SafeStat

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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

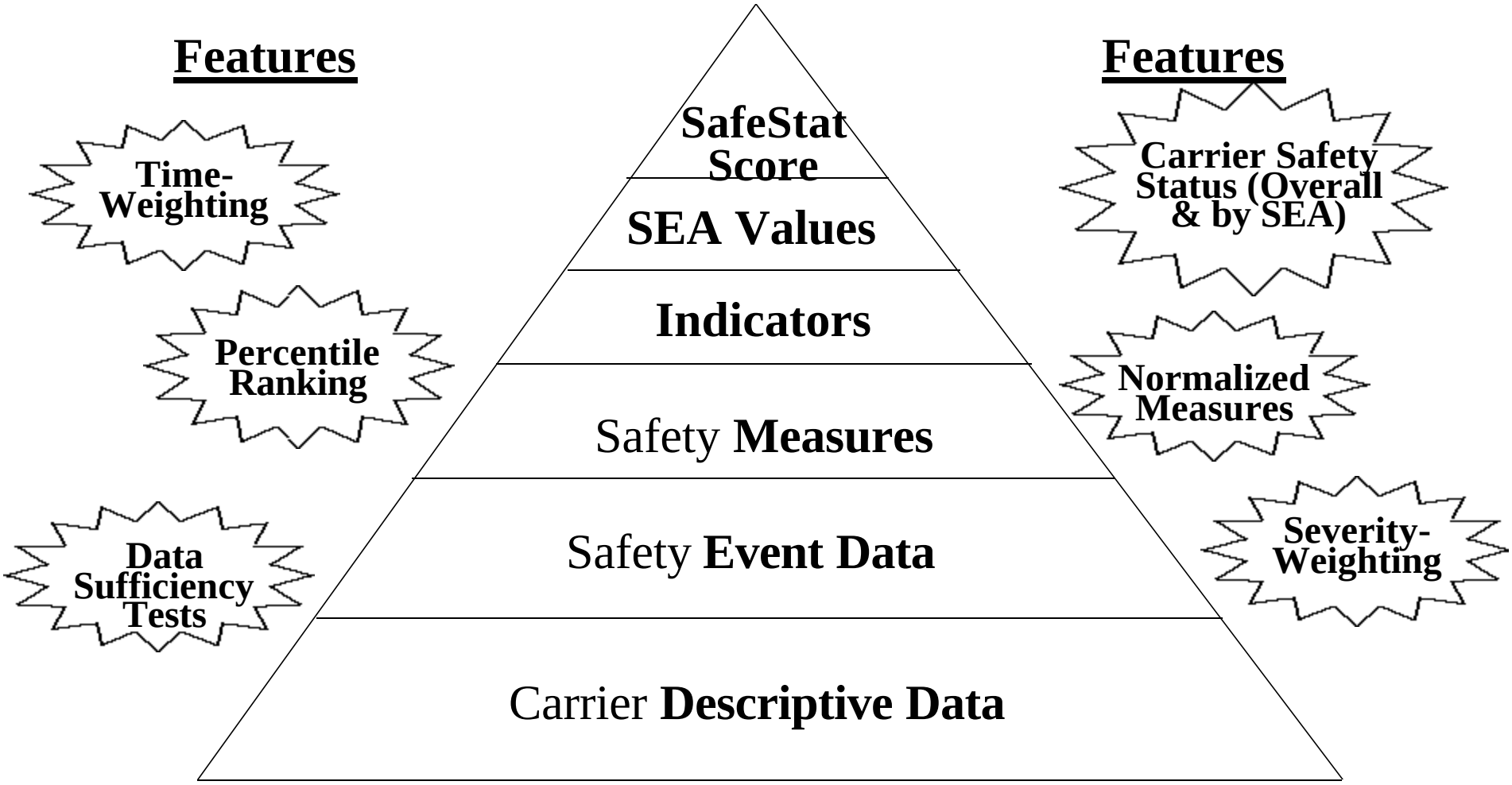
SafeStat Design

- **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**

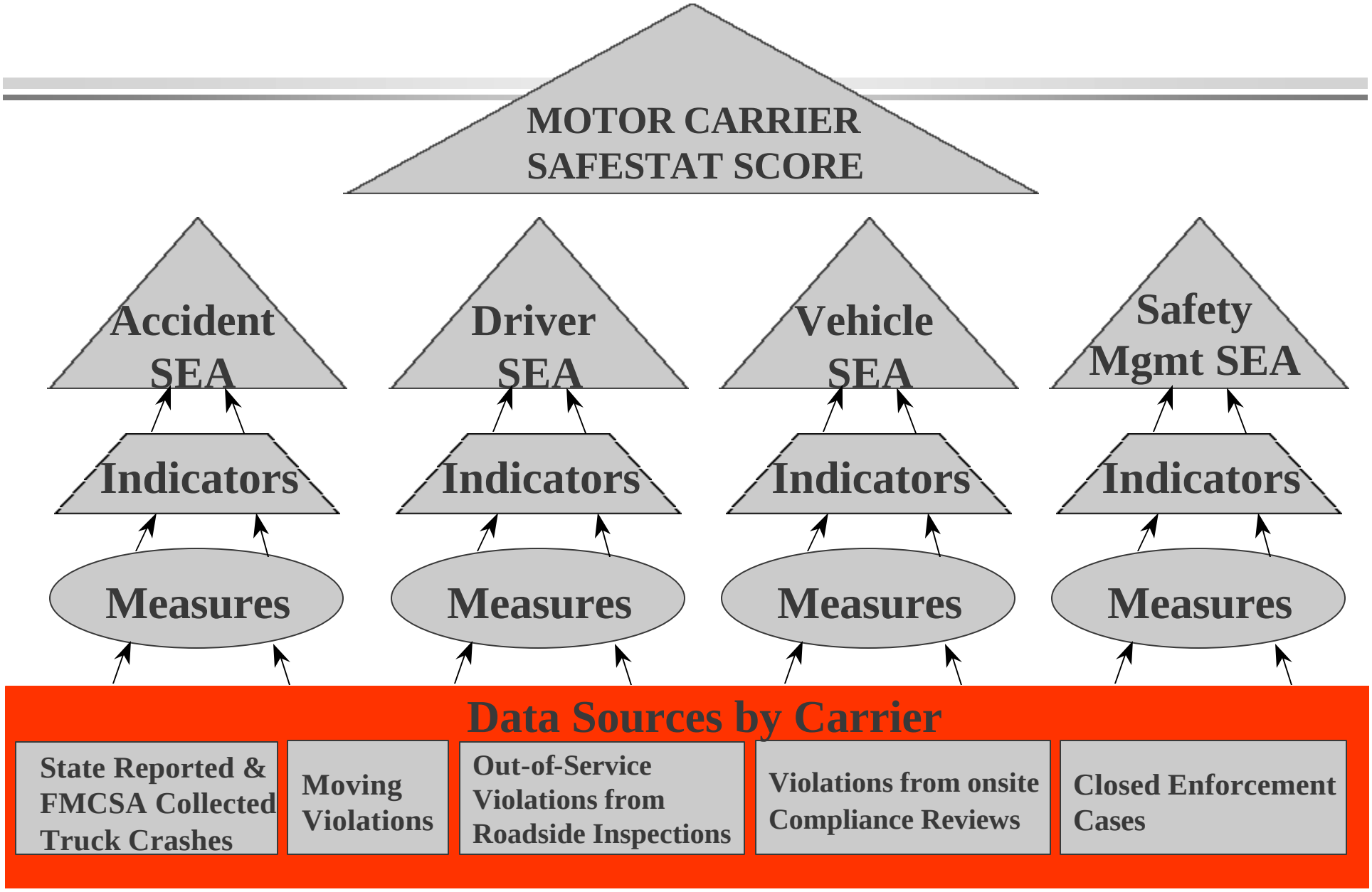
SafeStat Hierarchy and Features

- 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



SafeStat Overview



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*:*

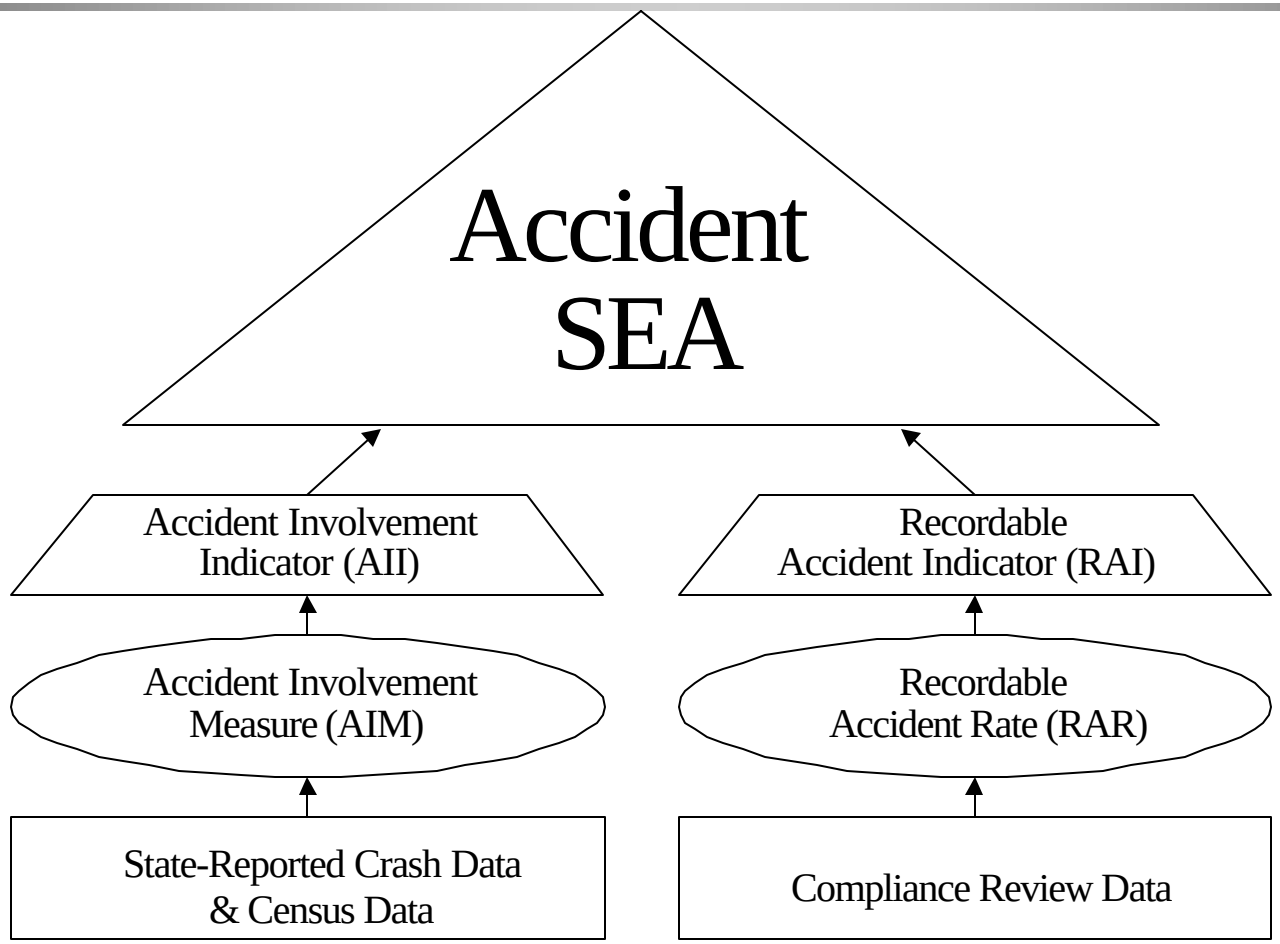
  85% *of the carriers (that have sufficient data) have a better safety status in that SEA*

  15% have a worse safety status

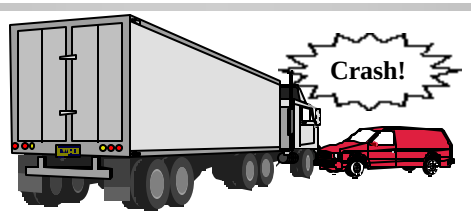
SafeStat SEAs

- Accident
- Driver
- Vehicle
- Safety Management

Accident SEA Summary



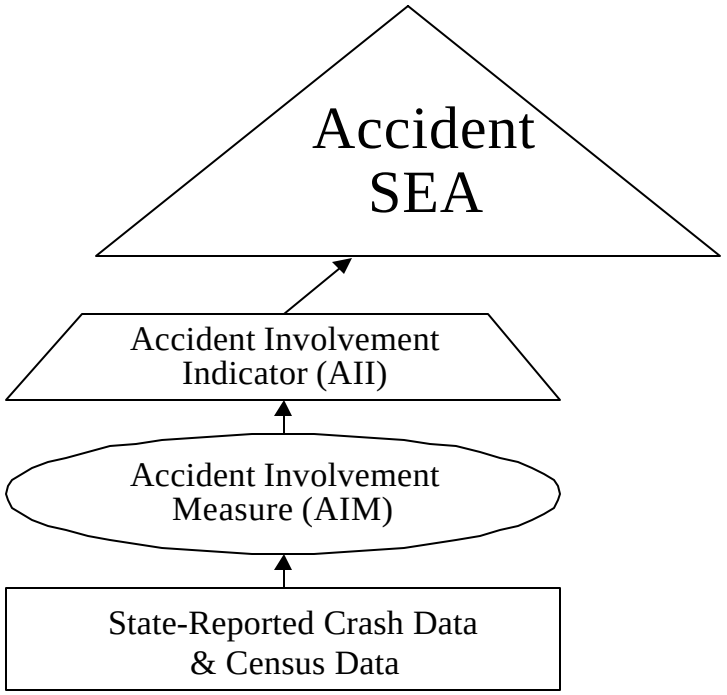
Accident SEA



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**

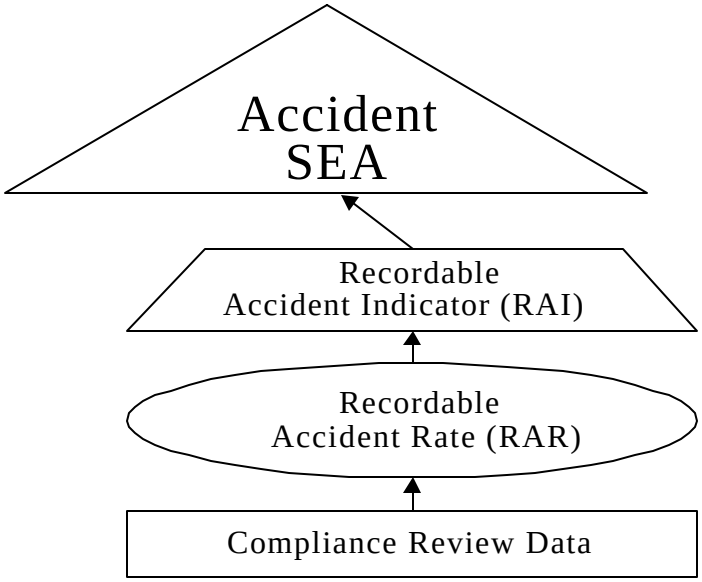
Accident SEA
Accident Involvement Indicator (AII)



- 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)

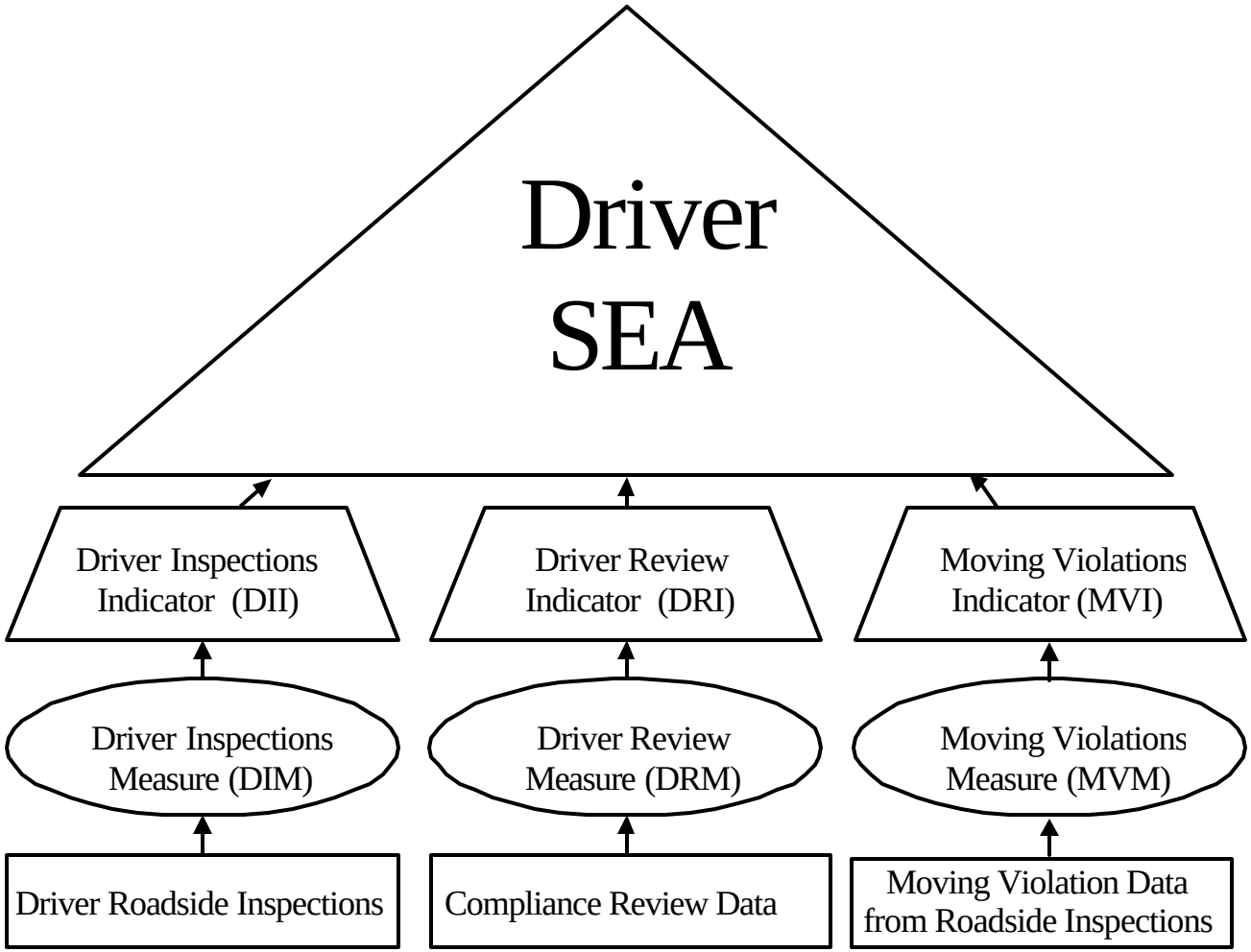


- # of Recordable Crashes and last 12 months VMT data are gathered during CR
- Recordable crashes are divided by VMT and multiplied by 1 million to obtain a Recordable Accident Rate (RAR) per million miles traveled.
- Carriers are peer-grouped by similar # of crashes and then ranked on a percentile basis 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

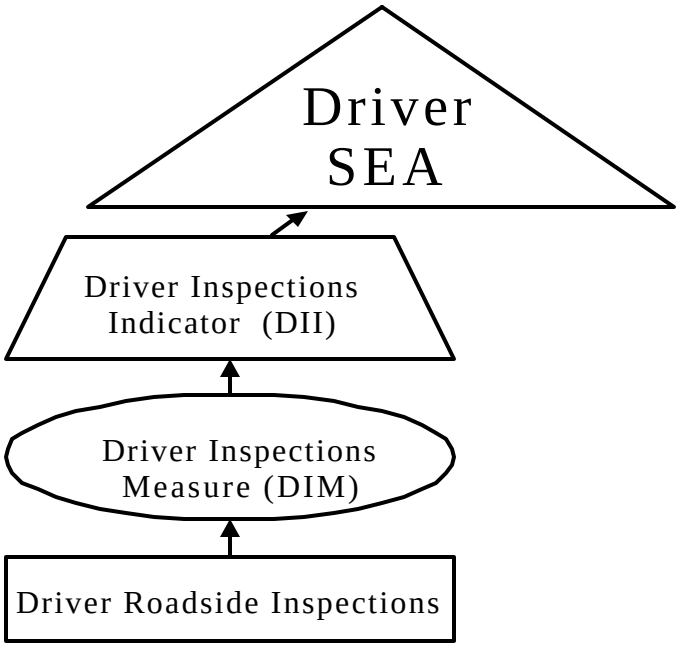


Driver SEA

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)

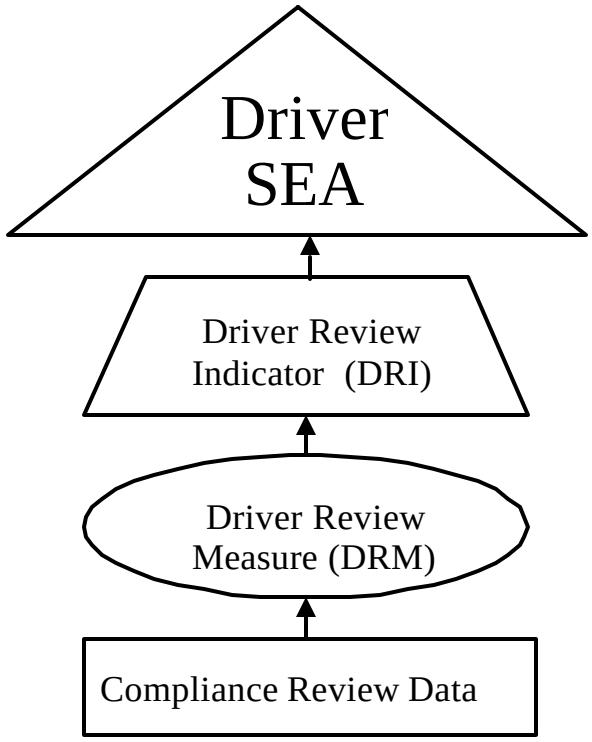


- DIM is based on OOS inspections that are severity-weighted (based on # of DOOS viol.) and time-weighted:

  0-6 months old # of inspections (3x)
  7-18 months old # or inspections (2x)
  19-30 months old # of inspections (1x)

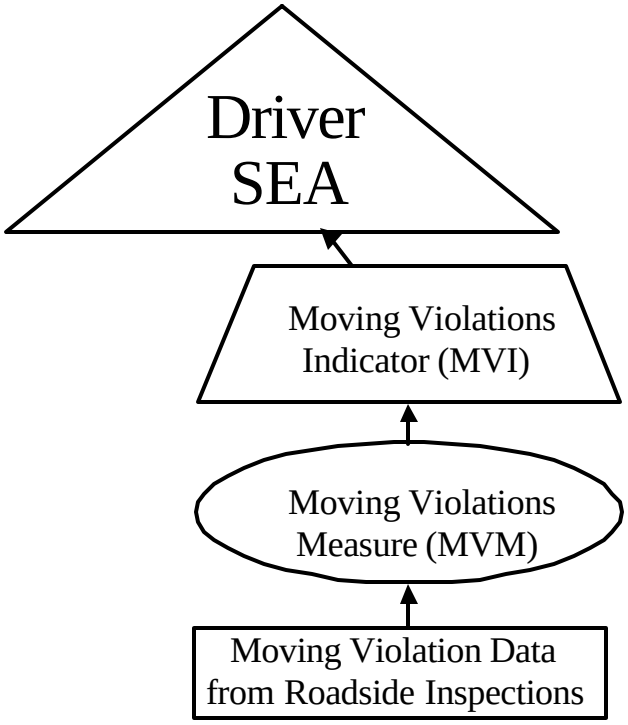
- DIM is adjusted up for violations of OOS orders (aka jumping OOS orders)
- Carriers are peer-grouped by similar # of driver inspections
- DII is percentile ranking of DIM

Driver 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

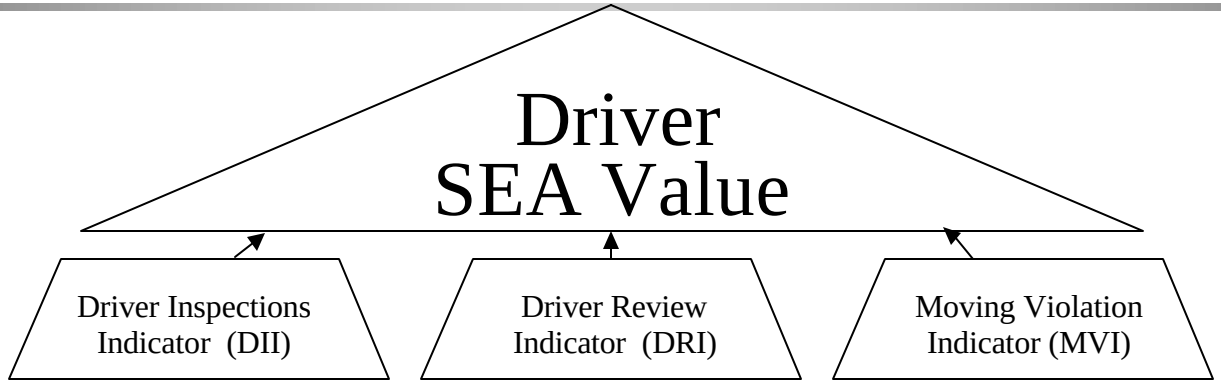
  Time weighting is applied to violations:

  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

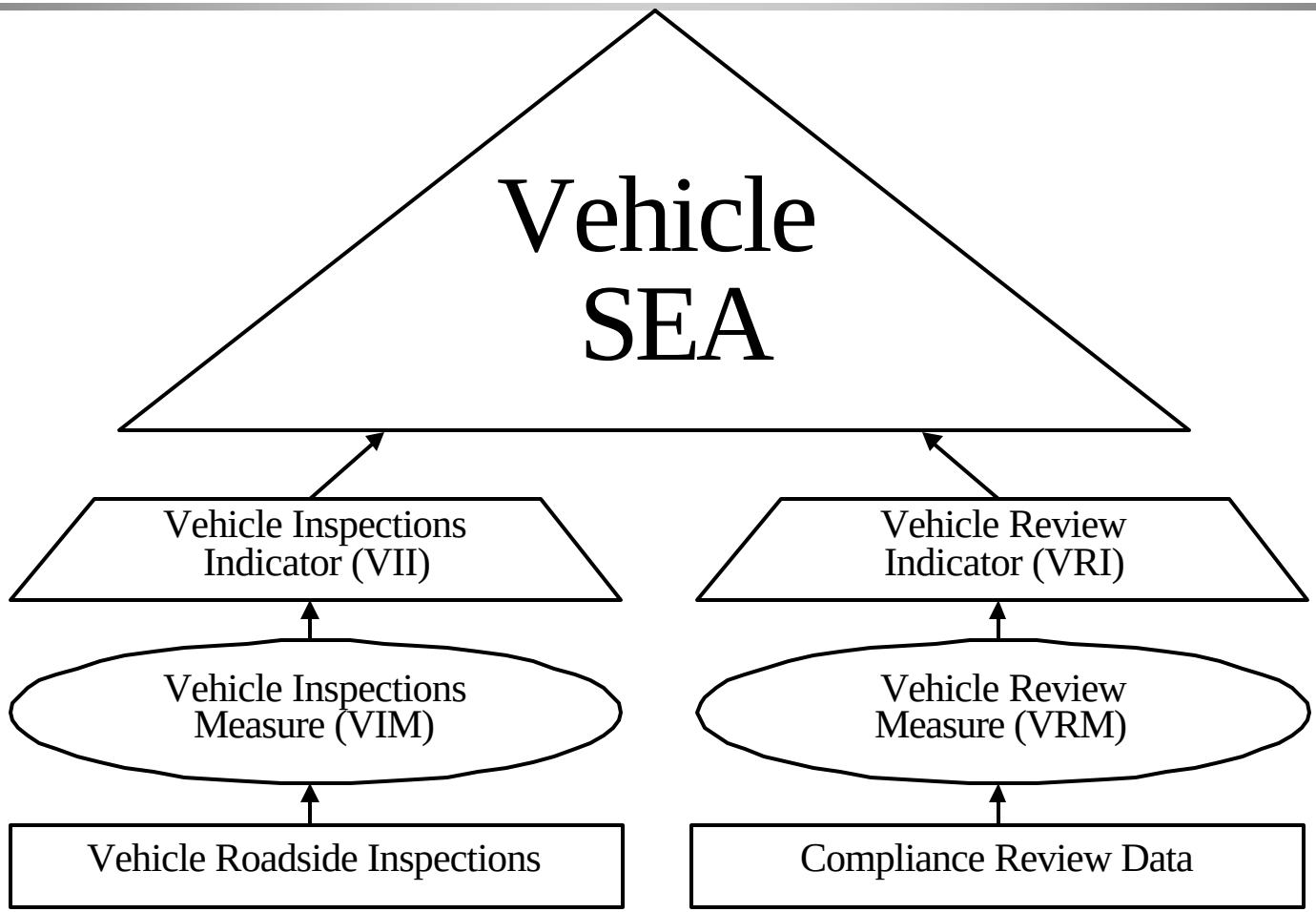
- MVI is percentile ranking of MVM

Driver SEA Value Calculation



- 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
- 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.

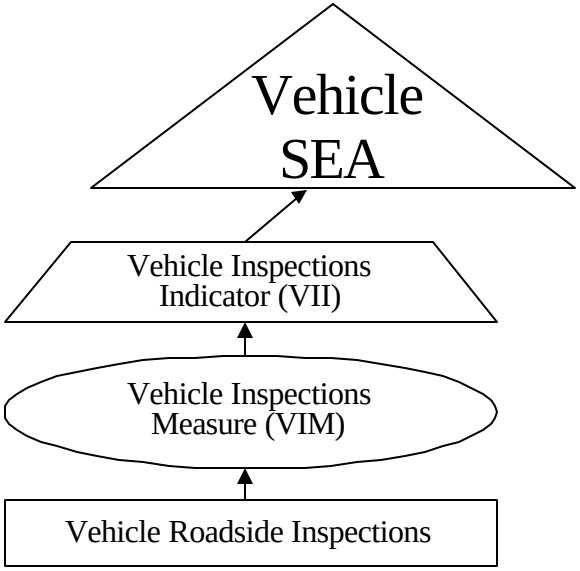
Vehicle SEA Summary



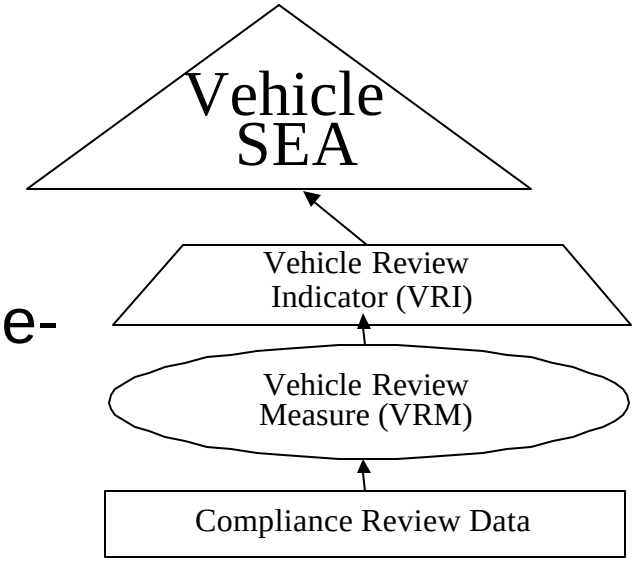
Data and Measures:

- **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

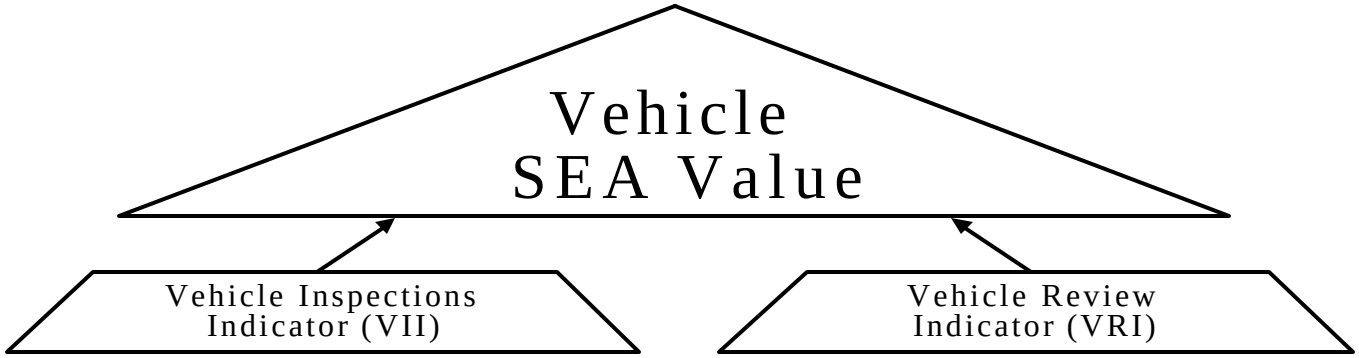


- VII is similar to DII but uses Vehicle OOS violations instead of Driver OOS violations



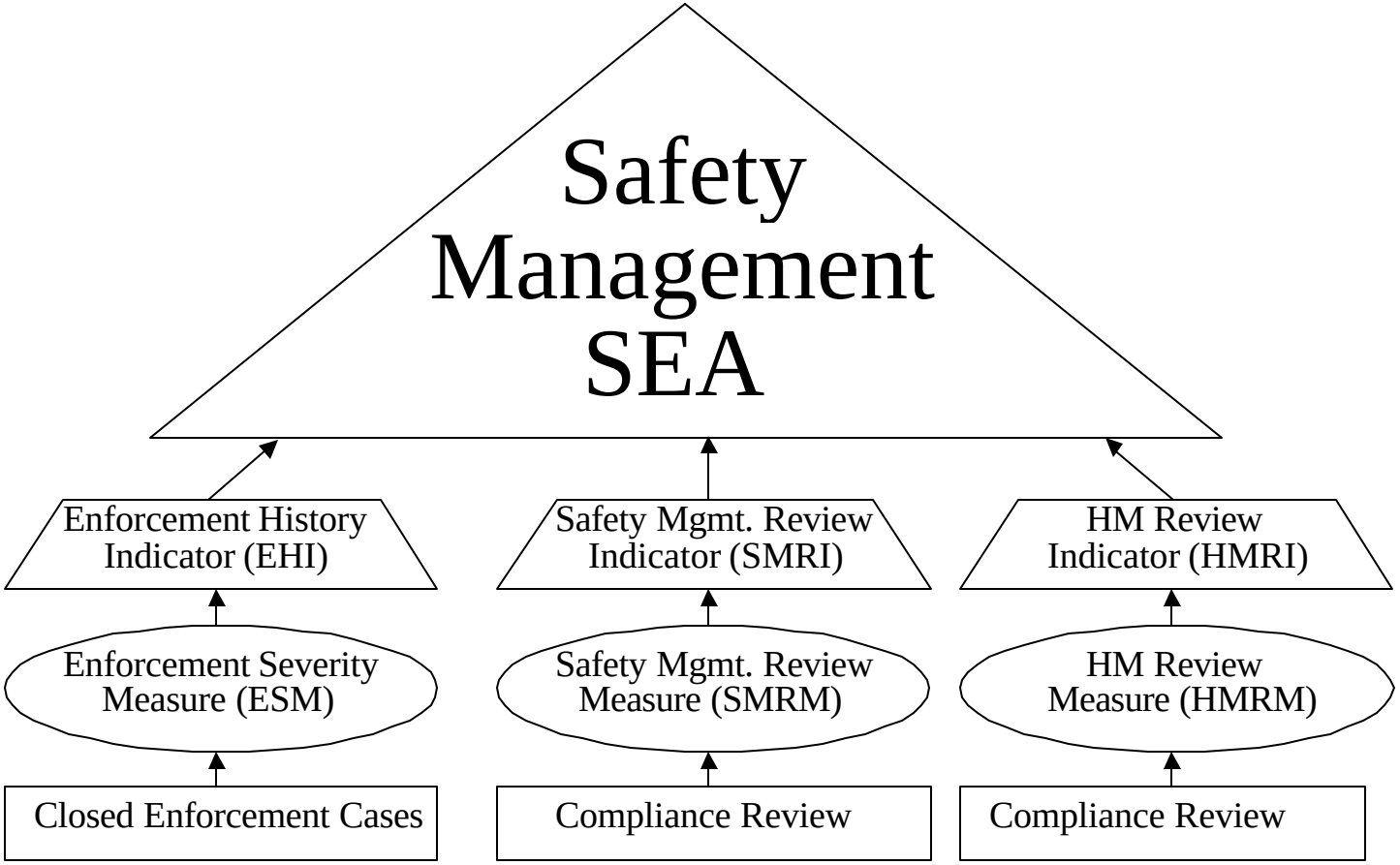
- VRI is similar to DRI but uses Vehicle-related violations of Acute/Critical regulations

Vehicle SEA Value Calculation



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

Safety Management SEA Summary

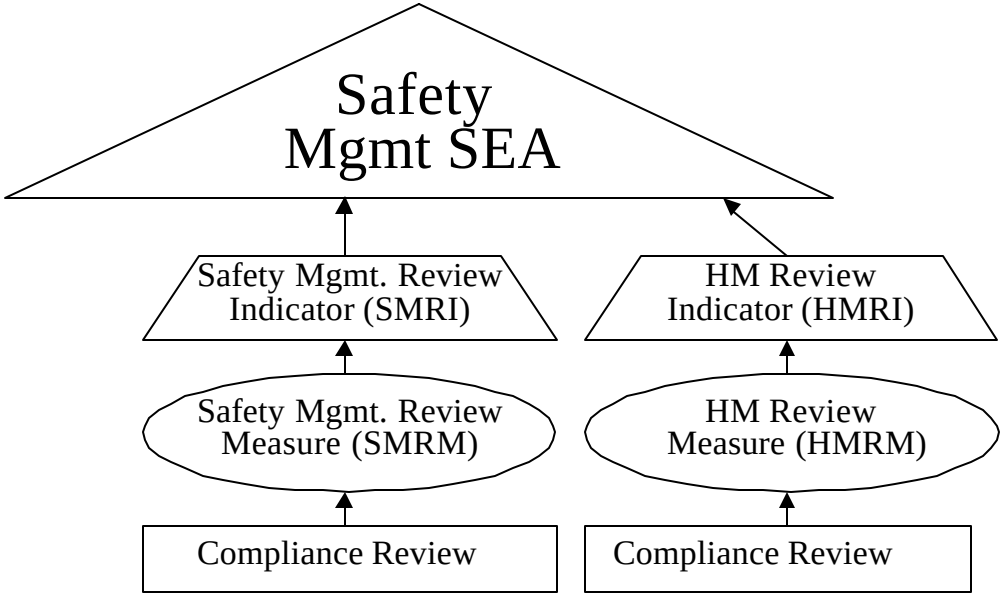


Safety Management SEA

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)**

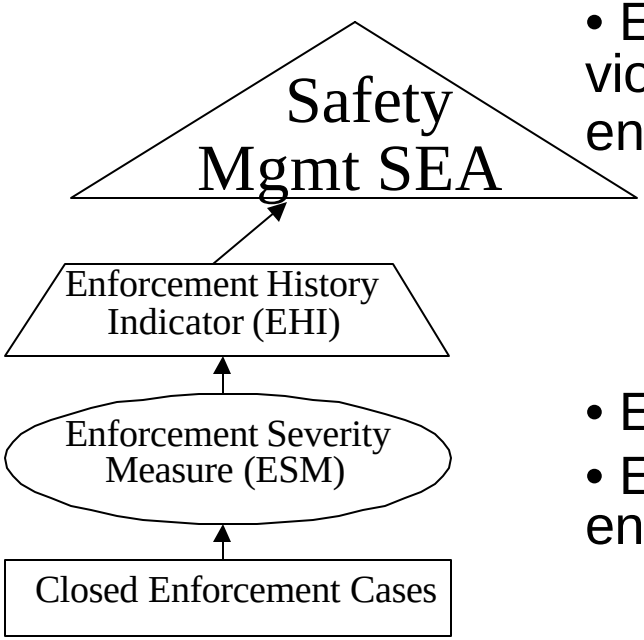
Safety Mgmt SEA - Indicators SMRI & HMRI



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

- HMRM 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

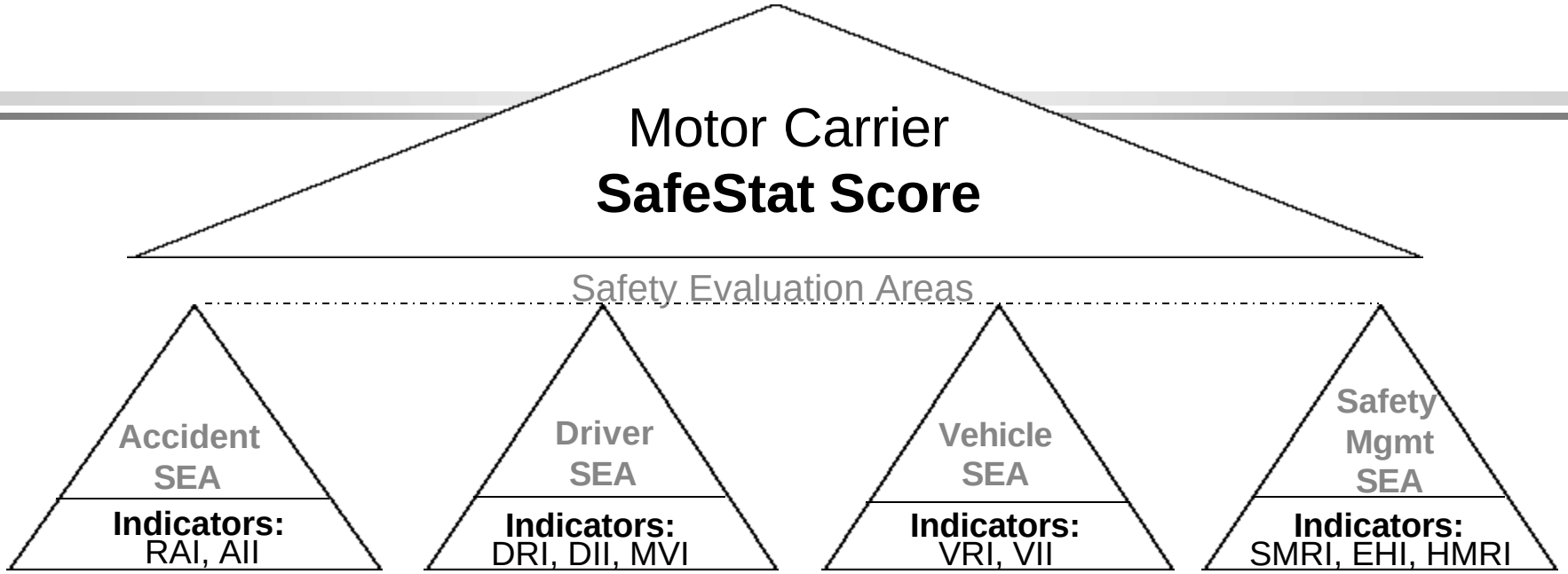
  2) a subsequent CR resulting in acute/critical violations.

- EHI of 50-74 assigned to all other carriers w/ enforcements.

Safety Mgmt SEA Value Calculation

Safety Management SEA Value is the **highest** of the EHI, SMRI & HMRI

SafeStat Detailed Summary



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)

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)

Safety Data:

Vehicle Violations (Critical & Acute from last CR)

Vehicle OOS Violations (Roadside Inspections)

Normalizing Data

Number of Vehicle Roadside Inspections

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)

* 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

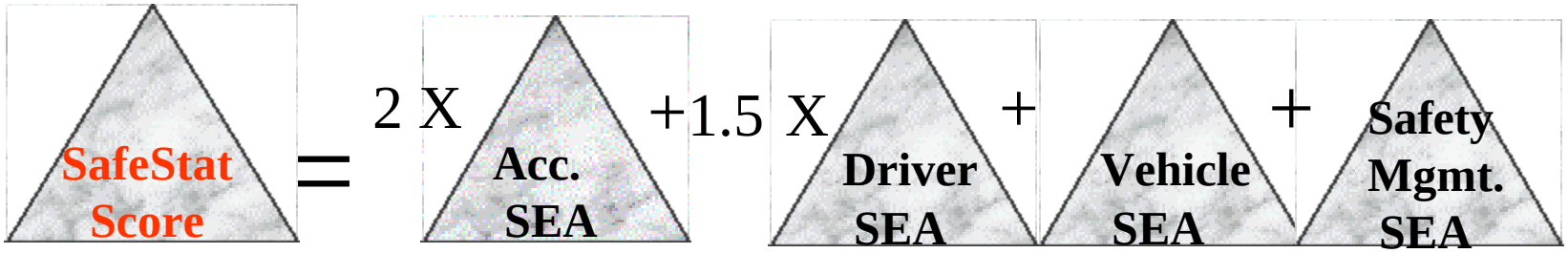
The SafeStat Score

- 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



SafeStat Categories for Scored Carriers

SafeStat evaluated carriers are assigned to **Categories (A-G)** based on their SafeStat Scores and SEA Values

SafeStat Categories for Scored Carriers

Categories	SafeStat Score Range	Includes SEA Values of 75 or Higher
A	350-550 ≥350 to ≤550	All 4 SEAs 3 SEAs that result in weighted score of 350 or more.
B	225-350 ≥225 to <350	3 SEAs that result in weighted score of less than 350. 2 SEAs that result in weighted score of 225 or more.
C	≥150 to <225	2 SEAs that result in weighted score less than 225.

Single-SEA
SafeStat Categories

Categories of carriers deficient in one SEA (SEA Value of 75 or higher)

SafeStat Categories for Carriers with One SEA Value

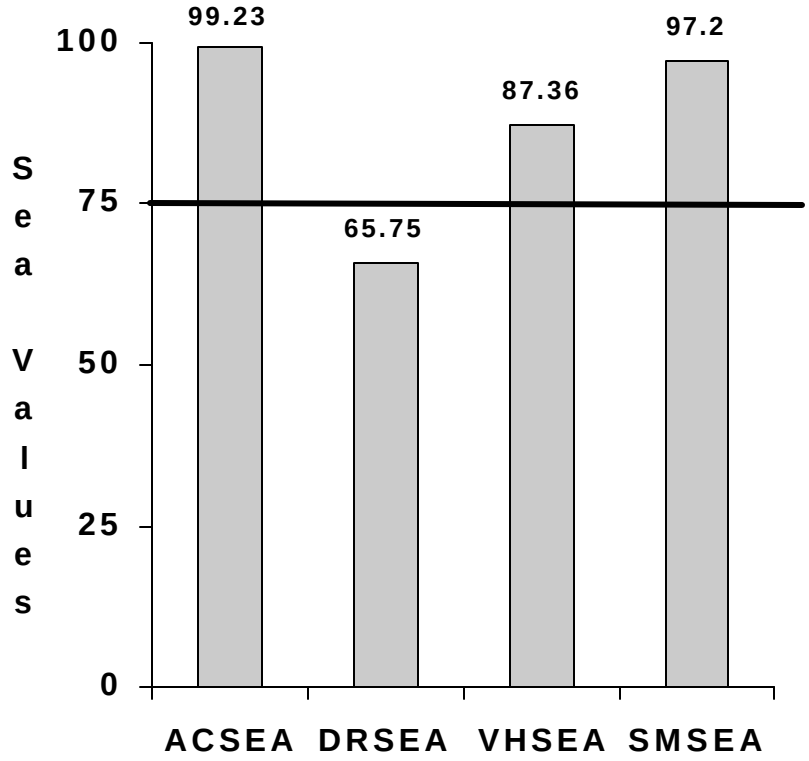
Single SEA Categories	Specific SEA	SEA Value
D	Accident	75-100
E	Driver	75-100
F	Vehicle	75-100
G	Safety Management	75-100

Example of SafeStat Results

Name: Rollemover Express

DOT # 12345

Physical Address	Mailing Address	
Launch Pad Road	**P.O... BOX 1234**	Power units: **35**
Yourtown, Ourstate 12345	**Yourtown, Ourstate 12345**	Hazmat Carrier: **yes**
		Passenger Carrier: **No**



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