Driver Safety History Indicator and the Inspection Selection System

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U.S. Department of Transportation

Federal Motor Carrier Safety Administration

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Agenda

- **Overview of CDC and CDC-ISS Study**
- **Phases**
  - **Confirmation analysis**
  - **ISS Technology and Use Survey**
  - **ISS and Query Central on the PDA development**
  - **Proof of concept field test**
  - **Methodology to test CDCM with ISS**
  - **CDC-ISS implementation**
- **Outcome Measures**
- **Results**
- **Discussion**

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CDC - Prior Research

- **Driver/Carrier Relationship Project**
  - Used 1994 citation data from IN and MI
  - Conclusions:
    - Violation rates differ among carriers
    - Higher violation rates associated with higher crash rates

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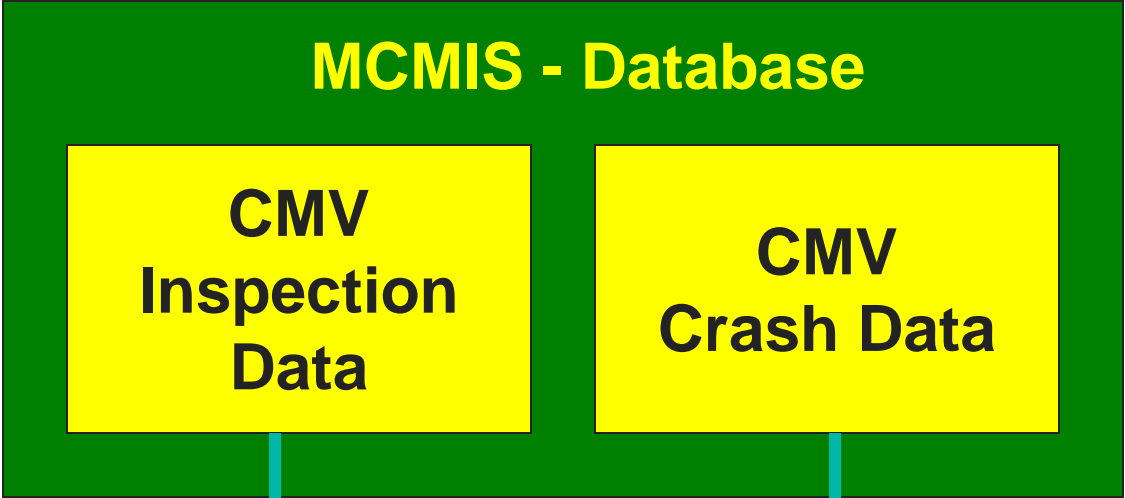NORTH DAKOTA STATE UNIVERSITY

CDC - Motivation / Background

- **Driver citation information linked to carriers may be useful, but problems collecting it**

- **Similar correlation with conviction data?**

- **Background of CDLIS**
  - **Created through CMVSA, operational since 1992**
  - **How it works**
  - **Problem: It doesn't identify the employing carrier**

- **Background of MCMIS**
  - **Use crash/inspection reports to link drivers to carriers**

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CDC Study Methodology

MCMIS - Database

CMV Inspection Data

CMV Crash Data

Contains:
- Carrier DOT#
- Driver CDL#
- Safety Data

CDLIS Search

State DMV Driver Records

Combined CDC Records

Contains:
- Driver CDL#
- Conviction data

Create Driver Conviction Measure (DCM)

3 * (disqualifying offense) +
2 * (serious offense) +
1 * (any other offense) = DCM

Create Carrier Driver Conviction Measure (CDCM)

$$\frac{\text{Sum of severity weighted \# of convictions (DCM)}}{\text{\# of drivers for carrier}}$$

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CDC Results

- **Correlation analysis of CDCM with OOS rates, crash rates, and SEA values revealed statistical and practical significant positive correlations**
  - Highest correlation coefficients with driver SEA value, accident SEA value, and driver OOS rate
    - $r = 0.15$ to 0.19
  - Correlations held across all size groups and regions
    - For largest groups, $r = 0.32$ to 0.55
- **More than 10% of carriers had CDCI, but no other SafeStat indicator**

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Table 1. Overall Correlation Analysis Between the Carrier Driver History Measure and Safety Variables

Carrier Safety Variable	Correlation with Carrier Driver History Measure		
	Sample Size	Pearson Correlation Coefficient	Significance Level
Vehicle OOS Rate	7,991	0.043	0.0001
Driver OOS Rate	8,789	0.149	0.0001
Crashes per Power Unit Rate	12,802	0.085	0.0001
Crashes per Driver Rate	12,110	0.009	0.3208
Accident SEA	2,946	0.175	0.0001
Driver SEA	9,745	0.188	0.0001
Vehicle SEA	8,980	0.080	0.0001
Safety Management SEA	915	0.097	0.0035

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Create Carrier Driver Conviction Indicator (CDCI)

- If sum of DCMs < 2   then do not use
- If sum of DCMs = 2-3   then = group 1
- If sum of DCMs = 4-6   then = group 2
- If sum of DCMs = 7-14 then = group 3
- If sum of DCMs > 14   then = group 4

For each group: rank CDCM values & transform into percentiles (0-100)

Result is Carrier Driver Conviction Indicator (CDCI)

CDC Results (cont)

- **Better Targeting of High Risk Carriers**
  - **Adds four times more carriers to the Safety Management SEA in SafeStat**
  - **Provides additional data on smaller carriers that is not being captured by other SEA values**
    - **Many carriers have CDCI but no other SEA**
    - **84% of these had less than 6 drivers**
  - **May provide valuable risk information not being captured by other SEA values**

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CDC-ISS Project

- **How do we apply CDC results to the real world?**
  - **CDC – Next step to use CDCM**
    - **Further analysis of DCM**
  - **ISS – Improve both the algorithm and the use**
    - **Implement CDCM as part of ISS**
- **Time frame: April 2003-September 2005**

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CDC-ISS Results to Date

- **Confirmation analysis completed**
  - **April 2003 MCMIS data**
    - **130,000 U.S. drivers matched to 46,000 carriers**
- **Survey of States (via email and web site)**
  - **Hardware and software used to support the existing algorithm**
  - **Use of screening / electronic clearance systems**
  - **Current usage level of the ISS algorithm**
  - **Suggested improvements to the algorithm and delivery platform**
- **ISS and Query Central on the PDA development**
- **Proof of concept field tests in OH and TN**
- **Methodology to test CDCM as part of ISS**
- **ISS-D implementation**
- **Analysis and Results**

CDC-ISS Analysis Results

- **Data Description**
  - **April 2003 MCMIS data**
    - **130,000 U.S. drivers matched to 46,000 carriers**
  - **CDLIS Conviction data**
  - **Calculation of DCM and CDCM**
  - **Significant correlation analysis results**
  - **22,201 (48%) of carriers have potential CDCI**
- **ISS Use Analysis**
  - **Maine (70) and Utah (75) have highest average ISS value for carriers inspected**
  - **Next step: Survey of states**

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Table 2. April 2003 - Overall Correlation Analysis Between the Carrier Driver History Measure and Safety Variables

Carrier Safety Variable	Correlation with Carrier Driver History Measure		
	Sample Size	Pearson Correlation Coefficient	Significance Level
Vehicle OOS Rate	35,253	0.094	0.0001
Driver OOS Rate	37,224	0.147	0.0001
Accident SEA	9,634	0.169	0.0001
Driver SEA	26,182	0.172	0.0001
Vehicle SEA	31,235	0.106	0.0001
Safety Management SEA	5,057	0.050	0.0004

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Information Systems

INFOSYS BANNER

Technology and ISS Usage Assessment

This survey is part of a FMCSA Research & Technology study, and your opinions are very important to its success. The survey should only take approximately 10 minutes to complete. If you have any questions regarding this survey or the overall study, please feel free to contact Jeff Loftus or Brenda Lantz. Thank you in advance for your participation.

For a brief description of ISS and Query Central, please click the following link. ISS - QC Description

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Q1. Do your agency motor carrier safety enforcement personnel use the ISS software and/or Query Central to access ISS information? If so, approximately how many users use each?

☐ Our enforcement personnel do _not_ use the ISS software nor Query Central.

Approximately, how many users:

a. Use the ISS software?

b. Use Query Central only?

c. Use both ISS and Query Central?

Q2. How many motor carrier safety enforcement personnel does your agency have?

Done   Internet

Survey of States

- **Responses from 44 States**

- **Current usage level of ISS**
  - **100% for some purpose**
  - **36% for primary basis to inspect (19 of 53)**

- **Hardware and software used to access ISS**
  - **96% laptops, 50% would consider PDA**

- **ISS data updates**
  - **Majority install from CD or require laptops brought in**
  - **23% (12) use the single carrier refresh**
  - **17% (9) use the carrier database refresh**

Survey of States (continued)

- **Internet access**
  - **47% (24) at fixed sites only**
  - **33% (17) at fixed and mobile sites**
  - **18% (9) have no access**
- **Use of screening / electronic clearance systems**
  - **73% NorPASS, PrePass, or Other (32 of 44)**
- **Suggested improvements to the algorithm**
  - **Include intrastate violations**
  - **More weight on driver violations (3 comments)**

Proof of Concept Field Tests

- **Hypotheses**
  - **Using a PDA will be more efficient for selection**
  - **Wireless connectivity with PDA is timely / adequate**
  - **Using the CDC measure alone will result in increased driver OOS rates**

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Use of PDA

Use of CDC Measure

- **Out of 158 inspections, 126 had a CDC value**
- **CDC identified 18 as "Inspect"**
  - **3 of these resulted in a driver OOS (16.7%)**
- **ISS did not identify 9 of the 18 as "Inspect"**
  - **All 3 of the OOS were in these 9**
- **CDC identified 84 as "Pass"**
  - **7 of these resulted in a driver OOS (8.3%)**

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Proof of Concept Field Tests

- **Conclusions**
  - **Using a PDA will be more effective for selection**
    - **Yes, noticeably easier than with desktop**
  - **Wireless connectivity with PDA is timely / adequate**
    - **Yes, demonstrated use and quick response times**
  - **Using the CDC measure alone will result in increased driver OOS rates**
    - **Yes, results are "promising"**

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Methodology to test CDCM with ISS

- **Implemented similar to SafeStat**
  - **Used CDC measure to create an indicator (CDCI)**
  - **Added it to Safety Management SEA**
  - **Calculated ISS values in same way**
    - **Certain carriers now receive safety values**
    - **Some carriers have higher values**

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CDC-ISS Implementation (ISS-D)

- **States selected to pilot test**
  - **States with best crash data available**
  - **Varied location / size**
- **Software (ISS-D) installed for majority of users in:**
  - **ID, NC, OH, and UT mid-January 2005**
  - **VT, CT, KY, and AK mid-March 2005**
- **ISS-D installed for a limited number of users in:**
  - **MO (4), WV (4), AZ (2), and WA (7)**
- **Explored use with electronic clearance system in KY**

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Outcome Measures

- **Project Safety Outcome Measures**
  - Anticipate increased use of ISS / improved ISS algorithm, increased driver OOS rates, and decreased crashes
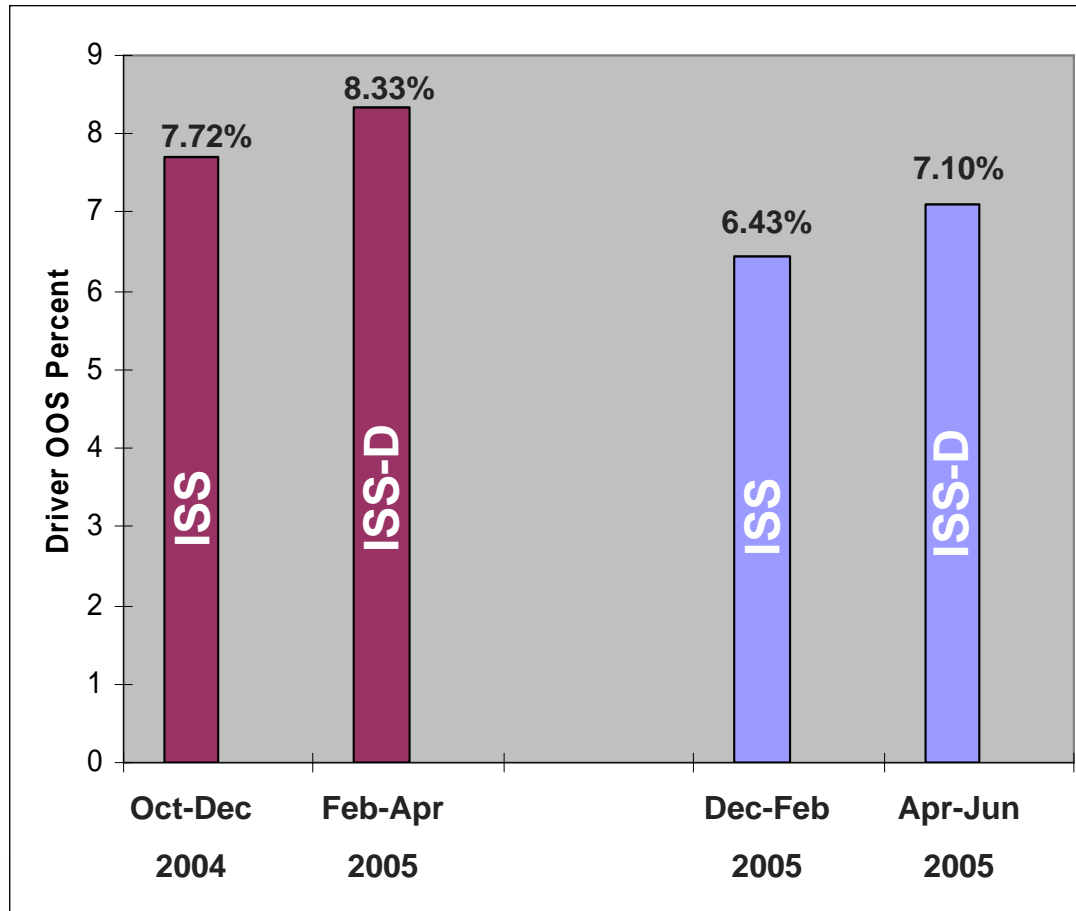 - Analyze ISS usage rates, OOS rates, and crash rates before and after implementation

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ISS vs. ISS-D: Before and After Results

- **ID, NC, OH, and UT**
  - **ISS**
    - **For Oct-Dec 2004, driver OOS rate = 7.72%**
    - **38,270 Level 1, 2, 3 and 6 inspections**
  - **ISS-D**
    - **For Feb-Apr 2005, driver OOS rate = 8.33%**
    - **38,812 Level 1, 2, 3 and 6 inspections**
- **AK, CT, KY, and VT**
  - **ISS**
    - **For Dec 2004-Feb 2005, driver OOS rate = 6.43%**
    - **23,717 Level 1, 2, 3 and 6 inspections**
  - **ISS-D**
    - **For Apr-Jun 2005, driver OOS rate = 7.10%**
    - **30,069 Level 1, 2, 3 and 6 inspections**
- **Preliminary crash analysis trends appear positive, but further analysis needed**

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ISS vs. ISS-D:
Before and After Results

Bar chart showing Driver OOS Percent:
- Oct-Dec 2004, ISS: 7.72%
- Feb-Apr 2005, ISS-D: 8.33%
- Dec-Feb 2005, ISS: 6.43%
- Apr-Jun 2005, ISS-D: 7.10%

Legend:
- ID, NC, OH, UT
- AK, CT, KY, VT

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http://www.ugpti.org/tssc/projects/drivesafe.php

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