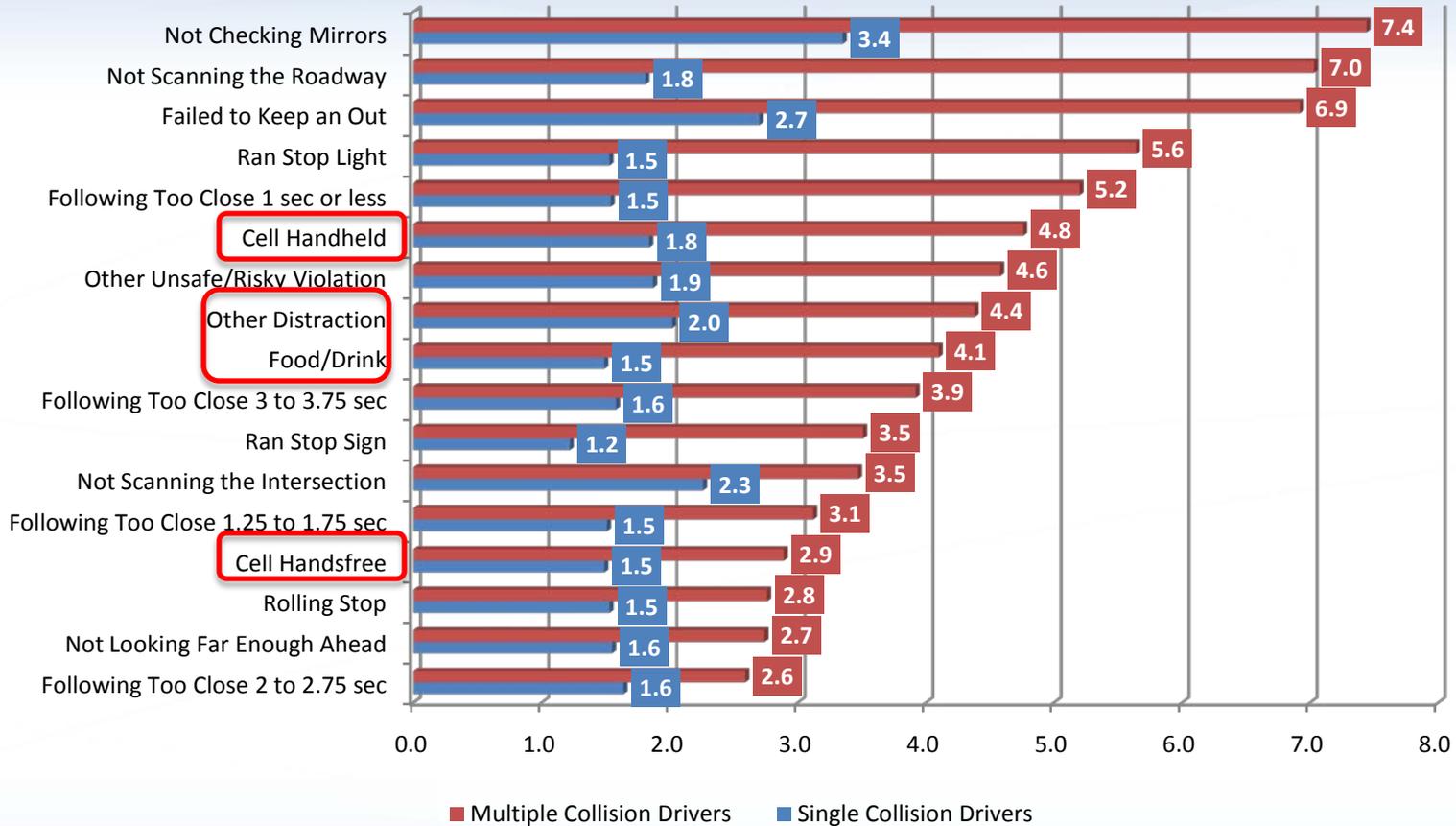
Distraction Type	% Identified in All Risky Driving Events
Cell Phone - Handheld	2.9%
Cell Phone - Hands Free	1.4%
Electronic Device	0.3%
Food / Drink	1.0%
Other	5.4%
Other Communication Device	0.8%
Passenger	0.1%
<b>ALL Distractions</b>	<b>11.9%*</b>

\* Slightly Higher than Previous Chart because an event can have multiple behaviors.

\*\* Driver Condition: Fatigue/Drowsy is 0.1% of Behaviors and a contributing factor in collisions 2.13% of the time in trucking (see ATA study).

# DriveCam Analytics

Single/Multi-Collision Drivers were “x” times more likely than non-collision drivers to . . .

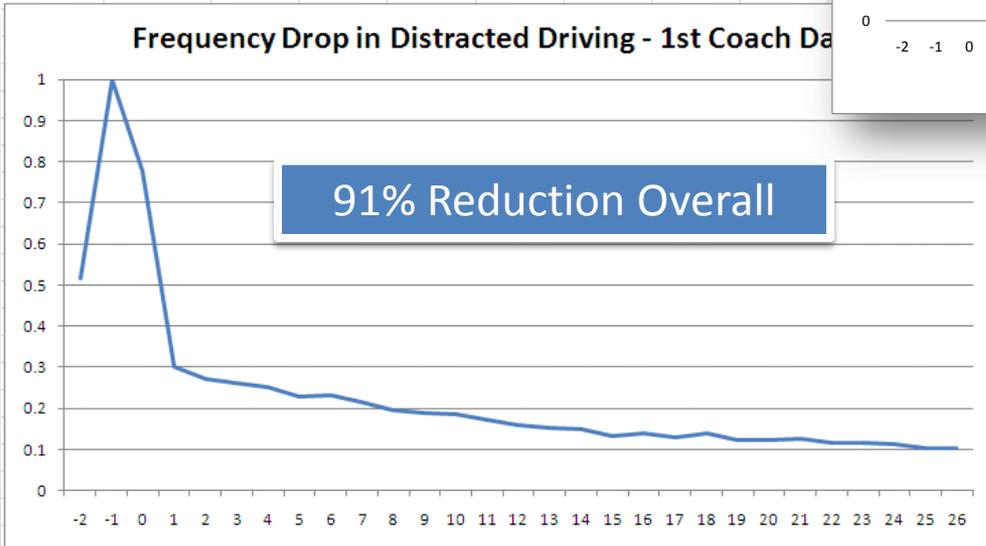
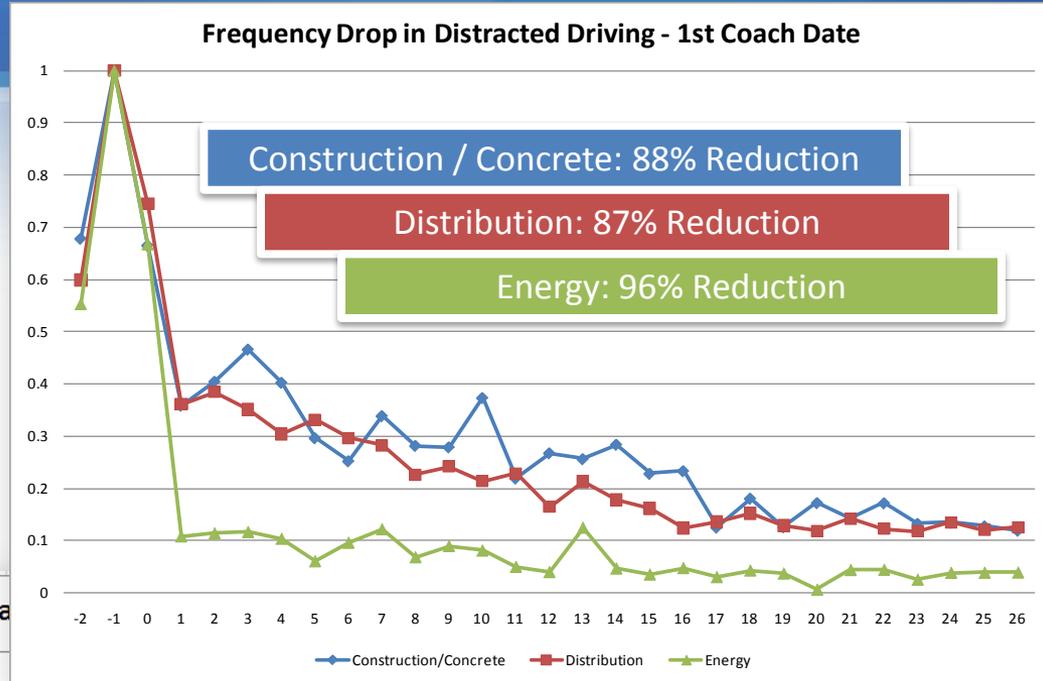


# DriveCam Analytics

- Events triggered by abrupt action – our data is a subset of total # of cell use occurrences
- Drivers identified with 3 or more cell phone events twice as likely to have a collision
- Drivers identified with 6 or more cell phone events 3 times as likely to have a collision & 6 times as likely if prior events were deemed risky

# In-Cab Video Impact

Impact of Identifying and Coaching Drivers on Distracted Driving Behaviors.

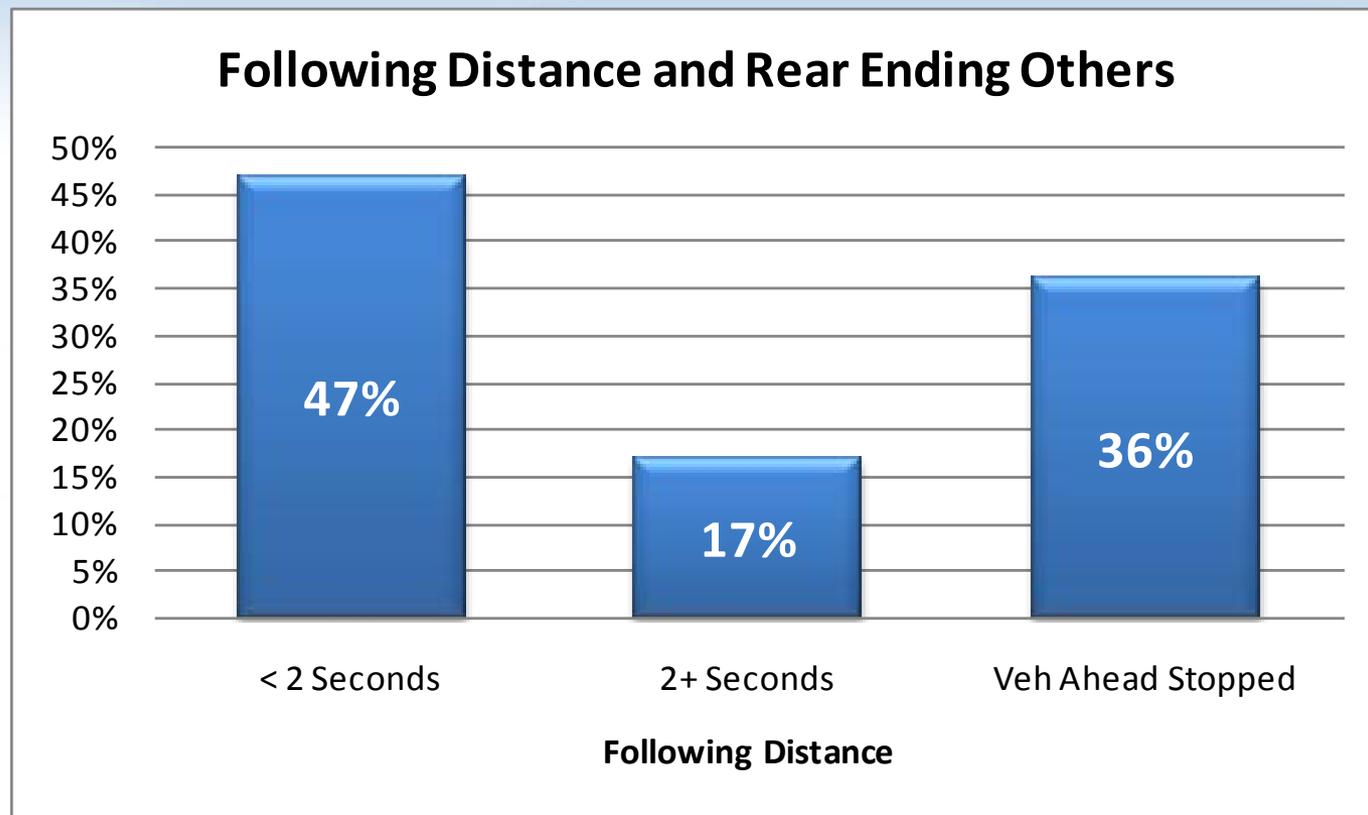


# Distracted Driving

- Many rear-end distracted driving crashes also include poor following distance
- With little distance ahead, the distracted driver has no margin for error when things change ahead
- Proper following distance increases the margin for safety...

[Rear ender 28.DCE](#)

# Distracted Driving



- Proper following distance = fewer distracted driving incidents

# Summary



# Summary

- Video-based solutions have tremendous advantages in identifying and eliminating distracted driving
  - Is the only way to identify “why” (the root cause) of a an event– and so leads to superior analytics
  - It is a powerful tool for changing driver behavior ( a picture is worth a thousand words)
  - As an exception based system, it is still cost effective
- Distracted Driving is highly correlated to collisions – so it is VERY dangerous
  - Note that other risky driving behaviors are more frequently identified.
  - In particular, in combination with other risky behaviors is a recipe for a severe collision (following distance, not looking far enough ahead, etc
- We applaud the efforts of the FMCSA and the MCSAC to address ways to make our roads safer.
  - It is also our passion! We are here to help!.
  - Thank you for your invitation today

 **Q&A**

