Federal Motor Carrier Safety Administration
Office of Analysis, Research and Technology

Talking Safety Technology

Wednesday, May 12, 2010

Talking Safety Technology

- Tire Pressure Monitoring Systems (TPMS) Field Operational Test (FOT)
- Enhanced Rear Signaling (ERS) Program for Commercial Motor Vehicles (CMVs)
- IntelliDrive for CMVs
- Commercial Skills Test Information Management System (CSTIMS)

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Tire Pressure Monitoring and Maintenance System Field Operational Test

Chris Flanigan
Technology Division

Previous Research

- Document the impacts of tire maintenance practices on commercial vehicle operating costs and safety
- Provide an estimate of the potential benefits for TPMS
  - Monitoring systems
  - Maintenance systems

Findings on Tire Maintenance Practices

- Approximately 50% were within 5 psi of the recommended pressure
- 1 out of 14 tires were 20+ psi underinflated
- Approximately 20% of dual-tire assemblies have tire pressures that differ by more than 5 psi
- Larger fleets perform stricter tire inflation maintenance

Financial Implications of Improper Tire Inflation

- Tire procurement costs increased by 10%–13%
- Fuel economy losses of 0.6%
- Accounts for one road call per year
- Total operating costs increased by $600–$800 per truck per year

Deployment of TPMS

- Approximately 5% of national truck fleets employ TPMS technology
- Lack of system penetration based on concerns of system reliability, maintenance costs, and initial system costs

Demonstrating Value of TPMS with Field Operational Test

- Show that TPMS will:
  - Increase the life of tires
  - Reduce fuel consumption
  - Reduce road calls for damaged/flat tires
  - Accurately measure tire pressure
  - Not introduce unscheduled maintenance

FOT Plan

- Install three different systems in two fleets
  - Sheetz and Gordon Food Services
- Test period of 12 months
- Perform vehicle inspections while collecting field data simultaneously
- Fleet technicians assisted in collecting data on test fleet and control fleet
- Ensured fleet returns daily to central facility to aid in data collection, failure tracking, and equipment recovery

Systems Tested

- Meritor Tire Inflation System by PSI (maintenance system)
  - 10 Sheetz tankers and 20 GFS trailers
- Tire Safeguard Monitoring system (wheel-mounted)
  - 16 GFS tractors and 19 GFS trailers
- Wabco Integrated Vehicle Tire Monitoring (valve stem-mounted)
  - 10 Sheetz tractors

Preliminary Results (Sheetz)

- 4.6 million miles traveled
- 706,000 gallons fuel consumed
- Tires on control fleet showed faster wear
- Test fleet had 1.8% increase in fuel economy over control fleet
- Final analysis complete December 2010

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Enhanced Rear Signaling for CMVs Program

Chris Flanigan
Technology Division

Rear End Crashes Involving Heavy Trucks

- 2006 GES data
  - Approximately 23,500 rear-end crashes
  - 135 fatalities
  - 1,603 incapacitating injuries

ERS Program Background

- Crash data analysis to determine causal factors
- Development and identification of countermeasures to aid in reducing them
  - External auditory signals, rear warning-light signals, and passive conspicuity octagonal markings
- Development of a prototype system with all countermeasures
  - Approximately 70 hours of real world testing

Current Work

- Objectives:
  - Update GES data analysis from Phase 1 with data from 2006
  - More closely explore countermeasures through static and dynamic testing
  - Develop a large scale Field Operational Test (FOT)

Light Configurations

Static Testing Preliminary Findings

- Main bumper, main bumper combined with cargo box, and main bumper combined with underride guard all significantly better at:
  - Increasing eye-drawing
  - Reducing eye-drawing time
- Main bumper ganged lighting received favorable ratings.
  - Higher attention-getting ratings
  - Ideal discomfort glare ratings

Dynamic (Smart Road) Testing

- Visual warning signal testing
  - Naïve participant testing
  - Eye-drawing capability
    - In-vehicle distraction task
  - Braking Performance
  - Rating scales
  - Discomfort glare, Attention getting, Helpfulness, Usefulness
- Most promising concept moved to real-world dynamic testing (Public Roadways)

Dynamic (Smart Road) Testing

64 participants total (16 per condition)

1. Baseline (normal brake lights)
2. Conspicuity Markings (second baseline)
3. Main Bumper Lighting Configuration
4. Ganged Underride/Trailer Lighting Configuration

Waiting on results from extended static testing

1

2

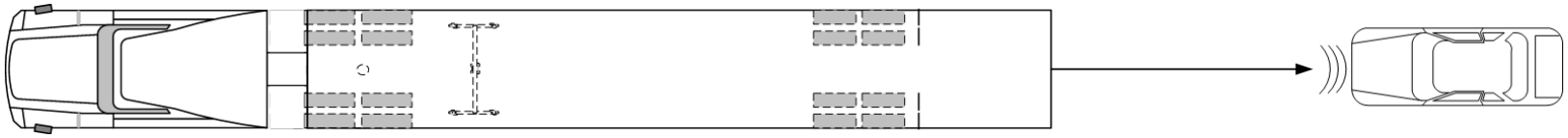
3

4

or

Real World Testing

- Visual warning signal testing
  - CDL driver & In-vehicle experimenter
  - Following driver's behavior (good and bad)
    - Eye-drawing capability
    - Brake response time
    - Unintended or undesirable event occurrences



Field Operational Test Plan

- Factors to consider in FOT design
  - Expected fleet's level of involvement
  - Develop countermeasure effectiveness metrics
    - System costs
    - Crashes avoided
- Fleet considerations
  - Type of operation
  - Size of fleet
  - Sufficient resources available for testing

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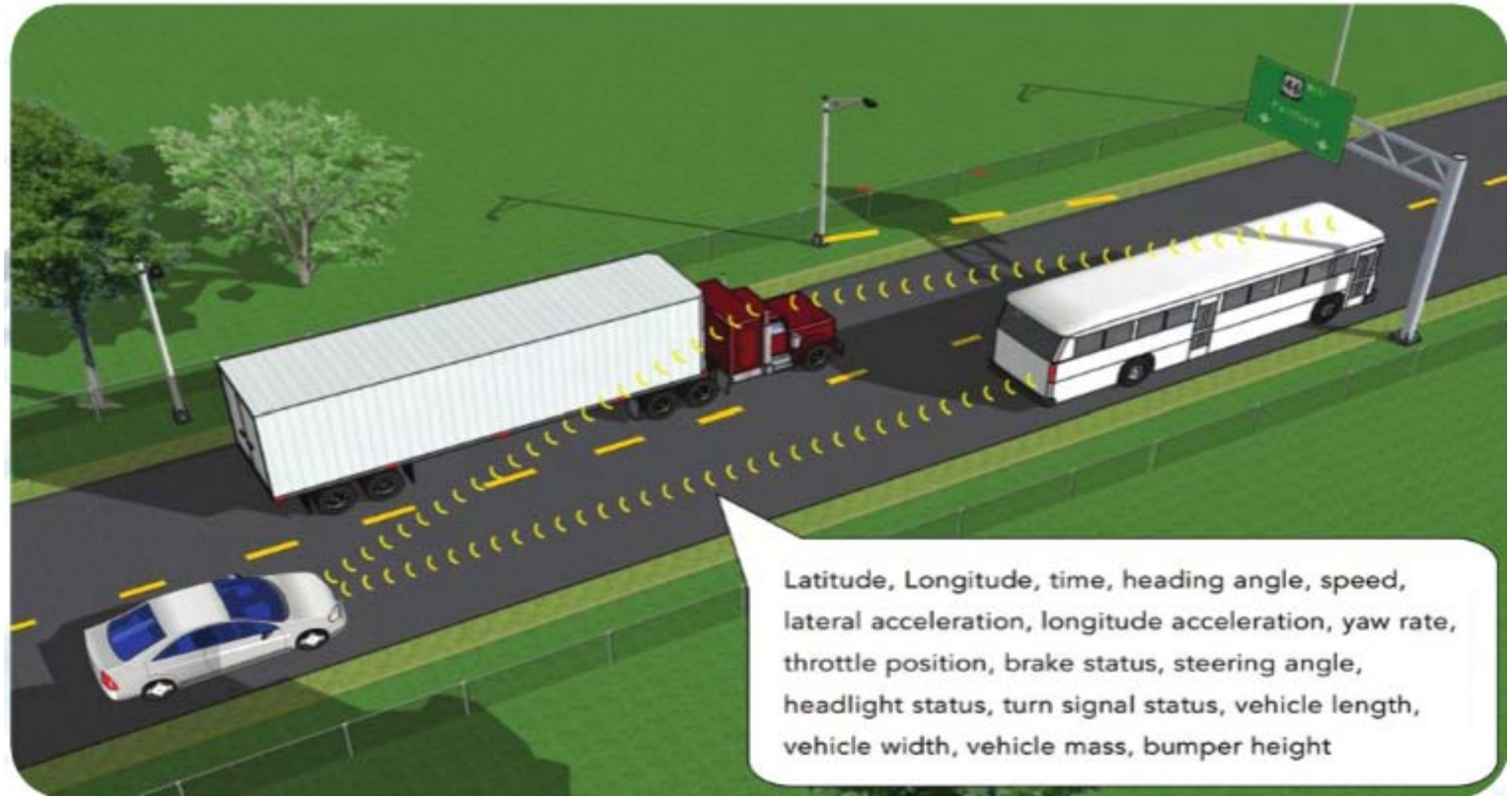
IntelliDrive for Commercial Motor Vehicles

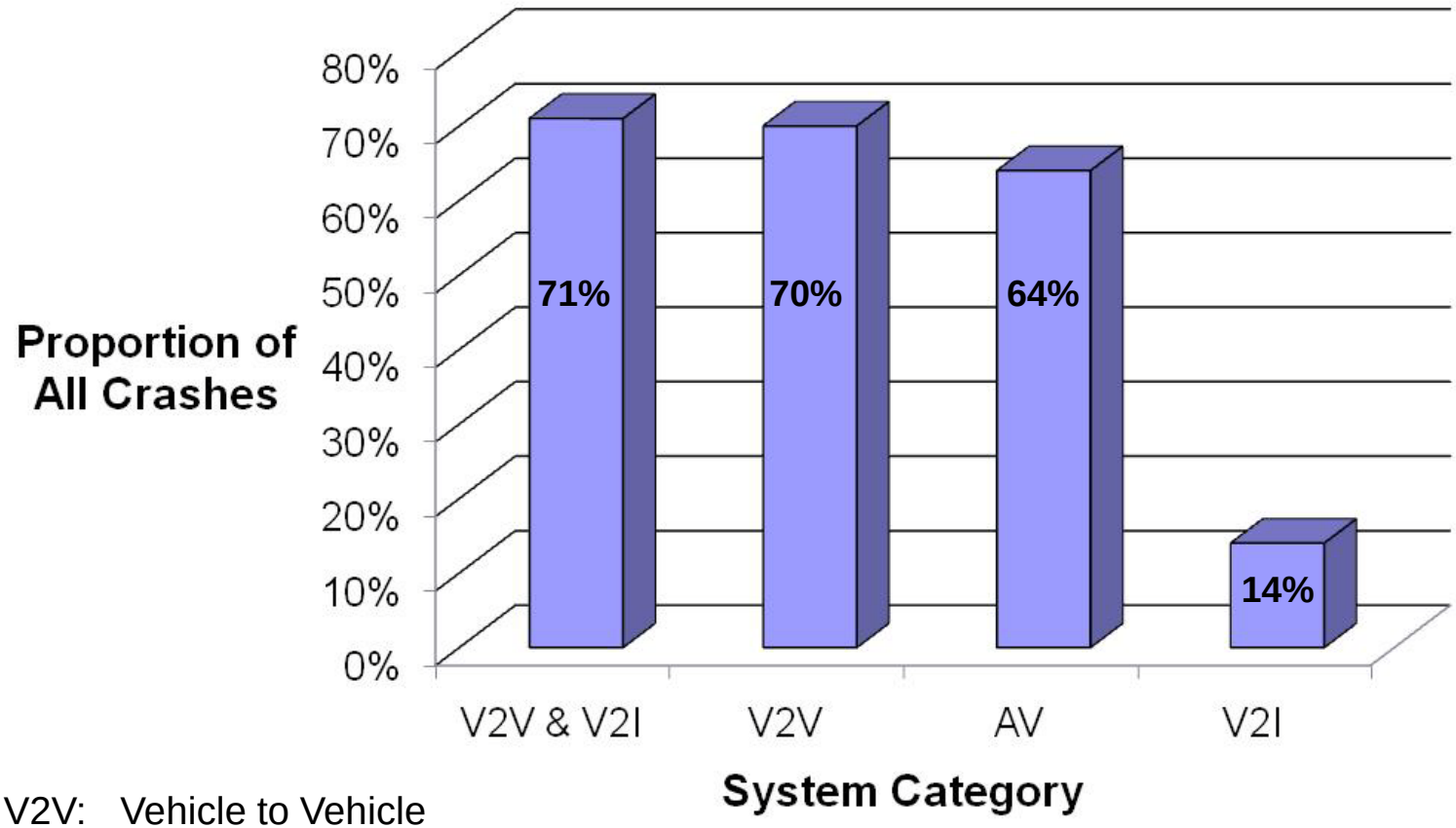
Jon Mueller

Technology Division

IntelliDrive℠

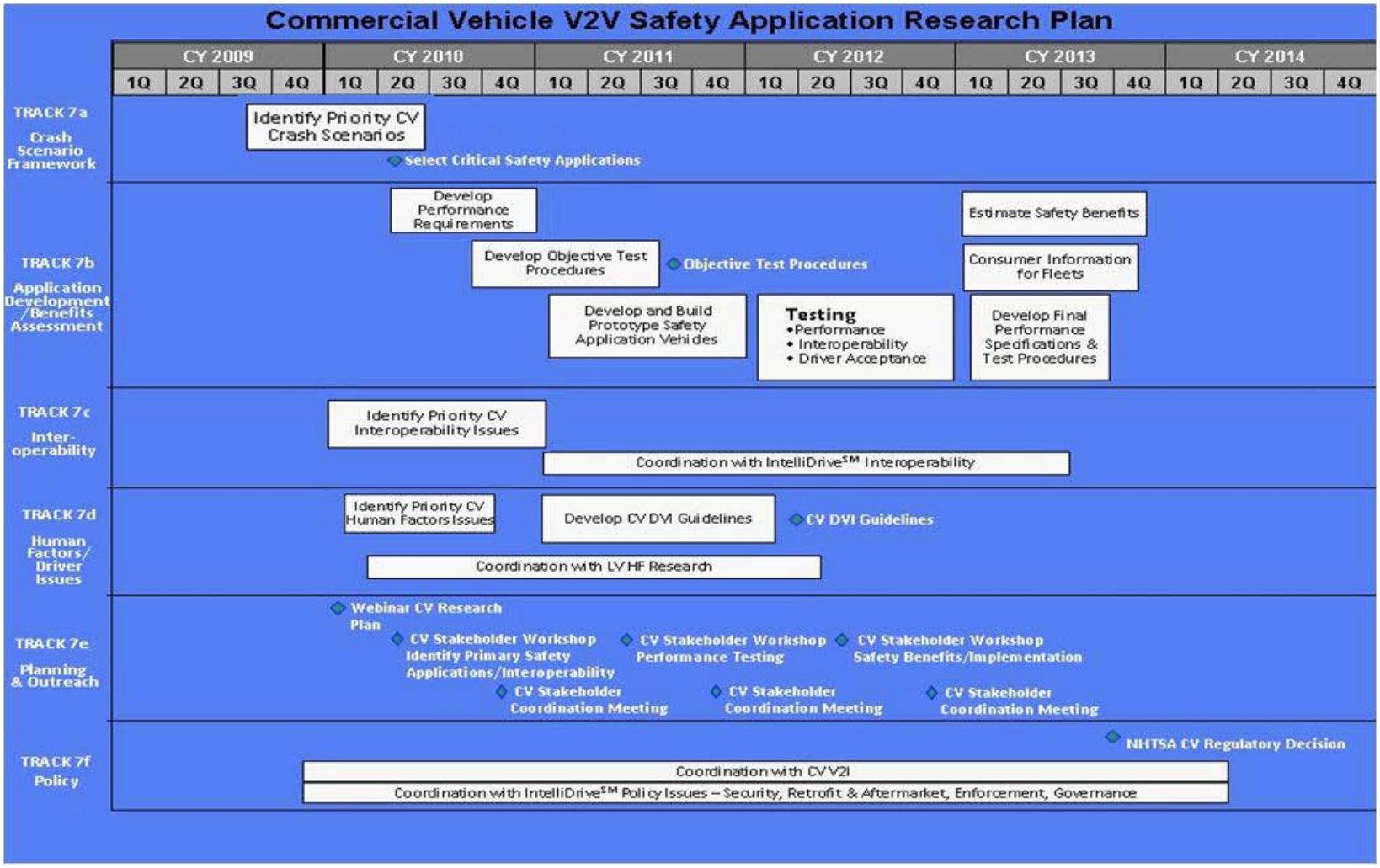


Potential Benefits of IntelliDrive

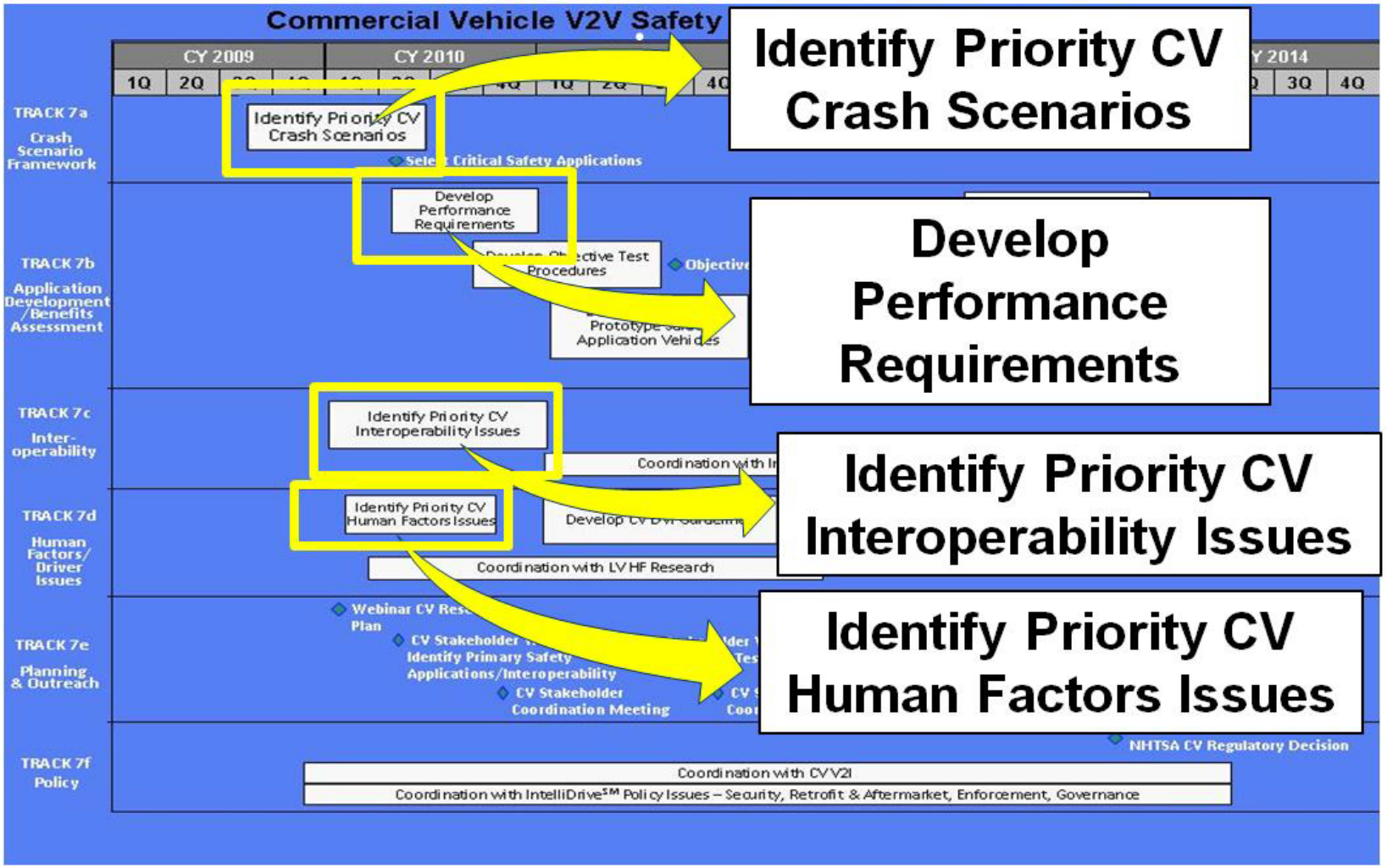


V2V: Vehicle to Vehicle
V2I: Vehicle to Infrastructure
AV: Autonomous Vehicle

CMV V2V Safety Applications Research Plan



CMV V2V Safety Applications Research Plan



Top Addressable Crash Scenarios

Pre-crash Scenario	All Crashes	V2V & V2I	AV
Changing lanes/Drifting same lane	69,000	69,000	
Rear-end	64,000	64,000	
Crossing paths	32,000	32,000	
Control loss	21,000	21,000	
Backing into vehicle	19,000	19,000	
Opposite Direction	14,000	14,000	
Running red light / stop sign	11,000	11,000	
Turns at traffic signals	8,000	8,000	
Turns at non signal	5,000	5,000	
Road edge departure	39,000	3,000	15,000
Parking	3,000	3,000	
Object contacted	36,000	2,000	16,000

Performance Requirements

- Background
  - Select applications to maximize the benefits of V2V
    - Inter-vehicle vs. autonomous systems
- Objectives
  - Identify applications that map to real-world crash scenarios
  - Identify CMV end-user needs
  - Describe the functional system requirements for applications
  - Determine minimum performance requirements for CMV V2V applications

CMV Driver–Vehicle Interface

- Background
  - V2V & V2I enables applications that may compete for the driver's attention
  - Instrument panel and methods for presenting information to the driver is unique for CMV
- Objectives
  - Determine the specific needs of commercial vehicles to develop effective Digital Visual Interfaces (DVIs)
  - Develop a reference of DVI metrics to facilitate development of IntelliDrive applications

Interoperability

- Background
  - Safety applications must work across any and all equipped vehicles, regardless of make, model, type, or qualified retrofit equipment.
  - Critical to the deployment and effectiveness of V2V safety systems
- Objectives
  - Determine technical issues unique to CMV inter-vehicle communications
  - Prioritize the resolution of interoperability issues affecting V2V and V2I safety applications.

Interoperability Categories

- Standards and Communication
  - Scalability
  - Reliability
  - Revision, Completion, Testing
  - Prioritization
  - Data Interchange Rules
  - Certification and Compliance
- Security
  - Protocols
  - Certificate Authority
  - Driver's Privacy
  - Message Authentication
- Data
  - Reliability
  - Validation & Integrity
  - Authentication

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Commercial Skills Testing Information Management System

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Purpose

- Web-based Software-As-A-Service
- Purpose
- 3rd Party Tester
- Skills test

Background

- 05/2002 DOT/OIG report on CDL fraud
- 07/2003 $ 1.1M funds from FHWA ITS JPO
- 02/2006 CSTIMS pilot tested
- 12/2006 Improvements & enhancements recommended
- 12/2009 Improvements & enhancements completed
- 01/2010 new CSTIMS launched into production

Roles & Responsibilities

Users with User Role	May Create/Modify Users with User Role:							
System Administrator	**SA**	**JA**	**CM**	**RP**	**EX**	**MC**	**AU**	**FM**
Jurisdiction Administrator	**SA**	**JA**						**FM**
CDL Monitor			**CM**			**MC**	**AU**	
System Administrator				**RP**	**EX**			

SA – System Administrator

JA – Jurisdiction Administrator

CM – CDL Monitor

RP – Tester's "Responsible Party"

EX – Examiner

MC – MVA Clerk

AU – Auditor

FM – FMCSA

Jurisdictional Parameters

- What is the maximum number examiner tests that can be done in one day?
- What is the maximum number of testers for which an examiner may work?
- Is the examiner authorized to work in multiple jurisdictions?
- What is the minimum number of days in advance an exam must be scheduled?
- What is the minimum number of waiting days after failing an exam?
- Is nighttime testing allowed?

Prerequisites

- Roles assigned
- Jurisdictional parameters must be set
- All skills tests must be scheduled in advance
- All examiners must be in system
- Test site, vehicle, & results must be in system

Schedule

	3/29/2010	3/30/2010	3/31/2010	4/1/2010	4/2/2010
6 AM					
7 AM					
8 AM					
9 AM					VI - Gonsor, 073 Sid - 073-2 BCS - Gonsor, 073 Sid - 073- RT - Gonsor, 073 Sid - 073-
10 AM					
11 AM					
12 PM					
1 PM					
2 PM					
3 PM					
4 PM				VI - Gonsor, 073 Sid - 073-1	
5 PM				BCS - Gonsor, 073 Sid - 073- RT - Gonsor, 073 Sid - 073-	
6 PM				VI - Gonsor, 073 Sid - 073-1 BCS - Gonsor, 073 Sid - 073-	
7 PM				RT - Gonsor, 073 Sid - 073-	

System Alerts

- Alerts automatically sent for events out of the norm. Examples:
  - More tests scheduled than manageable
  - Tests at more than one site by same examiner on same day
  - Examiners scheduled to work for more testers or more jurisdictions than allowed
  - Tester or Examiner under sanction
  - Examiner does not have proper jurisdiction-required CDL

Reports

- Tester
- Examiner Multiple Employment
- Test Pass-Fail Rates
- Schedule Information
- Sanctions

States' view of Benefits

- CSTIMS streamlines CDL skills test scheduling by facilitating:
  - Deployment of resources (in-house examiners)
  - Compliance by 3rd party testers
  - Monitoring by supervisors
  - Undercover investigation, oversight, & audits

States' view of Benefits (cont.)

- CSTIMS streamlines CDL skills test reporting by maintaining:
  - Log of all administered tests
  - All test results
- CSTIMS makes CDL skills testing process paperless, eliminating:
  - Forged, illegible, or changed test results
  - Periodic hand-drafted reports from testers

Next Steps

- Continue national deployment started in 2010
  - NM, SD, & KS currently using
  - OK, OR, & WV committed to using
  - TN & FL expressed serious interest in using
- Integrate CSTIMS with eCDL
  - eCDL is GPS-enabled software for recording results of CDL skills test in real-time

Next Steps (cont.)

- Since FY 2008, States may apply for FY 2009 CDL grants to:
  - Adopt or migrate to CSTIMS
  - CSTIMS-related expenses
- Starting FY 2010, States may also apply for Expanded* CVISN Grants to pay for CSTIMS:
  - CVISN Grants require 50:50 match

*Core CVISN Grant funds may be used provided State is Core CVISN Compliant.

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