U.S. Department of Transportation
Federal Motor Carrier Safety Administration

Improving Motor Carrier Safety Measurement

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Office of Research and Information Technology

National Academy of Sciences – Fixing America's Surface Transportation Act, 2015 (FAST Act) Tasking

Complete a consensus study of Compliance, Safety, Accountability (CSA) and the Safety Measurement System (SMS), in particular:

- The accuracy with which Behavior Analysis and Safety Improvement Category (BASIC) safety measures:
  - Identify high-risk carriers.
  - Predict or are correlated with future crash risk, crash severity, or other safety indicators for motor carriers.
- The methodology, including:
  - The weights assigned to particular violations
  - The tie between crash risk and specific regulatory violations, with respect to accurately identifying and predicting future crash risk for motor carriers.

National Academy of Sciences – FAST Act Tasking

- The relative value of inspection information and roadside enforcement data.
- Any data collection gaps or data sufficiency problems.
- The accuracy of safety data, include the use of crash data from crashes in which the carrier was free from fault.
- Whether BASIC percentiles for motor carriers of passengers should be calculated separately than for motor carriers of freight.
- The differences in the rates at which safety violations are reported to FMCSA for inclusion in the SMS by various enforcement authorities, including States, territories, and Federal inspectors.

National Academy of Sciences Process

- Established an esteemed panel with transportation and non-transportation experience.
- Reviewed Motor Carrier Management Information System (MCMIS) database and SMS.
- Four panel meetings; three meetings had both open and closed sessions.
- In the open sessions, the panel heard from:
  - FMCSA.
  - Critics of SMS, including the American Transportation Research Institute (ATRI), the Government Accountability Office (GAO), and others.
  - Various industry stakeholders, including the Owner Operator Independent Drivers Association, the American Trucking Associations, the United Motorcoach Association, and the American Bus Association.
- Ran an Item Response Theory (IRT) model on a subset of data.

Findings

- SMS has many useful elements to identify unsafe practices and is a defensible way to rank motor carriers; however, the program is not based on a principled scientific approach.
- IRT modeling can fill that gap:
  - Incorporates many of the elements of SMS.
  - Is transparent.
  - Provides an estimate of a measure of safety culture for each carrier, can be used to monitor and identify carriers for interventions.

Recommendations

- Develop an IRT model over the next two years. If it performs well, FMCSA should start using it.
- Look for ways to collaborate more with States to improve MCMIS data.
- Consider non-MCMIS sources of data.
- Structure a user-friendly version of the MCMIS data file to facilitate its use by external parties.
- Decide on which carriers receive interventions using both an absolute and relative metric.

Item Response Theory – What is it?

- An established, documented statistical approach.
- Tests data and identifies correlations — will inform the Agency and:
  - Provide statistical support for what violations to include, safety weightings and time weightings.
  - Account for the probability of being selected for inspection.
  - Provide for a multi-dimensional model, which could redefine BASICs.
  - Adapt to changes over time.
  - Address other concerns raised.
- Two years is needed due to the complexity and amount of data in the model.

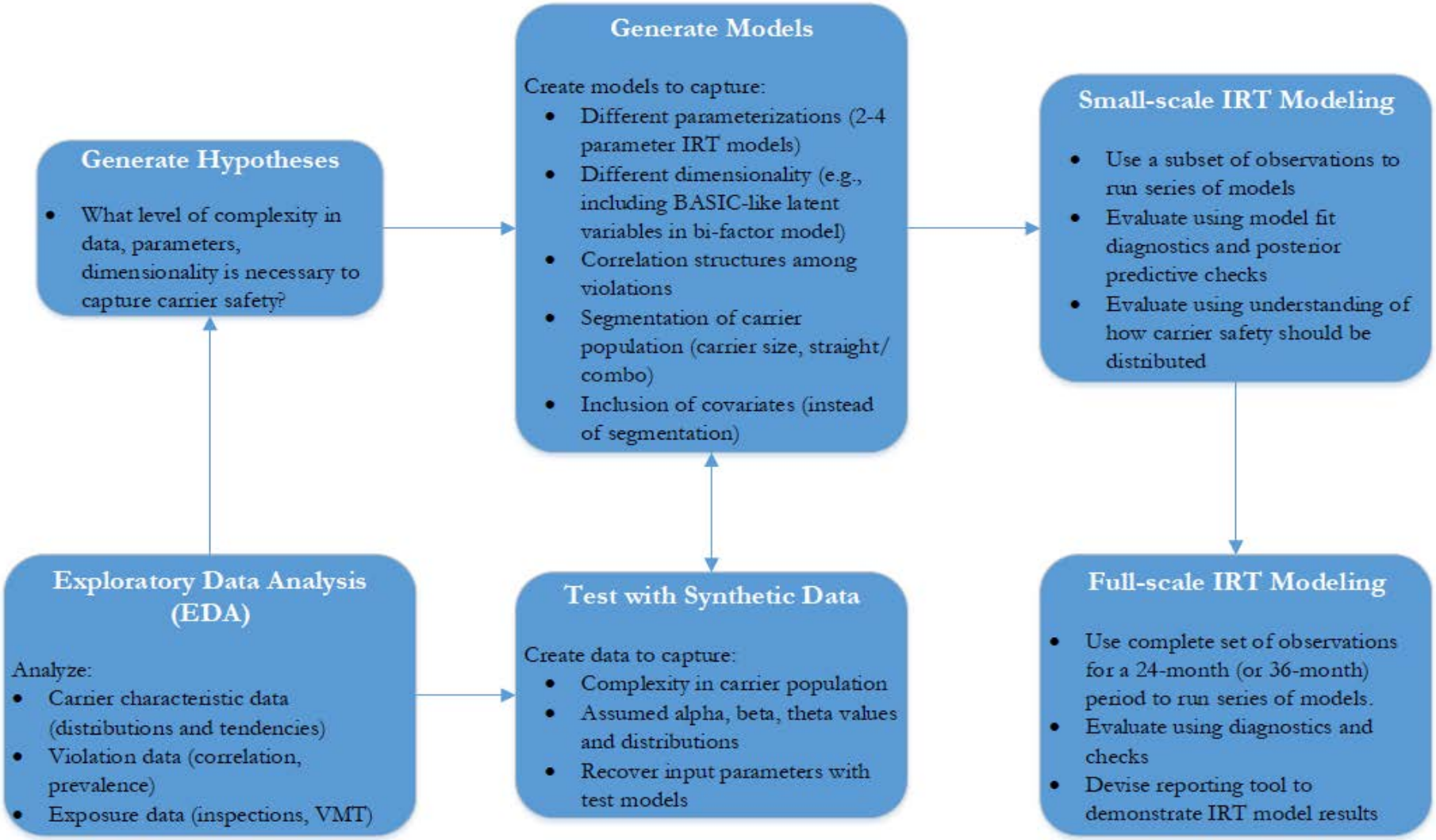
Item Response Theory Example

Rank	Expert Opinion/Ad Hoc Analysis	Item Response Theory
1	Speeding 15+	Speeding 6-10
2	Speeding 11-14	Speeding 11-14
3	Speeding 6-10	Speeding 15+

Overall Approach

- Two focus areas:
  - Data and data improvements.
  - Development, analysis and review of IRT modeling.
- Technical expertise and assistance
  - Agency Integrated Project Team.
  - Additional resources at Volpe.
  - University Agreement.
  - NAS Standing Committee.
- Stakeholder involvement
  - NAS Standing Committee.
  - Public meeting on data and comments through notices.
  - Developing additional options.

IRT Development Process



High-Level Program Timeline (Anticipated)