SafeStat

Safety Status

Measurement System

(Version 8.5)
What is SafeStat?

- SafeStat is a data-driven analysis system that determines the current relative safety status of individual motor carriers.
- SafeStat was developed at the Volpe Center for the Federal Motor Carrier Safety Administration (FMCSA).
- Data used are maintained and managed at the Federal level by the FMCSA.
Uses of SafeStat

- FMCSA Compliance Reviews (CRs):
  » Semiannually identifies and prioritizes carriers for on-site FMCSA compliance reviews

- PRISM Program:
  » Identifies and monitors poorly performing carriers for the PRISM Federal/State safety improvement process (MCSIP)

- Inspection Selection System (ISS):
  » Supports recommendation of evaluated carriers’ drivers and vehicles for roadside inspections

- A&I Online (www.ai.volpe.dot.gov)
  » Makes SafeStat results available via the internet to industry and the public to promote safety awareness and self-improvement
SafeStat Methodology

- Involves **analytically assessing** a motor carrier in four **Safety Evaluation Areas (SEAs)**:
  - Accident SEA
  - Driver SEA
  - Vehicle SEA
  - Safety Management SEA
- **Each SEA** is based on **two or more indicators** supported by different data sources
SafeStat Design

- Event and exposure data are used to calculate normalized measures for each carrier.
- Measures are ranked and assigned percentile values (Indicators) from 0-100 - with 100 being highest or worst.
- Indicators are combined into SEA values.
- SEA values are weighted and summed to derive the SafeStat score.
SafeStat Hierarchy and Features

- The SafeStat algorithm design is computationally hierarchical beginning with safety event data building to a SafeStat Score.
- Algorithm features data sufficiency tests, normalization and weighting.
SafeStat Hierarchy and Features

Features
- Time-Weighting
- Percentile Ranking
- Data Sufficiency Tests

Features
- Carrier Safety Status (Overall & by SEA)
- Normalized Measures
- Severity-Weighting

SafeStat Score

SEA Values

Indicators

Safety Measures

Safety Event Data

Carrier Descriptive Data
SafeStat Overview

MOTOR CARRIER SAFESTAT SCORE

- Accident SEA
  - Indicators
  - Measures
- Driver SEA
  - Indicators
  - Measures
- Vehicle SEA
  - Indicators
  - Measures
- Safety Mgmt SEA
  - Indicators
  - Measures

Data Sources by Carrier

- State Reported & FMCSA Collected Truck Crashes
- Moving Violations
- Out-of-Service Violations from Roadside Inspections
- Violations from onsite Compliance Reviews
- Closed Enforcement Cases
SafeStat Data

At the foundation of SafeStat are safety event data and exposure data

» Carrier specific safety event data reflect the carrier’s safety compliance and performance and include:
  – State Reported Crashes (last 30 mos.)
  – Recordable Crashes from CRs (last 12 mos. CRs)
  – Roadside Inspection Violations (last 30 mos.)
  – Moving Violations (last 30 mos.)
  – Compliance Review Violations (last 18 mos. CRs)
  – Closed Enforcement Cases (last 6 years)

» Exposure data normalize a carrier’s safety event data:
  – Number of drivers/vehicles and VMT
  – Number of inspections
SafeStat Measures

- Safety measures are the result of normalizing safety event data.

- Example: accident event data are converted to accident rates which take into account differences in exposure.
SafeStat Indicators

- **Indicators** rank carriers by their safety measures converted to a percentile (0-100) scale.

- When determining **indicators**, SafeStat may employ peer groupings that reflect differences in operations to assure appropriate comparisons among carrier types and size classes.
SafeStat SEA Values

- Safety Evaluation Areas (SEAs) represent the four major criteria used to evaluate carriers’ safety status
- A SEA Value, also on a 0-100 percentile scale, is derived from the Indicators related to that SEA
- For example a SEA Value of 85 means:
  - 85% of the carriers (that have sufficient data) have a better safety status in that SEA
  - 15% have a worse safety status
SafeStat SEAs

- Accident
- Driver
- Vehicle
- Safety Management
Accident SEA Summary

Accident SEA

- Accident Involvement Indicator (AII)
  - Accident Involvement Measure (AIM)
    - State-Reported Crash Data & Census Data

- Recordable Accident Indicator (RAI)
  - Recordable Accident Rate (RAR)
    - Compliance Review Data
Accident SEA

Data & Measures

- **State reported crashes** (using NGA standard) over past 30 months normalized by **# of power units** from FMCSA carrier registration data yield the **Accident Involvement Measure (AIM)**

- **Recordable crashes** from Compliance Reviews (CRs) conducted during the previous 12 months normalized by **vehicle miles traveled (VMT)** yield the **Recordable Accident Rate (RAR) Measure**
Accident SEA
Accident Involvement Indicator (AII)

State-Reported Crash Data & Census Data

Accident Involvement Measure (AIM)

Accident Involvement Indicator (AII)

Accident SEA

- Accident Involvement Measure (AIM) applies time weighting (most recent crashes have greatest weight) and severity weighting (crashes involving injury/fatality and/or HM release have more weight)
- AIM is calculated by dividing weighted-crashes by average # of power units
- AII is percentile ranking of weighted AIM

- Carriers are peer-grouped by similar # of crashes and ranked on a percentile basis to obtain an AII
Accident SEA - Recordable Accident Indicator (RAI)

- # of Recordable Crashes and last 12 months VMT data are gathered during CR

- Recordable crashes are divided by VMT and multiplied by 1 million to obtain a Recordable Accident Rate (RAR) per million miles traveled.

- Carriers are peer-grouped by similar # of crashes and then ranked on a percentile basis to obtain the RAI
Accident SEA Value Calculation

- For Carriers with no CR within past 12 months:
  » Accident SEA = AII

- Carriers with CR within past 12 months and no state-reported crashes since the CR
  » Accident SEA = RAI

- Carriers with CR within past 12 months and at least one state-reported crash since the CR
  » Accident SEA = highest of (AII, RAI)
Driver SEA Summary

Driver SEA

Driver Inspections Indicator (DII)
Driver Review Indicator (DRI)
Moving Violations Indicator (MVI)

Driver Inspections Measure (DIM)
Driver Review Measure (DRM)
Moving Violations Measure (MVM)

Driver Roadside Inspections
Compliance Review Data
Moving Violation Data from Roadside Inspections
Data and Measures:

- **Driver OOS Violations** normalized by number of roadside inspections over past 30 months yield the Driver Inspection Measure (DIM)

- **Driver-Related Critical and Acute Violations** from CRs completed within past 18 months yield the Driver Review Measure (DRM)

- **Moving Violations** over past 30 months normalized by number of drivers yield the Moving Violation Measure (MVM)
Driver SEA

Driver Inspection Indicator (DII)

- DIM is based on OOS inspections that are severity-weighted (based on # of DOOS viol.) and time-weighted:
  - 0-6 months old # of inspections (3x)
  - 7-18 months old # of inspections (2x)
  - 19-30 months old # of inspections (1x)

- DIM is adjusted up for violations of OOS orders (aka jumping OOS orders)

- Carriers are peer-grouped by similar # of driver inspections

- DII is percentile ranking of DIM

Driver Inspections Measure (DIM)

Driver Inspections Indicator (DII)

Driver Roadside Inspections
Driver SEA - Driver Review Indicator (DRI)

- Driver Review Measure (DRM) is based on violations of driver-related Critical and Acute Regulations from CRs
- DRM accounts for the number and severity of violations
- DRI is percentile ranking of DRM

- Carriers with CR and no violations are given a DRI of 0
Driver SEA - Moving Violations Indicator (MVI)

- MVM is based on Moving Violations (MVs) issued in conjunction with roadside inspections normalized by the number of drivers.

  Time weighting is applied to violations:
  
  0-6 months old # of MVs (3x)
  7-18 months old # or MVs (2x)
  19-30 months old # of MVs (1x)

- Carriers are peer-grouped by similar # of MVs

- MVI is percentile ranking of MVM
Driver SEA Value Calculation

1. Driver SEA Value is the highest of the DII and DRI and uses the MVI when its value is greater than the DII and DRI.

2. When the MVI is greater than the DII and DRI, Driver SEA is equal to the weighted average of MVI and the highest of the DII and DRI.
Vehicle SEA Summary

Vehicle SEA

Vehicle Inspections Indicator (VII)

Vehicle Inspections Measure (VIM)

Vehicle Roadside Inspections

Vehicle Review Indicator (VRI)

Vehicle Review Measure (VRM)

Compliance Review Data
Data and Measures:

- **Vehicle OOS Violations** normalized by number of roadside inspections over past 30 months yield the **Vehicle Inspection Measure (VIM)**

- **Vehicle-related Critical and Acute Violations** from CRs completed within past 18 months yield the **Vehicle Review Measure (VRM)**
Vehicle SEA - Indicators VII & VRI

• VII is similar to DII but uses Vehicle OOS violations instead of Driver OOS violations

• VRI is similar to DRI but uses Vehicle-related violations of Acute/Critical regulations

Vehicle SEA

Vehicle Inspections Measure (VIM)

Vehicle Roadside Inspections

Vehicle Inspections Indicator (VII)

Vehicle SEA

Vehicle Review Indicator (VRI)

Vehicle Review Measure (VRM)

Compliance Review Data
Vehicle SEA Value Calculation

- Vehicle SEA Value is the highest of the VII and VRI.

Vehicle SEA Value
  - Vehicle Inspections Indicator (VII)
  - Vehicle Review Indicator (VRI)
Safety Management SEA Summary

Safety Management SEA

Enforcement History Indicator (EHI)
Enforcement Severity Measure (ESM)
Closed Enforcement Cases

Safety Mgmt. Review Indicator (SMRI)
Safety Mgmt. Review Measure (SMRM)
Compliance Review

HM Review Indicator (HMRI)
HM Review Measure (HMRM)
Compliance Review
Safety Management SEA

Data and Measures:

- Safety Management/HM **Critical and Acute Violations** from CRs completed within past 18 months yield the **Safety Mgmt Review Measure (SMRM)** and the **HM Review Measure (HMRM)**
- SMRM and HMRM account for the number and severity of violations
- **Closed Enforcement Cases** are used to determine the **Enforcement Severity Measure (ESM)**
Safety Mgmt SEA - Indicators
SMRI & HMRI

- SMRI is similar to DRI but uses Safety Management-related violations of Acute/Critical regulations

- HMRI is similar to DRI but uses Hazardous Material-related violations of Acute/Critical regulations
Safety Mgmt SEA - Enforcement History Indicator (EHI)

- Enforcement Severity Measure (ESM) is calculated for carriers with closed enforcement cases in the past 6 years.
- ESM includes severity weighting (based on # of violations cited) and time weighting of each enforcement case:
  - 0-12 months old cases (4x)
  - 13-30 months (3x)
  - 31-50 months (2x)
  - 51-72 months (1x)
- EHI is percentile based on ESM rank.
- EHI of 75-100 assigned to carriers w/CR-initiated enforcements within past 30 months with either
  1) no subsequent CR or
  2) a subsequent CR resulting in acute/critical violations.
- EHI of 50-74 assigned to all other carriers w/enforcements.
Safety Mgmt SEA Value Calculation

Safety Management SEA Value

- Enforcement History Indicator (EHI)
- Safety Mgmt. Review Indicator (SMRI)
- HM Review Indicator (HMRI)

Safety Management SEA Value is the highest of the EHI, SMRI & HMRI
SafeStat Detailed Summary

Motor Carrier
SafeStat Score

Safety Evaluation Areas

- Accident SEA
  - Indicators: RAI, AII
  - Safety Data:
    - State-Reported Crashes
    - Recordable Crashes (Last CR)
  - Normalizing Data
    - Number of Power Units Owned & Term-Leased (MCS-150 Census Data)
    - Vehicle Miles Traveled (Last CR)

- Driver SEA
  - Indicators: DRI, DII, MVI
  - Safety Data:
    - Driver Violations (Critical & Acute from last CR)
    - Driver OOS Violations (Roadside Inspections)
    - Jumping OOS Orders (Roadside Inspections)
    - Moving Violations (Roadside Inspections)
  - Normalizing Data
    - Number of Driver Roadside Inspections
    - # of Drivers (MCS-150 Census Data)

- Vehicle SEA
  - Indicators: VRI, VII
  - Safety Data:
    - Vehicle Violations (Critical & Acute from last CR)
    - Vehicle OOS Violations (Roadside Inspections)
  - Normalizing Data
    - Number of Vehicle Roadside Inspections

- Safety Mgmt SEA
  - Indicators: SMRI, EHI, HMRI
  - Safety Data:
    - Safety Mgmt Violations (Critical & Acute from Last CR)
    - HAZMAT Violations (Critical & Acute from Last CR)
    - Enforcement History Closed Cases (Enforcement Database)
    - HAZMAT OOS Violations* (Roadside Inspections)
  - Normalizing Data
    - Enforcement History Closed Cases
    - HAZMAT OOS Violations* pending HM inspection normalizing data

* Pending HM inspection normalizing data
SafeStat Results

- The SafeStat Score
- Assignment of Carriers to Categories
  - Scored carriers
  - Single SEA carriers
- Example of SafeStat Results
- Effectiveness Study
The SafeStat Score

- The **SafeStat score** only applies to carriers with safety deficiencies.

- Only carriers that have deficient SEA values of 75 and higher (the worst 25th percentile) in **two or more** of the four **SEAs** receive a **SafeStat Score**.
SafeStat Score Calculation

- A carrier must have two or more SEAs with a value of 75 or greater (worst 25th percentile)
- SafeStat sums only the SEAs with values of 75 or greater to determine the SafeStat Score
- More emphasis is put on the Accident SEA (twice the weight) and Driver SEA (1.5 greater weight) than Vehicle and Safety Mgmt SEAs

\[
\text{SafeStat Score} = 2 \times \text{Acc. SEA} + 1.5 \times \text{Driver SEA} + \text{Vehicle SEA} + \text{Safety Mgmt. SEA}
\]
SafeStat evaluated carriers are assigned to **Categories (A-G)** based on their SafeStat Scores and SEA Values.

### SafeStat Categories for Scored Carriers

<table>
<thead>
<tr>
<th>Categories</th>
<th>SafeStat Score Range</th>
<th>Includes SEA Values of 75 or Higher</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>350-550 &lt;br&gt; &gt;350 to ≤550</td>
<td>All 4 SEAs &lt;br&gt; 3 SEAs that result in weighted score of 350 or more.</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>225-350 &lt;br&gt; &gt;225 to &lt;350</td>
<td>3 SEAs that result in weighted score of less than 350. &lt;br&gt; 2 SEAs that result in weighted score of 225 or more.</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>&gt;150 to &lt;225</td>
<td>2 SEAs that result in weighted score less than 225.</td>
</tr>
</tbody>
</table>
Categories of carriers deficient in one SEA (SEA Value of 75 or higher)

**SafeStat Categories for Carriers with One SEA Value**

<table>
<thead>
<tr>
<th>Single SEA Categories</th>
<th>Specific SEA</th>
<th>SEA Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Accident</td>
<td>75-100</td>
</tr>
<tr>
<td>E</td>
<td>Driver</td>
<td>75-100</td>
</tr>
<tr>
<td>F</td>
<td>Vehicle</td>
<td>75-100</td>
</tr>
<tr>
<td>G</td>
<td>Safety Management</td>
<td>75-100</td>
</tr>
</tbody>
</table>
Example of SafeStat Results

**Name: Rollemover Express**

<table>
<thead>
<tr>
<th>DOT # 12345</th>
<th>Mailing Address</th>
<th>Power units: 35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Address</td>
<td>P.O... BOX 1234</td>
<td>Hazmat Carrier: yes</td>
</tr>
<tr>
<td>Launch Pad Road</td>
<td>Yourtown, Ourstate 12345</td>
<td>Passenger Carrier: No</td>
</tr>
<tr>
<td>Yourtown, Ourstate 12345</td>
<td>Yourtown, Ourstate 12345</td>
<td></td>
</tr>
</tbody>
</table>

- SafeStat Score: 383.02
- Overall Rank: 19
- State Rank: 3
- Previous Status: Warning letter
- Current Status: *Category A (At Risk)*
  
  CR Recommended
SafeStat Effectiveness Study

A study was conducted to confirm SafeStat effectiveness by comparing post-run crash rates for scored vs. unscored carriers:

1. SafeStat was run 18 months in the past with data available at that time to identify and score carriers.

2. Carriers with sufficient data were assigned to 3 groups based on the SafeStat run results: At-Risk (Categories A&B), Other Scored (Category C) and unscored.

3. Post-run crash rates for each group were observed and compared.
Effectiveness Study Results

Carriers identified by SafeStat have higher crash rates than carriers not identified by SafeStat.

[Diagram showing crash rates as a percentage of not identified carriers for Category A & B (At-Risk), Category C (Other Identified), and Not Identified.]