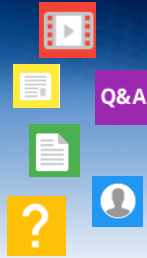**Understanding FMCSA's
Item Response Theory Model
For Identifying At-Risk Carriers**

11:00 AM Eastern Time (New York)
10:00 AM Central Time (Chicago)
9:00 AM Mountain Time (Denver)
8:00 AM Pacific Time (Los Angeles)

J. J. Keller & Associates, Inc.® Since 1953

NPTC
National Private Truck Council

Housekeeping Items

- Audio streamed through computer speakers
- Widgets are resizable and moveable
  - Minimize/maximize
  - Expand/shrink
- Enter questions via the Q&A
- Check out the resources area to download today's slides
- Click the help icon if you need tech help

Q&A

?

J. J. Keller & Associates, Inc.® Since 1953

NPTC
National Private Truck Council

**Understanding FMCSA's
Item Response Theory Model
For Identifying At-Risk Carriers**

May 8, 2019

J. J. Keller & Associates, Inc.® Since 1953

NPTC
National Private Truck Council

FMCSA's Item Response Theory

This webcast will cover ...

- A regulatory overview
- Best practices in compliance
- A case study in implementation
- Question & Answer

Attention Attendees:

+ Thank you for attending!
+ You will be muted during the event.
+ Please use the Q&A feature to send in questions to us. We'll try to answer them during the Q&A period if they are not covered in the presentation.
+ The slides and recording will be posted within 7 days at: www.jjkeller.com/nptcinfo

Gary Petty
President & CEO
National Private Truck Council

NPTC National Private Truck Council

J. J. Keller & Associates, Inc. Since 1953

Meet Your Presenters

Gary Petty
President & CEO
National Private Truck Council

Tom Bray
Industry Consultant-Transportation
J. J. Keller & Associates, Inc.

Tom Moore, CTP
Senior Vice President
National Private Truck Council

Randy Maddox, CTP
Regional Manager,
Oldcastle APG

J. J. Keller & Associates, Inc. Since 1953

NPTC National Private Truck Council

Item Response Theory:
The New Measurement Model

Tom Bray
Industry Consultant – Transportation
J. J. Keller & Associates, Inc.

NPTC National Private Truck Council

J. J. Keller & Associates, Inc. Since 1953

Problems with Existing System

- Subject-matter-expert driven
  - Severity and time weights assigned by experts
  - No statistical base for many severity and methodology decisions
  - Only a few BASICs closely related to future crash risk
  - Does not correlate into safety culture
    - Carrier can be intervened with due to one bad BASIC, while carrier one point under the threshold in all seven BASICs in not even looked at
    - Which one is safer?

Tom Bray
Industry Consultant – Transportation
J. J. Keller & Associates, Inc.

NPTC — National Private Truck Council

J. J. Keller & Associates, Inc. — Since 1953

Item Response Theory (IRT)

- Would replace the existing math used in the BASIC methodology
- Used heavily in education and health care

Tom Bray
Industry Consultant – Transportation
J. J. Keller & Associates, Inc.

NPTC — National Private Truck Council

J. J. Keller & Associates, Inc. — Since 1953

Item Response Theory (IRT)

- Statistically driven
  - Provides information on which violations should be used and what the severity should by based on data in the system
  - Can be set up to consider the probability of being selected for an inspection
  - Multi-dimensional
    - Multiple stages in developing score
    - $Y_{ijk} | [N_{ijk} > 0] \sim$ binomial (N_{ijk}, p_{ik}), logit $(p_{ik})[1] = \beta_k - \alpha_k\theta_i, \theta_i \sim N(0,1)$
  - Adapts over time as data develops

Tom Bray
Industry Consultant – Transportation
J. J. Keller & Associates, Inc.

NPTC — National Private Truck Council

J. J. Keller & Associates, Inc. — Since 1953

Item Response Theory (IRT)

- Will require "consolidating" violations
- Current system uses too many separate violations
  - Would not eliminate the use of, but would consolidate
  - Similar to current "violation groups" that are information-only in current BASICs

Tom Bray
Industry Consultant – Transportation
J. J. Keller & Associates, Inc.

NPTC
National Private Truck Council

J. J. Keller
& Associates, Inc.®
Since 1953

Item Response Theory (IRT)

- Patterns in the data are watched, not just raw numbers
- Under IRT carriers with one repeating issue will be viewed differently than carriers that are mediocre across the board

Tom Bray
Industry Consultant – Transportation
J. J. Keller & Associates, Inc.

NPTC
National Private Truck Council

J. J. Keller
& Associates, Inc.®
Since 1953

Item Response Theory (IRT)

- Would lead to an overall "safety culture" rating
- BASICs may remain or change
  - What will change is the math used to develop the BASIC scores
- Much more complex system
  - $Y_{ijk} | [N_{ijk} > 0] \sim binomial\ (N_{ijk}, p_{ik}),\ logit\ (p_{ik})^{[1]} = \beta_k - \alpha_k \vartheta_i,$ $\vartheta_i \sim N(0,1)$, replaces
  - T/S weighted violations ÷ number of relevant inspections

Tom Bray
Industry Consultant – Transportation
J. J. Keller & Associates, Inc.

NPTC
National Private Truck Council

J. J. Keller
& Associates, Inc.®
Since 1953

Hurdles to Overcome

- Very complex model
- Data quality issues
  - MCS-150 data issues
  - Roadside inspection data issues

Tom Bray
Industry Consultant – Transportation
J. J. Keller & Associates, Inc.

NPTC
National Private Truck Council

J. J. Keller
& Associates, Inc.
Since 1953

Current Timeline

- FMCSA developing
- Small-scale tests: Spring/summer 2019
- Full model first run: Fall 2019
- Rollout/implementation: 2019 to ???
  - All dates are estimates!

Tom Bray
Industry Consultant – Transportation
J. J. Keller & Associates, Inc.

NPTC
National Private Truck Council

J. J. Keller
& Associates, Inc.
Since 1953

Things to Remember

- This system is what will select carriers for intervention
  - Warning letters
  - ISS Optional or Inspect
  - Focused or compliance reviews
- The secrets will remain the same
  - Prevent crashes
  - Avoid roadside inspection violations
  - There will still be "winners and losers"

Tom Bray
Industry Consultant – Transportation
J. J. Keller & Associates, Inc.

NPTC
National Private Truck Council

J. J. Keller
& Associates, Inc.
Since 1953

Beyond Compliance
Preparing for IRT

Tom Moore, CTP
Senior Vice President
National Private Truck Council

NPTC National Private Truck Council

J. J. Keller & Associates, Inc.®
Since 1953


Creating a Culture of Safety

- Past methods not yielding results? Overcoming WHADITW
- Use data to drive results
- Gather benchmarking
  - CSA Scores
  - Benchmarking
  - Driver input
- Drowning in a sea of data
  - Data never lies, it just never tells the whole truth
  - "Managing the eaches"

Tom Moore, CTP
Senior Vice President
National Private Truck Council

NPTC National Private Truck Council

J. J. Keller & Associates, Inc.®
Since 1953

DOT RECORDABLE ACCIDENTS

Bar chart: Accidents per Million Miles of Travel

Values: 0.97, 0.57, 0.51, 0.44, 0.42, 0.49, 0.49, 0.59, 0.55, 0.86, 0.61, 0.49, 0.53

Legend: 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015

Tom Moore, CTP
Senior Vice President
National Private Truck Council

NPTC National Private Truck Council

J. J. Keller & Associates, Inc.®
Since 1953
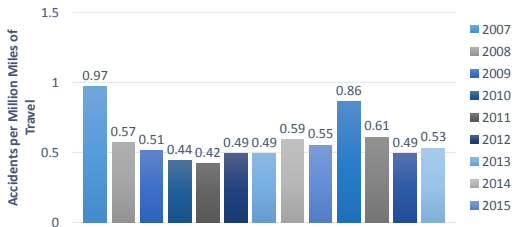
CSA Scores

	Unsafe Driving	Fatigued Driving	Driver Fitness	Controlled Substance	Vehicle Maintenance	HazMat	Crash
2014	12.1	10.9	10.7	0.91	20.8	1.94	27.2
2015	11.9	12.9	13.0	.05	21.9	1.3	22.3
2016	14	12	6.3	.12	18	1,7	25.7
2017	9	10	7	0.8	17	2.6	20
2018	14	12	9	.07	19	8.4	20
2019	12	16	11	3	23	7	23

Tom Moore, CTP
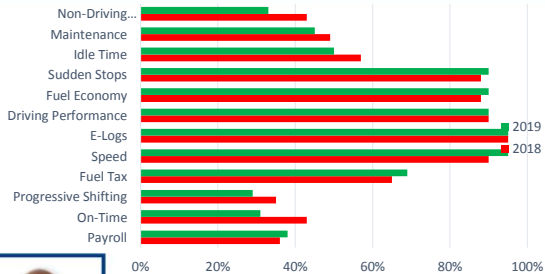Senior Vice President
National Private Truck Council

Onboard Technology Dominates
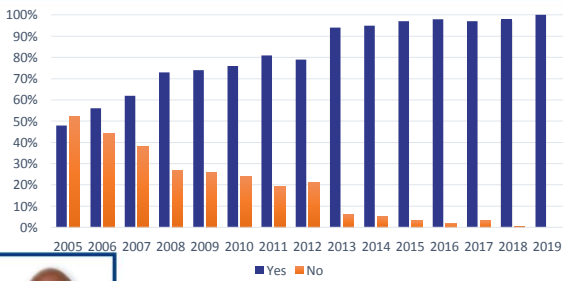
Tom Moore, CTP
Senior Vice President
National Private Truck Council

How Fleets Deploy Technology

Tom Moore, CTP
Senior Vice President
National Private Truck Council

Managing "Big" Safety Data

- CSA Indicators
- HOS
- Stability Control
- Use of Cruise Control
- Over Rev
- Idle Time
- PM Performance
- MPG

- Recordable Accident Ratio
- DOT Violations (EOBR)
  - Overall
  - Individual
- Employee Injury Ratio
- Tickets/Violations
- ECM Data

Tom Moore, CTP
Senior Vice President
National Private Truck Council

NPTC National Private Truck Council

J. J. Keller & Associates, Inc. Since 1953

_____

_____

_____

_____

_____

_____

_____

Gap Analysis

1. Define Goals/Objectives
2. Collect Data
3. Identify root causes of problems
4. Develop appropriate solutions
5. Plan and make changes

Narrow data focus to a manageable level by filtering out or reclassifying what we don't need…so you allow the right data to bubble to the top

Tom Moore, CTP
Senior Vice President
National Private Truck Council

NPTC National Private Truck Council

J. J. Keller & Associates, Inc. Since 1953

_____

_____

_____

_____

_____

_____

_____

Strategies for Success

- Don't get overwhelmed
- Narrow your focus
- Work on the meaningful few
- Set goals, and measure performance
- Communicate, educate and train
- Beware of analysis paralysis
- Translate it into what could have been done differently
- Design new policies and management practices

Tom Moore, CTP
Senior Vice President
National Private Truck Council

NPTC National Private Truck Council

J. J. Keller & Associates, Inc. Since 1953

_____

_____

_____

_____

_____

_____

_____

The Fleet Perspective:
Oldcastle APG

Randy Maddox, CTP
Regional Manager
Oldcastle APG

CRH / Oldcastle

- 3 Divisions – Materials, Building Envelope, and Architectural Products
- APG – 600 Class 7-8 trucks, 1,100 total pieces of equipment
- CRH – 3,100 Class 5-8 power units and over 6,000 total pieces of equipment
- Regional Manager for Oldcastle
- 31 years in the Transportation Industry
- Develop specs and negotiate prices based on specific company needs

Randy Maddox, CTP
Regional Manager
Oldcastle APG

Information Available in Data Analytics

Freight Costs
- Cost per Mile
- Miles per Gallon
- Repair and Maintenance Costs
- Average Cost per Pallet, Skid, Unit, etc.
- IFTA, IRP, CDL's, etc.

Customer Service Costs
- On-Time Delivery Accuracy
- On-Time Pickup Percentage
- Dwell Time
- Out-of-Network Shipments
- Order Fulfillment Accuracy

Randy Maddox, CTP
Regional Manager
Oldcastle APG

Getting Lost in Data Analytics

- Without data, we are just another person with an opinion!
- Which data is the right data to help make the greatest impact for my organization?
- What are my company goals? And how do I know what to look for to support, achieve and exceed those goals?

Increase in Confusing Graphs
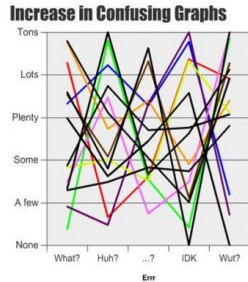
Randy Maddox, CTP
Regional Manager
Oldcastle APG

Who Are You and Who Do You Want To Be?

- Tanker
  - Fuel, foods, chemicals, etc.
- Dry/Box Van
  - Shipping containers
- Flatbed
  - Drop-decks, Conestogas
- Refrigerated

Randy Maddox, CTP
Regional Manager
Oldcastle APG

What Are Your Company's Goals?

- Talk to your CFO and/or President and find out what they are looking for
- Identify no more than 3 to 5 KPI's and focus on them
  - Too many measurements will cause you to lose focus on the original point of impact
- Learn what metrics and measurements are driving the data
  - How many factors touch that data point? First understand, then look to improve
- Deep dive into that specific data point
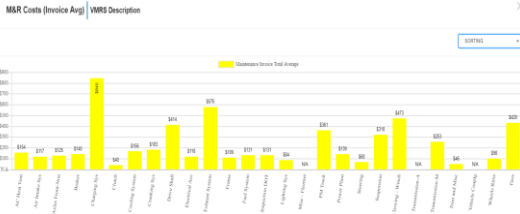 - Compare like points to give apple to apple comparisons

Randy Maddox, CTP
Regional Manager
Oldcastle APG

DATA – KPI Examples
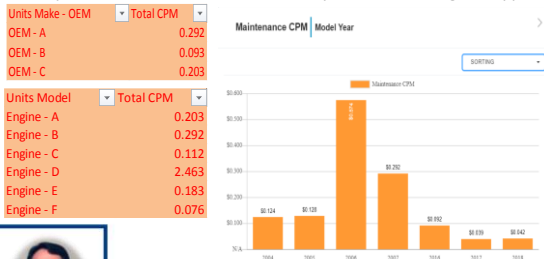
• Repair and Maintenance costs by VMRS code

Randy Maddox, CTP
Regional Manager
Oldcastle APG

DATA – KPI Examples

• Repair and Maintenance costs by OEM and Engine Type

Units Make - OEM	Total CPM
OEM - A	0.292
OEM - B	0.093
OEM - C	0.203

Units Model	Total CPM
Engine - A	0.203
Engine - B	0.292
Engine - C	0.112
Engine - D	2.463
Engine - E	0.183
Engine - F	0.076

Randy Maddox, CTP
Regional Manager
Oldcastle APG

DATA - SME's (Subject Matter Experts)

• Work with your I.T. Department, they should help you develop the proper points to get to the true data.

• OEM's – talk to your contact at your dealers. Get more than one OEM and more than one opinion at that OEM.

• Diesel Mechanics – they are hands on with the repairs

• Drivers – They can help you and they can hurt you. They know how to skew the data! Earn their trust by sharing the data and reason for the data with them first before presenting it in a public form to your C-Suite. (It may save you some embarrassment)
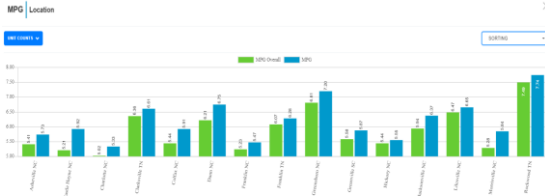
Randy Maddox, CTP
Regional Manager
Oldcastle APG

DATA – KPI Examples

- Miles per Gallon by location – who is doing a better job of fuel consumption?

Randy Maddox, CTP
Regional Manager
Oldcastle APG

DATA – KPI Examples

- Miles per Gallon by OEM and Model Year – who is doing a better job?

Units Make - OEM	MPG Overall	MPG Driving	Units Count
OEM - A	6.4	6.57	13
OEM - B	5.43	5.69	7
OEM - C	6.1	6.42	25
OEM - D	5.03	5.4	2

Randy Maddox, CTP
Regional Manager
Oldcastle APG

Recap

➤ Don't get lost in the Data – focus on 3-5 KPI's
➤ Know what means the most to your company – talk to your CFO or President
➤ Understand the mechanics and measurements behind the data
➤ Identify weaknesses and set goals to improve
➤ Continually monitor the results
➤ Never separate the data from the source, share the data with your drivers, learn from them by bringing the data and the drivers together to have a unification of goals

Randy Maddox, CTP
Regional Manager
Oldcastle APG

Question & Answer Session

Gary Petty
President & CEO
National Private
Truck Council

Tom Bray
Industry Consultant-Transportation
J. J. Keller & Associates, Inc.

Tom Moore, CTP
Senior Vice President
National Private
Truck Council

Randy Maddox, CTP
Regional Manager,
Oldcastle APG

J. J. Keller
& Associates, Inc.®
Since 1953

NPTC
National Private Truck Council

More Questions?

Tom Bray
Industry Consultant-Transportation
J. J. Keller & Associates
tbray@jjkeller.com

Tom Moore, CTP
Senior Vice President
National Private Truck Council
tmoore@nptc.org

J. J. Keller
& Associates, Inc.®
Since 1953

NPTC
National Private Truck Council

Please join us for our next webcasts

How to Use the DataQ System to Remove a Non-Fault Crash from Your Record
Thursday, May 9, 2019
Visit www.jjkeller.com/nptcinfo to register

J. J. Keller
& Associates, Inc.®
Since 1953

NPTC
National Private Truck Council

5/8/2019

Thank you for participating in today's webcast!

Visit: **www.jjkeller.com/nptcinfo**
for today's presentation and to learn more
about future NPTC and J. J. Keller webcasts

J. J. Keller
& Associates, Inc.®
Since 1953

NPTC
National Private Truck Council