



TRB Alternative Compliance Subcommittee Presentation  
January 8, 2018

# **FMCSA Beyond Compliance Research Project**

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Services**

# Overview

- Review of FAST Act Requirements
- Research Objectives and Hypotheses
- Information Collection/Research Design Plan
- Assessment of Best Practices Utilized/Draft Comprehensive Framework

# FAST Act Requirements

- FMCSA to provide recognition *including* credit or an improved SMS percentile, for carriers that:
  - Install advanced safety equipment
  - Use enhanced driver fitness measures
  - Adopt fleet safety management tools, technologies and programs: or
  - Satisfy other standards determined appropriate by the Administrator

# FAST Act Requirements

- FMCSA to carry out Beyond Compliance through:
  - Developing a process for identifying elements of technology and safety programs as a basis for recognition
  - Seeking input from Stakeholders
  - Using a third party for a monitoring program
  - Providing a report to Congress

# Research Objectives and Hypotheses

- Core Hypothesis of the FAST Act and Research:
  - *Carriers that adopt and implement best safety management technologies and practices perform more safely than those that do not.*
- Research time frame does not allow for a prospective analysis, so a retrospective analysis was conducted with interviewed carriers

# Initial Carrier Interviews – a “pre-test”

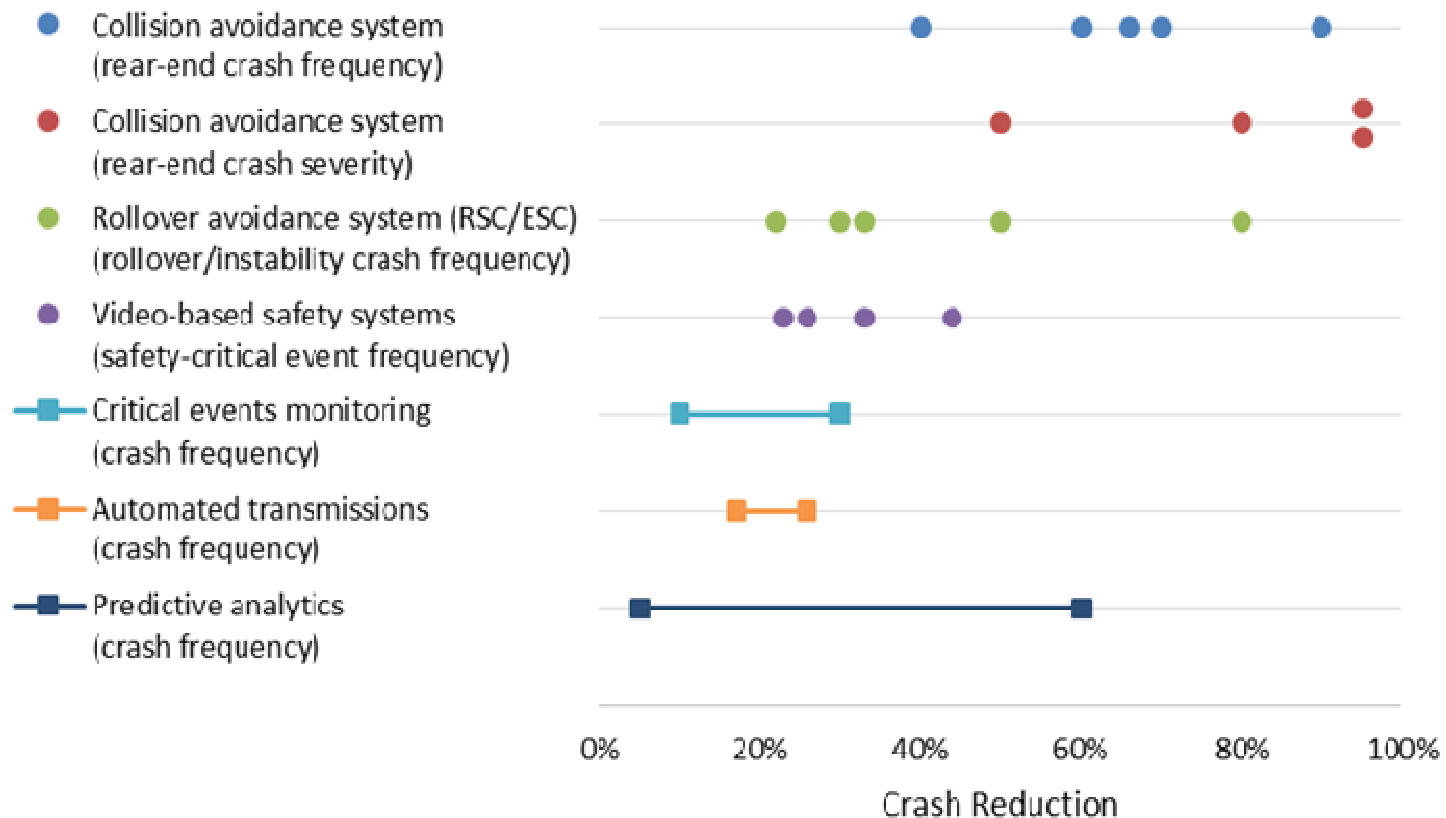
- Interviewed 7 motor carriers & 2 motor coach companies
- Determined key safety program elements which the carriers believe are important to improving performance
- Identified what is measurable and how program elements might be built from these metrics
- Merged interview results with literature synthesis and analyses of current best practices to build two strawman decision trees:
  - Potential sources of carrier investment to improve safety; and
  - Potential elements of a FMCSA-driven program to encourage investment through recognition in the CSA process

# Carrier Interviews - Results

- Key Carrier themes
  - Create and lead a strong safety culture
  - Hire and retain the best drivers
  - Train drivers effectively
  - Actively manage safety performance
  - Leverage technology to enhance safe operations

# Carrier Safety Results

Estimated Safety Improvement  
from Advanced Safety Technologies



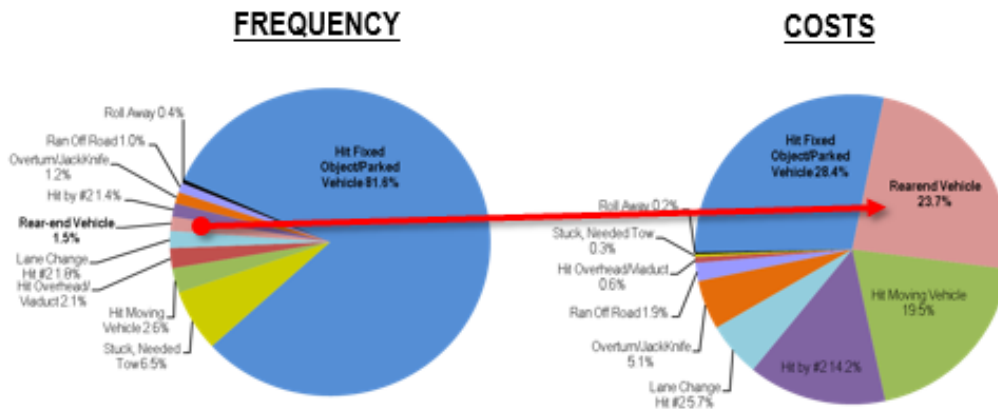


# Carrier Case Study #1

- Autonomous Emergency Braking (AEB)
  - *"Single greatest safety program implemented"*
  - Rear-end crash rate reduced ~70%
  - Crash severity reduced ~95% (post-crash claims cost)

Pre-Implementation

Post-Implementation

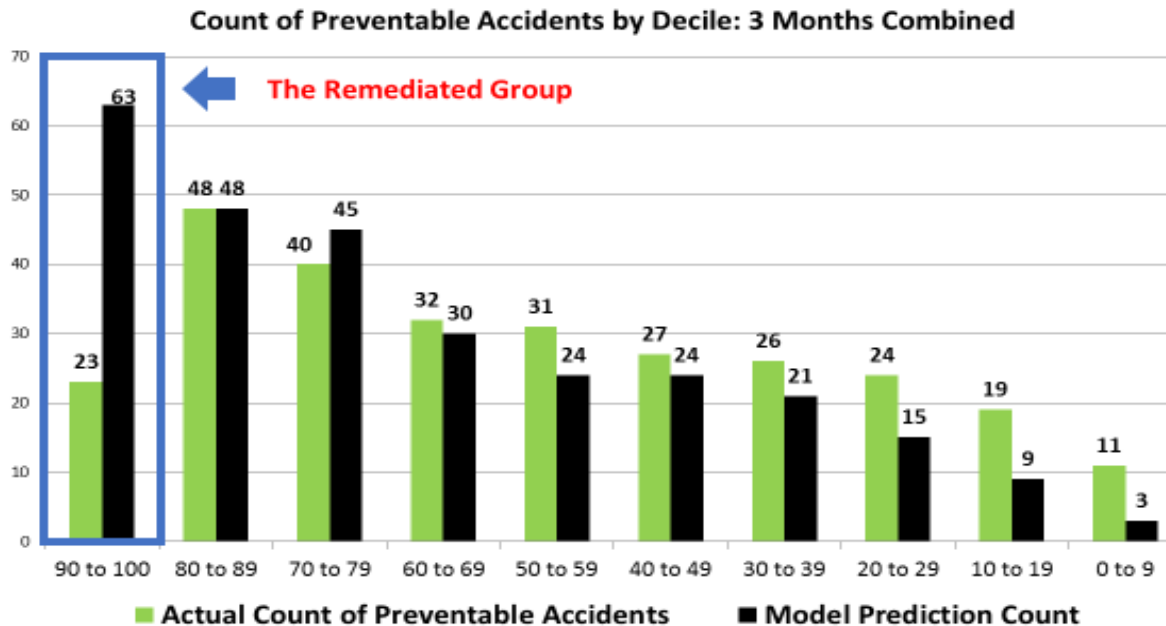


Project to Date	Trucks w/ CMS Avg Cost	Trucks w/o CMS Avg Cost	% Variance Avg Cost
Auto Claims	\$8,440	\$156,992	(95%)
Preventable crashes	\$12,456	\$217,914	(94%)
DOT Preventable crashes	\$16,935	\$430,496	(96%)
Lost Time Injuries	\$346	\$49,380	(99%)

Normalized costs per 100 trucks

# Carrier Case Study #2

- Predictive Analytics Modeling
  - Over three-month period, highest-risk decile had 40 fewer crashes than predicted by the calibrated/validated model
  - Over 12-month period, highest-risk decile performed as well or better than the rest of the fleet



# Carrier Case Study #3

- Video-Based Safety Technology Measures
  - Enable behavior-based coaching, prior to crash
  - Pay a quarterly safety bonus based on observed behavior instead of avoidance of negative outcomes
  - Focus coaching on highest-risk drivers

## Results

CSA Crash BASIC scores:	Pre-video-based initiative = 40%	Post = 5%	(-35%)
CSA Unsafe Driving BASIC:	Pre-video-based initiative = 42%	Post = 18%	(-24%)
DOT Reportable Crash rates:	Pre-video-based initiative = .68/MM	Post = .17/MM	(-75%)

## Video triggered events / 100K miles:

Following distance	Pre-video-based initiative = 12	Post = 7	(-42%)
Handheld cell phone use	Pre-video-based initiative = .77	Post = .25	(-68%)
No Seatbelt use	Pre-video-based initiative = 3.72	Post = .6	(-84%)
Driver Turnover	Pre-video-based initiative = 35%	Post = 28%	(-7%)

# Literature Synthesis

- 106 initial documents, 24 reviewed in detail
  - Mix of synthesis, meta-analysis, and primary studies
- Vendor review based on academic or trade articles, industry news articles, and websites
- Difficult to directly compare estimates of safety effectiveness across technologies and programs

Study	Primary or Secondary Estimate	Vehicle or Driver Scope	Technology-Relevant % Improvement	Overall % Improvement
<b>Roll Stability Control (RSC)</b>				
<b>FMCSA (2009)</b>	Secondary	Truck	37-53% crash	-
<b>Hickman et al (2013)</b>	Primary	Truck	35.7% crash	-
<b>Kingsley (2009)</b>	Primary	Truck	-	10.2% crash

# Next Steps

ICR Process

# Challenges with building a Beyond Compliance program

- There is insufficient inspection data for a large percentage of carriers
- How do you measure safety improvements when there is not enough data?
- What makes one carrier safer than another?
  - Is it qualitative/cultural?
  - Is it investment/technology?
- The information that might be agreed upon is not easily represented as data
- The data that does exist is muddled by dozens of confounding factors

# All is not lost....

- Industry stakeholders / subject matter experts can reach consensus on criteria for information to improve safety
  - They may need some help with the process
- We have a good sense for the tenets for effective carrier safety and we know which carriers appear to be safe under CSA

# Why we need the ICR process

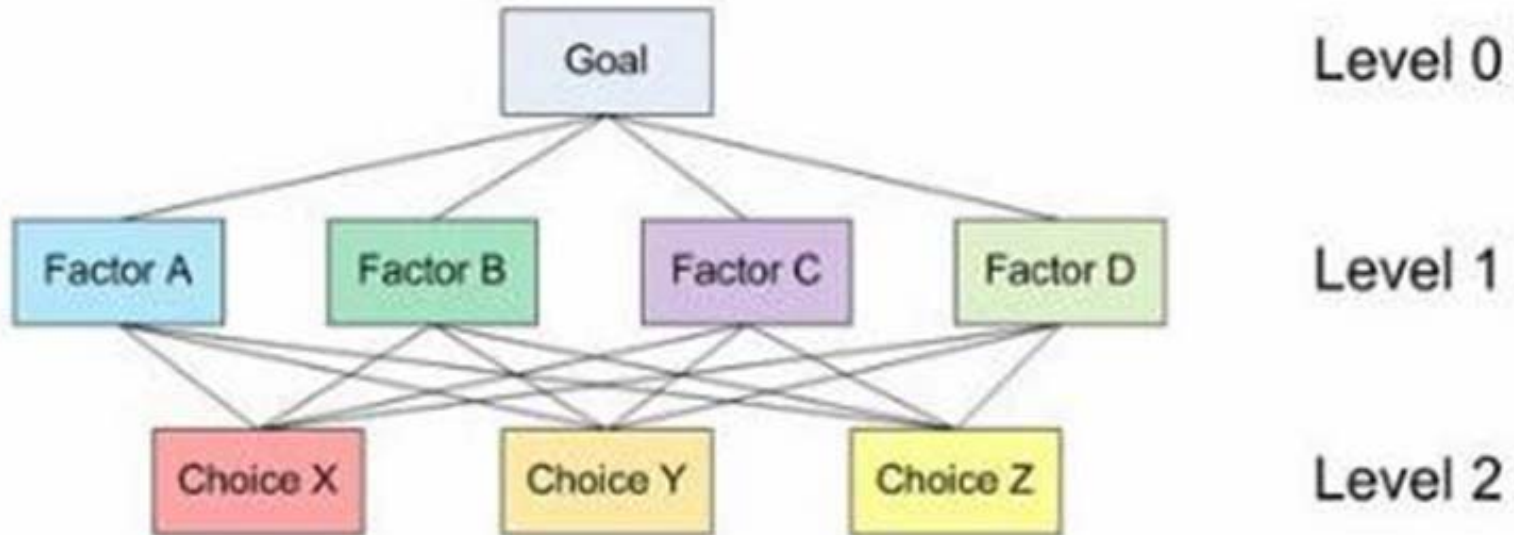
- Nine interview subjects are not sufficient to both capture and prioritize such a complex framework
- Structured interviews with industry experts can best assist FMCSA in the prioritization process
- These interviews will provide a quantitative assessment of expert opinion using the Analytic Hierarchy Process (AHP) as the model



# Analytic Hierarchy Process

- The AHP is a systematic approach for complex decision-making that involves both tangible and intangible factors
- Three steps to implementing the AHP
  1. **Define the goal** – Determine the elements of a safety program that best represent a carrier operating at such a high level of safety performance as to be considered Beyond Compliance.
  2. **Define the evaluation criteria or factors** – Define the evaluation criteria or factors by which achievement of the goal is assessed.
  3. **Define the alternatives or choices** – Define the safety program elements available to motor carriers

# AHP Process



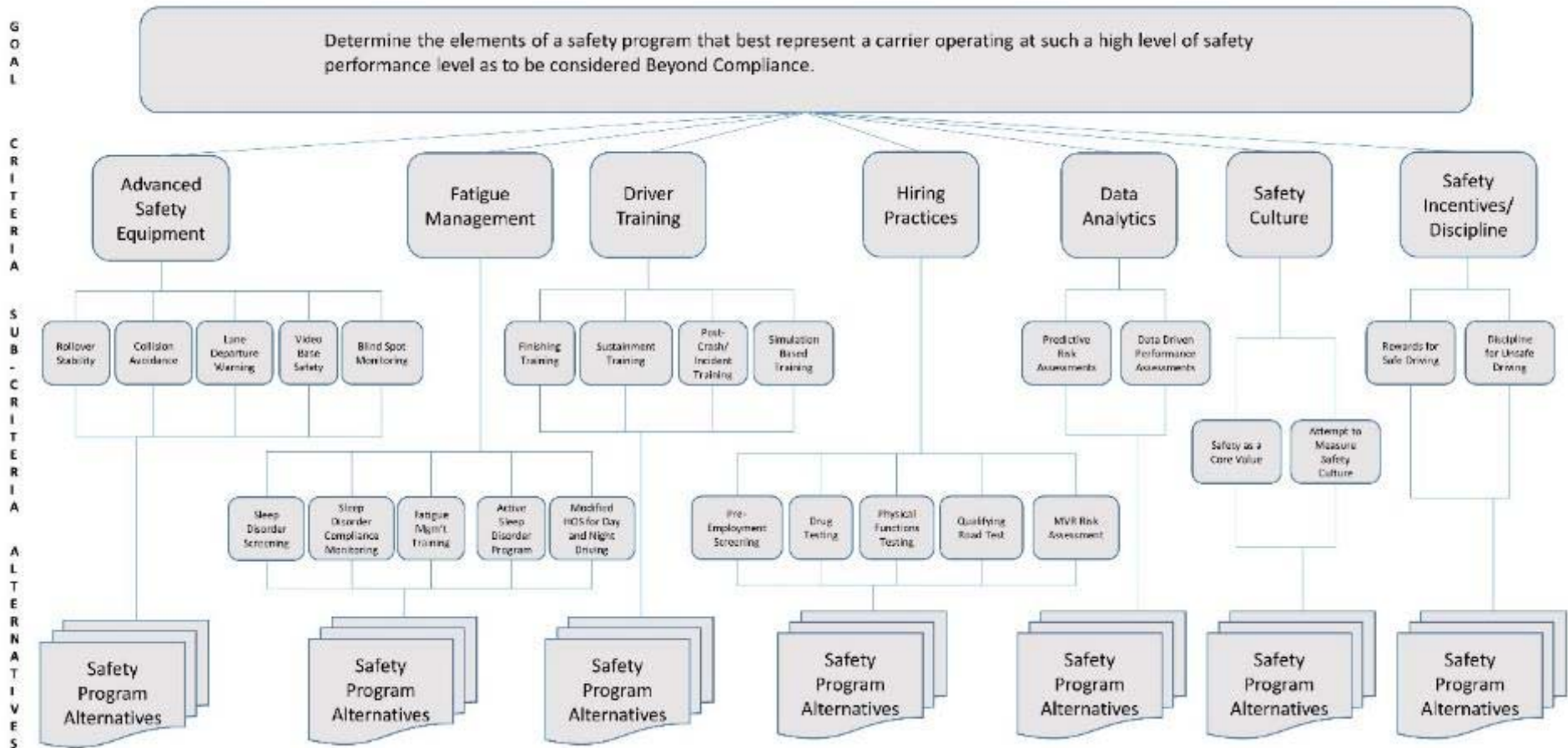
# Role of Initial Carrier Outreach vs. AHP process

- The initial carrier outreach gave us insight into the most relevant carrier safety program criteria and sub-criteria to consider in a Beyond Compliance program
- The AHP is a systematic approach to expand on what we learned from those interviews



Criteria	Advanced Safety Equipment	Fatigue Management	Driver Training	Hiring Practices	Data Analytics	Safety Culture	Safety Incentives/Discipline
Sub-criteria	<ul style="list-style-type: none"> <li>Rollover Stability</li> <li>Collision Avoidance</li> <li>Lane Departure Warning</li> <li>Video-Based Safety</li> <li>Blind Spot Monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Sleep Disorder Screening</li> <li>Sleep Disorder Compliance Monitoring</li> <li>Active Sleep Disorder Program</li> <li>Internally Modified Hours-of-Service Rules for Daytime and Nighttime Driving</li> </ul>	<ul style="list-style-type: none"> <li>Finishing Training</li> <li>Sustainment Training</li> <li>Post-Crash/Incident Training</li> <li>Simulation-based Training</li> </ul>	<ul style="list-style-type: none"> <li>Pre-Employment Screening</li> <li>Drug Testing</li> <li>Physical Functions Testing</li> <li>Qualifying Road Test</li> <li>Internally</li> </ul>	<ul style="list-style-type: none"> <li>Predictive Analytics for Safety Performance</li> <li>Data Driven Risk Assessment</li> </ul>	<ul style="list-style-type: none"> <li>Safety as a Core Corporate Value</li> <li>Attempt to Measure Safety Culture</li> </ul>	<ul style="list-style-type: none"> <li>Rewards for Safe Driving</li> <li>Discipline for Unsafe Driving</li> </ul>

# Framework to Implement the AHP for Beyond Compliance



# How will Prioritization Work?

## Example Pairings

Safety as Core Value	9	7	5	3	1	3	5	7	9	Collision Warning
Safety as Core Value	9	7	5	3	1	3	5	7	9	Video Safety System
Safety as Core Value	9	7	5	3	1	3	5	7	9	Collision Avoidance
Safety as Core Value	9	7	5	3	1	3	5	7	9	Blind Spot Monitoring
Safety as Core Value	9	7	5	3	1	3	5	7	9	Lane Departure
Safety as Core Value	9	7	5	3	1	3	5	7	9	Driver Fitness
Safety as Core Value	9	7	5	3	1	3	5	7	9	Speed Monitoring
Collision Warning	9	7	5	3	1	3	5	7	9	Video Safety System
Collision Warning	9	7	5	3	1	3	5	7	9	Collision Avoidance
...										

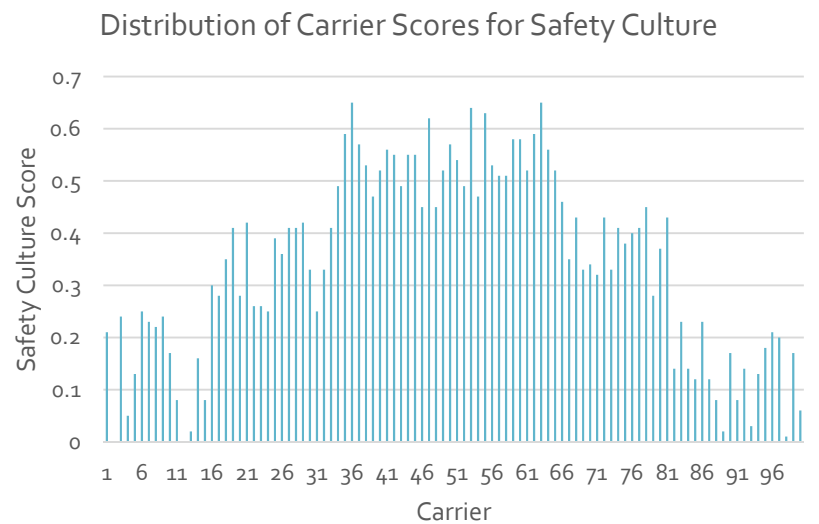
- Each participant will perform a series of pairwise comparisons, prioritizing certain elements of a Beyond Compliance program over others
- The results will be analyzed to determine a score for each Beyond Compliance program alternative
- Scores are between 0 and 100% for each alternative and the sum total of all alternative scores must be 100%

Score	Interpretation
1	Elements are equally important
3	One element is slightly more important than the other
5	One element is more important than the other
7	One element is strongly more important than the other
9	One element is absolutely more important than the other

# How will Prioritization Work? (cont'd)

Criteria		Score	Carrier #1
Advanced Safety Equipment		0.030	
Fatigue Management		0.250	
Criteria		Score	Carrier #2
Advanced Safety Equipment		0.025	
Fatigue Management		0.175	
...			
Criteria		Score	Carrier N
Advanced Safety Equipment		0.050	
Fatigue Management		0.150	
Driver Training		0.100	
Hiring Practices		0.050	
Data Analytics		0.050	
Safety Culture		0.500	
Safety Incentives/ Discipline		0.100	

- Each carrier will generate scores for the criteria and sub-criteria
- The average and distribution of these scores can be observed across all carriers
- This helps to identify the safety program elements that are most critical to superior performance



# Identifying Participants

- AHP is a decision-making process that uses expert opinion to rank choice alternatives based on the most relevant factors for complex decisions
- We propose to aim for approximately 100 carriers to serve as experts based on the following criteria:
  - Superior safety records as indicated by:
    - DOT reportable crash rates ( $\leq 0.0100$  crashes per power unit)
    - Driver out of service rates ( $\leq 0.005$  drivers per power unit)
    - Vehicle out of service rates ( $\leq 0.0900$  drivers per power unit)
  - Medium (10-99 power units) and Large (100+ power units) carriers only
    - Safety performance data for smaller carriers can be skewed due to rarity of crashes and inspections
- 2,380 carriers meet these criteria based on data in MCMIS – 100 carriers represent 3.5% of eligible carriers
- Enlist industry groups (ATA, NTTCC, NPTC), state trucking associations, etc.) to help identify appropriate staff at the eligible carriers

# Projected Work Flow

Task	Month	Days
Contact Carrier Industry Groups w/ criteria	1	10
Select 8-12 carriers per industry group	1-2	5
Set up informational webinars (w/ pre-test)	2	20
Conduct webinars, explain survey	3	10
Follow up with phone calls	3-4	10
Attendees complete surveys	3-4	0
Survey analysis	5-7	10
Develop draft technical memorandum	6-8	10
<b>Total</b>		<b>75</b>



# Moving from AHP to a Beyond Compliance Program

Post OMB Approval of Outreach to Additional Carriers

# Phased Implementation Plan 1

- Create a framework for a Beyond Compliance Program:
  - Codify safety best practices common to most high-performing carriers and motor coach companies
  - Identify performance measures to validate identified best practices
  - Develop program qualification standards for BC recognition
  - Develop data structures for measuring eligibility and evaluating BC performance over time
- Propose BC program management scheme options

# Phased Implementation Plan 2

- Outline ways to generate excitement and encourage carriers to participate and motivate lesser-performing carriers to meet higher standards of safety performance
- Develop methodology for measuring and monitoring program effectiveness
- Develop options for third party administration
- Draft update report to Congress

# Questions/Discussions

- General Discussion
- Potential Role of TRB Committee