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Model Performance Measures for State Traffic Records Systems

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EXECUTIVE SUMMARY

Quality traffic safety records are critical to the planning, management, and evaluation of any successful State traffic safety program. This need has become even more pronounced in light of grant requirements in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (Public Law 109-59; SAFETEA-LU) and rising Congressional expectations for data-driven performance management with outcome-oriented measures. The National Highway Traffic Safety Administration is releasing this new collection of 61 performance measures to help States meet this need. These performance measures were crafted with substantial input from a group of 35 experts with experience in at least one of the six core State traffic records systems. The measures are designed to provide traffic records professionals with the information necessary to develop and deploy quantifiable performance measures appropriate for their traffic record systems.

The measures are intended for use by Federal, State, and local governments to monitor the development and implementation of traffic record data systems, strategic plans, and data-improvement grant processes. They have been grouped by performance attribute—timeliness, accuracy, completeness, uniformity, integration, and accessibility—across the six core State traffic record data systems -- crash, vehicle, driver, roadway, citation/adjudication, and emergency medical services (EMS)/injury surveillance. These common performance measures and the attendant guidance on their application are expected to help stakeholders quantify systemic improvements to their traffic records systems.

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INTRODUCTION

The National Highway Traffic Safety Administration has identified 61 model performance measures for the six core State traffic records data systems -- crash, vehicle, driver, roadway, citation/adjudication, and EMS/injury surveillance. These model performance measures address the six performance attributes -- timeliness, accuracy, completeness, uniformity, integration, and accessibility.

The initial input for these performance measures was provided by an expert panel whose members had experience in at least one of the six core State traffic records systems. The measures developed were vetted by the highway safety community in 2009 with the report delivered to NHTSA in 2010. NHTSA considered all of the performance measures in the initial report and modified the collection of measures to ensure their utility under existing traffic records grant programs. Members of the expert panel reconvened in 2010 to finalize the measures. These performance measures could not have been produced without the significant contributions of the expert panel and the Governors Highway Safety Association (GHSA).

Table 1 summarizes the distribution of the model measures by data system and performance attribute.

Table 1. Distribution of Model Performance Measures

Data System	**Performance Attribute**						
	Timeliness	Accuracy	Completeness	Uniformity	Integration	Accessibility	**Total**
Crash	2	2	3	1	1	1	**10**
Vehicle	2	1	4	1	1	1	**10**
Driver	2	2	3	1	1	1	**10**
Roadway	2	1	4	1	1	1	**10**
Cit/Adj	2	2	3	1	1	1	**10**
EMS/ Injury*	2	2	3	2	1	1	**11**
Total	**12**	**10**	**20**	**7**	**6**	**6**	**61**

*Because the EMS/Injury Surveillance Data System comprises several databases, many of the performance attribute measures are analogously used for each database within the system.

The model performance measures are intended to help States monitor and improve the quality of the data in their traffic record systems. Specifically, States can use these measures to develop and track performance goals in their Traffic Records Strategic Plans, Traffic Records Assessments, and Highway Safety Plans; establish data-quality improvement measures for specific traffic records projects; and support data improvement goals in the Strategic Highway Safety Plan.

Key features of the model performance measures
The model performance measures were designed with these characteristics in mind:

- *Use is voluntary*: States should use the measures for those data system performance attributes they wish to monitor or improve. If the suggested measures are not deemed appropriate, States are free to modify them or develop their own.

- *The measures are flexible*: The measures are models. States can modify a measure to meet a specific need as long as its overall intent remains the same.

- *The measures do not set numerical performance goals*: They describe what to measure and suggest how it should be measured but are not intended to establish a numerical performance goal. Each State should set its own performance goals.

- *The measures provide a template or structure States can populate with specific details*: For example, the States must decide what data files to use and what data elements are critical. States should take advantage of these decision-making opportunities to focus on their most important performance features.

- *The measures are not exhaustive*: The measures attempt to capture one or two key performance features of each data system performance attribute. States may wish to use additional or alternative measures to address specific performance issues.

- *The measures are not intended to be used to compare States*: Their purpose is to help each State improve its own performance. Each State selects the measures it uses, establishes its own definitions of key terms, and may modify the measures to fit its circumstances. Since the measures will vary considerably from State to State, it is unlikely that they could be used for any meaningful comparisons between States. NHTSA has no intention of using the measure to make interstate comparisons.

Core traffic records data systems
The model performance measures were created for the six core traffic data systems.

1. Crash: The State repository that stores law enforcement officer crash reports.

2. Vehicle: The State repository that stores information on registered vehicles within the State (also known as the vehicle registration system). This database can also include records for vehicles not registered in the State—e.g., a vehicle that crashed in the State but was registered in another State.

3. Driver: The State repository that stores information on licensed drivers within the State and their driver histories. This is also known as the driver license and driver history system. The driver file also could contain a substantial number of records for drivers not licensed within the State—e.g., an unlicensed driver involved in a crash.

4. Roadway: The State repository that stores information about the roadways within the State. It should include information on all roadways within the State and is typically composed of discrete sub-files that include: roadway centerline and geometric data, location reference data, geographical information system data, travel and exposure data, etc.

5. Citation/Adjudication: The component repositories, managed by multiple State or local agencies, which store traffic citation, arrest, and final disposition of charge data.

6. EMS/Injury Surveillance: The component repositories, managed by multiple State or local agencies, which store data on motor vehicle-related injuries and deaths. Typical components of an EMS/injury surveillance system are pre-hospital EMS data, hospital emergency department data systems, hospital discharge data systems, trauma registries, and long term care/rehabilitation patient data systems.

Performance attributes

Listed below are the six performance attributes for each of the six data systems. The attributes are applied somewhat differently for each of the data systems. Generally, however, the performance attributes were developed to capture the following core characteristics.

1. Timeliness: Timeliness reflects the span of time between the occurrence of an event and entry of information into the appropriate database. Timeliness can also measure the time from when the custodial agency receives the data to the point when the data is entered into the database.

2. Accuracy: Accuracy reflects the degree to which the data is error-free, satisfies internal consistency checks, and does not exist in duplicate within a single database. Error means the recorded value for some data element of interest is incorrect. Error does not mean the information is missing from the record. Erroneous information in a database cannot always be detected. In some cases, it is possible to determine that the values entered for a variable or data element are not legitimate codes. In other cases, errors can be detected by matching with external sources of information. It may also be possible to determine that duplicate records have been entered for the same event (e.g., title transfer).

3. Completeness: Completeness reflects both the number of records that are missing from the database (e.g., events of interest that occurred but were not entered into the database) and the number of missing (blank) data elements in the records that are in a database. In the crash database, internal completeness reflects the amount of specified information captured in each individual crash record. External crash completeness reflects number or percentage of crashes on which crash reports are entered into the database. However, it is not possible to determine precisely external crash completeness as it is impossible to determine the number of unreported crashes. The measures in this report only address internal completeness by measuring what is *not* missing.

4. Uniformity: Uniformity reflects the consistency among the files or records in a database and may be measured against some independent standard, preferably a national standard. Within a State all jurisdictions should collect and report the same data using the same definitions and procedures. If the same data elements are used in different State files, they should be identical or at least compatible (e.g., names, addresses, geographic locations). Data collection procedures and data elements should also agree with nationally accepted guidelines and standards such as the Model Minimum Uniform Crash Criteria (MMUCC).

5. Integration: Integration reflects the ability of records in a database to be linked to a set of records in another of the six core databases—or components thereof—using common or unique identifiers. Integration differs in one important respect from the first four attributes of data quality. By definition, integration is a performance attribute that always involves two or more traffic records subsystems (i.e., databases or files). For integration, the model performance measures offer a single performance measure with database-specific applications that typically are of interest to many States. The samples included are of course not exhaustive. Many States will be interested in establishing links between databases and sub-databases other than those listed here, and therefore will be interested in measuring the quality of those other integrations. Note that some of the specific examples herein involve integration of files within databases rather than the integration of entire databases.

6. Accessibility: For the first five attributes, performance measurement is accomplished by the owners and operators of the various databases and sub-files, by examining the data in the files and the internal workings of the files. Accessibility, which reflects the ability of legitimate users to successfully obtain desired data, is different. Accessibility is measured in terms of customer satisfaction. For every database and file in a traffic records system, there is a set of legitimate users who are entitled to request and receive data. The accessibility of the database or sub-file is determined by obtaining the users' perceptions of how well the system responds to their requests. Some users' perceptions may be more relevant to measurement of accessibility than others. Each database manager should decide which of the legitimate users of the database would be classified as principal users, whose satisfaction with the system's response to requests for data and other transactions will provide the basis for the measurement of accessibility. Thus, the generic approach to measurement of database accessibility in the model performance measures is as follows:

- Identify the principal users of the database;
- Query the principal users to assess (a) their ability to obtain the data or other services requested and (b) their satisfaction with the timeliness of the response to their request; and
- Document the method of data collection and the principal users' responses.

How the principal users are contacted and queried is up to the database managers. Similarly, the extent to which the principal users' responses are quantified is left to the managers to determine. However, this measure does require supporting documentation that provides evidentiary support to the claims of accessibility.

This measure would be best used to gauge the impact of an improvement to a data system. Surveying the principal users before and after the rollout of a specific upgrade would provide the most meaningful measure of improved database accessibility. The following examples provide two possible methods for collecting this information. For more information on developing germane survey instruments, see NHTSA's *The Art of Appropriate Evaluation: A Guide for Highway Safety program Managers.*[1]

Example 1: Database managers ask their principal users to provide a letter or note detailing their satisfaction with the database's output—applicability of data, timeliness of response, etc.—on an annual basis. The database manager reviews these written responses and categorizes them as positive, neutral, or negative. An increase in the percentage of positive responses or a decrease in the percentage of negative responses from a baseline to a current reporting period could then be interpreted as indicating improved database accessibility.

Example 2: Database managers query principal users within two days following delivery of requested data. The query consists of two questions using a 4-point Likert scale like the ones shown to quantify the principal users' satisfaction. Interpreting this measure involves describing the distribution of categorical responses.

1. Did you receive the data, information, or assistance that you needed?
   __ Yes, fully
   __ Yes, for the most part
   __ Only partially
   __ No

2. Were you satisfied with the speed of the response to your latest request?
   __ Yes, fully
   __ Yes, for the most part
   __ Only partially
   __ No

Performance measure criteria

Each model performance measure was developed in accordance with the following criteria:

- Specific and well-defined: The measures are appropriate and understandable.
- Performance based: The measures are defined by data system performance, not supporting activities or milestones: "awarded a contract" or "formed a Traffic Records Coordinating Committee" are not acceptable performance measures.
- Practical: The measures use data that is readily available at reasonable cost and can be duplicated.

[1] Pullen-Seufert, N. C., & Hall, W. L. (Eds.). (2008, December). The art of appropriate evaluation: A guide for highway safety program managers. (DOT HS 811 061; Contract No. DTNH22-05-D-05043). Washington, DC: National Highway Traffic Safety Administration. Available at www.nhtsa.gov/people/injury/research/ArtofAppEvWeb/images/ArtofAppEvalCOLOR.pdf.

- Timely: The measures should provide an accurate and current—near real-time—snapshot of the database's timeliness, accuracy, completeness, uniformity, integration, and accessibility.

- Accurate: The measures use data that is valid and consistent with values that are properly calculated.

- Important: The measures capture the essence of this performance attribute for the data system; for example, an accuracy measure should not be restricted to a single unimportant data element.

- Universal: The measures are usable by all States, though not necessarily immediately.

These criteria take a broad view of performance measures. For example, performance on some of the model measures may not change from year to year. Once a State has incorporated uniform data elements, established data linkages, or provided appropriate data file access, further improvement may not be expected. Some States cannot use all measures. For example, States that do not currently maintain a statewide data file cannot use measures based on this file (see in particular the injury data files). Some measures require States to define a set of critical data elements. Many measures require States to define their own performance goals or standards. The model measures should be a guide for States as they assess their data systems and work to improve their performance. Each State should select performance measures most appropriate to the circumstance and should define and modify them to fit their specific needs.

Terminology used

The following terms are used throughout the document:

- Data system: One of the six component State traffic records databases, such as crash, injury surveillance, etc.

- Data file (such as "crash file" or "State Hospital Discharge file"): A data system may contain a single data file—such as a State's driver file—or more than one, e.g., the injury system has several data files.

- Record: All the data entered in a file for a specific event (a crash, a patient hospital discharge, etc.).

- Data element: Individual fields coded within each record.

- Data element code value: The allowable code values or attributes for a data element.

- Data linkages: The links established by matching at least one data element in a record in one file with the corresponding element or elements in one or more records in another file or files.

- State: The 50 States, the District of Columbia, Puerto Rico, the Territories, and the Bureau of Indian Affairs. These are the jurisdictions eligible to receive State data improvement grants.

How measures are classified in the 6x6 data system performance attribute matrix
The 61 measures have been classified by data system and performance attribute, both of which are explained in detail below.

1. Data system: Performance measures are classified by the data system they apply to and where they are calculated. Some measures involve data transferred from one file (the origin data file) to another (the destination file) or data whose collection is not under the control of the destination data file. D-T-1, for example, is *the median or mean number of days from (a) the date of an adverse action against a driver to (b) the date of entry into the driver's record.* D-T-1 is classified as a driver measure because it is derived from the driver file by taking, for example, each conviction on file and determining the time from the conviction date until entry into the file. This is a valid measure of the timeliness of data on the driver file. The driver file owners and managers, however, have little or no control over the timeliness of this measure because courts provide them with the conviction data.

   This highlights an important factor in the management and improvement of State traffic records data systems. The six traffic safety data systems are highly interconnected, with data flowing almost constantly from one to another. The responsibility for improving performance on a measure classified with one data system may rest with persons associated with other data systems.

2. Performance attribute: The boundaries between some performance attributes are not exclusive. For example, NHTSA suggests correct location coding in the crash system as an accuracy measure (coded using the State's roadway database), as a completeness measure (coded with latitude and longitude coordinates), and as an integration measure (linked to a geographic information system [GIS] master database). The model measures are used in the performance attribute that appears to be most appropriate. Some measures could well be used for other performance attributes as well.

Notes on defining and calculating performance measures

1. Specified number of days: Some measures are defined in terms of a specified number of days (such as 30, 60, or 90). Each State can establish its own period for these measures.

2. Defining periods of interest: States will need to define periods of interest for several of the measures. These periods should be of an appropriate length for the data being gathered. A State may wish to calculate the timeliness of its crash database on an annual basis. The

same State may also wish to calculate the timeliness of their other databases (e.g., driver, vehicle) on a monthly or weekly basis because of their ability to generate revenue. These decisions are left to the State to make per the situation and their data needs.

3. Critical data elements: Some measures are defined using a set of "critical data elements." Unless a measure is specifically defined in a national standard, each State can define its own set of critical data elements. Data elements that many States use are presented as examples for each data system.

4. When measures should be calculated: Many measures can be calculated and monitored using data from some period of time such as a month, a quarter, or a year. All measures should be calculated and monitored at least annually. A few measures are defined explicitly for annual files. States should calculate measures at the same time or times each year for consistency in tracking progress.

5. Missing data: Some completeness measures are defined in terms of "missing" data, such as C-C-1—*the percentage of crash records with no missing critical data elements.* "Missing" means that the data element is not coded—nothing was entered. Many data elements have null codes that indicate that information is not available for some reason. Typical null codes are "not available," "not documented," "not known," or "not recorded." A data element with a null value is not counted as missing data because it does contain a valid code, even though the data element may contain no useful information. The States should determine under what circumstances a null value is valid for a particular data element. For accuracy measures, a data element with missing data or a null value is not considered an error. It is up to the State—specifically, the custodians of a database—to decided if null codes should be accepted as legitimate entries or treated as missing values.

6. How to define "entered into a database": Some records do not have all their data entered into a database at the same time. In general, an event is considered to be "entered into a database" when a specified set of critical data elements has been entered. In fact, many databases will not accept a record until all data from a critical set is available. States may define "entered into a database" using their own data entry and data access processes.

7. How to calculate a timeliness measure: For all systems, there will be a period of time between the event generating the record and when the information is entered into the file (or is available for use). The model performance measures include several methods to define a single number that captures the entire distribution of times. Each method is appropriate in different situations.

    A. The median time for events to be entered into the file can be calculated as the point at which 50 percent of events within a period of interest are entered into the file.
    B. Mean time for events to be entered into the file (counting all events). The mean can be calculated as the average (the sum of the times for all events divided by the number of events).

C. Percentage of events on file within some fixed time (such as 24 hours or 30 days).

8. Tradeoffs between timeliness and completeness: Generally speaking, the relationship between timeliness and completeness is inversely proportional: the more timely the data, the less complete it is and vice versa. This is because many data files have records or data elements added well past the date of the event producing the record, so the files may be incomplete when the performance measure is calculated. There are three methods of choosing data to calculate the performance measures that offer different combinations of timeliness and completeness. Depending on the need for greater timeliness or completeness, users should choose accordingly.

For example, if timeliness is important when calculating the first Crash Completeness measure C-C-1—*the percentage of crash records with no missing critical data elements*—could be calculated in the following manner**:**

A. Select the period: calendar year 2007 crash file.
B. Select the date for calculation: April 1 of the following year. So calculate using the 2007 crash file as it exists on April 1, 2008.
C. Calculate: take all crashes from 2007 on file as of April 1, 2008; calculate the percentage with missing data for one or more critical data elements.

This method offers several advantages. It is easy to understand and use, and can produce performance measures in a timely manner. Its disadvantage is that performance measures calculated fairly soon after the end of the data file's period may not be based on complete data. For example, NHTSA's Fatality Analysis Reporting System (FARS) is not closed and complete for a full year; the 2007 file was not closed until Dec. 31, 2008. Timeliness measures will exclude any records that have not yet been entered by the calculation date, so timeliness measures may make the file appear to be timelier than it will be when the file is closed and completed. Completeness measures will exclude any information entered after the calculation date for records on file. Completeness measures calculated on open files will make those files appear less complete than measures calculated on files that are closed and completed.

When completeness is most important the performance measure could be calculated after a file (say an annual file) is closed and no further information can be added to it. This method reverses the simple method's advantages and disadvantages, providing performance measures that are accurate but not timely. The final FARS file, for example, is a very complete database. Its completeness, however, comes at the expense of timeliness. In comparison, the annual FARS file is less complete, but is more timely.

Another—preferable—method calculates a performance measure using all records *entered* into a file during a specified period. The timeliness measures produced by this method will be accurate but the completeness and accuracy measures may not, because the records entered during a given time period may not be complete when the measure is calculated. For example, the Crash Timeliness measure C-T-1—*the median or mean number of days*

from (a) the crash date to (b) the crash report is entered into the database—could be calculated as follows:

A. Select the period: calendar year 2007.
B. Take all records entered into the State crash file during the period: if the period is calendar year 2007 the crashes could have occurred in 2007 or 2006 (or perhaps even earlier depending on the State's reporting criteria).
C. Calculate the measure: the median or mean time between the crash date and the date when entered into the crash file.

States should choose methods that are accurate, valid, reliable, and useful. They may choose different methods for different measures. Or they may use two different methods for the same measure, for example calculating a timeliness measure first with an incomplete file (for example the 2007 crash file on April 1, 2008) and again with the complete and closed file (the 2007 crash file on January 1, 2009, after it is closed). Once methods have been selected for a measure, States should be consistent and use the same methods to calculate that measure using the same files in the same way each year. To accurately gauge progress, States must compare measures calculated by the same method using the same files for successive years.

9. Privacy issues in file access and linkage: Data file access and linkage both raise broad issues of individual privacy and the use of personal identifiers. The Driver Privacy Protection Act, the Health Insurance Portability and Accountability Act, and other regulations restrict the release of personal information on traffic safety data files. Information in many files may be sought for use in legal actions. All data file linkage and all data file access actions must consider these privacy issues.

CRASH DATABASE MODEL PERFORMANCE MEASURES

CRASH DATABASE					
TIMELINESS	*ACCURACY*	*COMPLETENESS*	*UNIFORMITY*	*INTEGRATION*	*ACCESSIBILITY*
C-T-1: The *median* or *mean* number of days from (a) the crash date to (b) the date the crash report is entered into the database. C-T-2: The *percentage* of crash reports entered into the database within XX* days after the crash. *e.g., 30, 60, or 90 days	C-A-1: The *percentage* of crash records with no errors in *critical* data elements. Example: Crash severity C-A-2: The *percentage* of in-State registered vehicles on the State crash file with Vehicle Identification Number (VIN) matched to the State vehicle registration file.	C-C-1: The *percentage* of crash records with no missing *critical* data elements. C-C-2: The *percentage* of crash records with no missing data elements. C-C-3: The *percentage* of unknowns or blanks in *critical* data elements for which unknown is not an acceptable value.	C-U-1: The *number* of MMUCC-compliant data elements entered into the crash database or obtained via linkage to other databases.	C-I-1: The *percentage* of appropriate records in the crash database that are linked to another system or file. Examples: Crash w/in-State driver *linked to* Driver file Crash w/EMS response *linked to* EMS file	C-X-1: To measure accessibility: • Identify the principal users of the crash database • Query the principal users to assess (a) their ability to obtain the data or other services requested and (b) their satisfaction with the timeliness of the response to their request • Document the method of data collection and the principal users' responses

TIMELINESS

Timeliness always reflects the span of time between the occurrence of some event and the entry of information from the event into the appropriate database. For the crash database, the events of interest are crashes. States must measure the time between the occurrence of a crash and the entry of the report into the crash database. The model performance measures offer two approaches to measuring the timeliness of a crash database:

C-T-1: The *median* or *mean* number of days from (a) the crash date to (b) the date the crash report is entered into the database. The median value is the point at which 50 percent of the crash reports were entered into the database within a period defined by the State. Alternatively, the arithmetic mean could be calculated for this measure.

C-T-2: The *percentage* of crash reports entered into the database within XX days after the crash. The XX usually reflects a target or goal set by the State for entry of reports into the database. The higher percentage of reports entered within XX days, the timelier the database. Many States set the XX for crash data entry at 30, 60, or 90 days but any other target or goal is equally acceptable.

ACCURACY

Accuracy reflects the number of errors in information in the records entered into a database. *Error* means the recorded value for some data element of interest is incorrect. Error does not mean the information is missing from the record. Erroneous information in a database cannot always be detected. Methods for detecting errors include: (a) determining that the values entered for a variable or element are not legitimate codes, (b) matching with external sources of information, and (c) identifying duplicate records have been entered for the same event. The model performance measures offer two approaches to measuring crash database accuracy:

C-A-1: The *percentage* of crash records with no errors in *critical* data elements. The State selects one or more crash data elements it considers critical and assesses the accuracy of that element or elements in all of the crash records entered into the database within a period defined by the State. Below is a list of suggested critical data elements.

C-A-2: The *percentage* of in-State registered vehicles on the State crash file with Vehicle Identification Number (VIN) matched to the State vehicle registration file.

Critical Crash Data Elements Used by Many States

Environment

- Record #
- Location (on/at/distance from; lat/long, location code)
- Date, time (can calculate day of week from this too)
- Environment contributing factors (up to 3)
- Location description (roadway type, location type, roadway-contributing factors – up to 3)
- Crash type, severity, # involved units
- Harmful events (first harmful, most harmful)

Vehicle/Unit

- Crash record #, vehicle/unit #
- VIN decoded sub-file of values for make, model, year, other decode values
- Sequence of events (multiple codes)
- Harmful events (1st and most harmful for each vehicle)
- SafetyNet variables for reportable vehicles/crashes (carrier name/ID, additional vehicle codes, tow away due to damage)
- Vehicle contributing factors

Driver/Pedestrian/Pedalcyclist

- Crash record #, vehicle/unit #, person #
- Personal identifiers (name, driver license #, address, other)
- Person type (driver, pedestrian, pedalcyclist)
- License (type, endorsements & restrictions, compliance with endorsements/restrictions)
- Driver maneuvers
- Driver contributing factors (condition, distraction, etc.)

Person

- Crash record #, vehicle/unit #, person #
- Person type (driver, occupant, non-occupant)
- Demographics (age, sex, other)
- Seating position
- Protective device type (occupant protection, helmet, etc.)
- Protective device use
- Airbag (presence, deployment: front, side, both, none)
- Injury severity (if this can be sourced through EMS/Trauma/hospital records, let the linkage bring in actual severity of injury)
- Transported to _____
- Transported by _____
- EMS Personal Casualty Report #

Administrative Tracking Variables

- Agency record number (if different from crash report number)
- Report completion date
- Report submission date
- Report accepted date
- Report returned to agency for edits date
- Report returned corrected date
- Initial errors (count by level of severity: # critical errors; # non-critical errors)
- Final quality rating

COMPLETENESS

Completeness reflects both the number of records that are missing from the database (e.g., events of interest that occurred but were not entered into the database) and the number of missing (blank) data elements in the records that are in a database. Completeness has internal and external aspects. In the crash database, external crash completeness reflects the number or percentage of crashes for which crash reports are entered into the database. It is impossible, however, to establish precisely external crash completeness as the number of unreported crashes cannot be determined. Internal completeness can be determined since it reflects the amount of specified information captured in each individual crash record. The model performance measures offer three approaches to measuring the internal completeness of a crash database:

C-C-1: The *percentage* of crash records with no missing *critical* data elements. The State selects one or more crash data elements it considers critical and assesses internal completeness by dividing the number of records not missing a critical element by the total number of records entered into the database within a period defined by the State.

C-C-2: The *percentage* of crash records with no missing data elements. The State can assess overall completeness by dividing the number of records missing no elements by the total number of records entered into the database within a period defined by the State.

C-C-3: The *percentage* of unknowns or blanks in *critical* data elements for which unknown is not an acceptable value. This measure should be used when States wish to track improvements on specific critical data values and reduce the occurrence of illegitimate null values.

UNIFORMITY

Uniformity reflects the consistency among the files or records in a database and may be measured against some independent standard, preferably a national standard. The model performance measures offer one approach to measure crash database uniformity:

C-U-1: The *number* of MMUCC-compliant data elements entered into the crash database or obtained via linkage to other databases. The MMUCC Guideline is the national standard for crash records.

INTEGRATION

Integration reflects the ability of records in the crash database to be linked to a set of records in another of the six core databases—or components thereof—using common or unique identifiers.

C-I-1: The *percentage* of appropriate records in the crash database that are linked to another system or file.

Linking the crash database with the five other core traffic records databases can provide important information. For example, a State may wish to determine the percentage of in-State drivers on crash records that link to the driver file.

ACCESSIBILITY

Accessibility reflects the ability of legitimate users to successfully obtain desired data. The below process outlines one way of measuring crash database accessibility:

C-X-1: To measure accessibility:

- **Identify the principal users of the crash database**
- **Query the principal users to assess (a) their ability to obtain the data or other services requested and (b) their satisfaction with the timeliness of the response to their request**
- **Document the method of data collection and the principal users' responses**

For more detailed information on measuring accessibility, please see the in-depth discussion found in the introduction.

VEHICLE DATABASE MODEL PERFORMANCE MEASURES

VEHICLE DATABASE					
TIMELINESS	*ACCURACY*	*COMPLETENESS*	*UNIFORMITY*	*INTEGRATION*	*ACCESSIBILITY*
V-T-1: The *median* or *mean* number of days from (a) the date of a critical status change in the vehicle record to (b) the date the status change is entered into the database. V-T-2: The *percentage* of vehicle record updates entered into the database within XX* days after the critical status change. *e.g., 1, 5, or 10 days	V-A-1: The *percentage* of vehicle records with no errors in *critical* data elements. Example: Vehicle Identification Number (VIN)	V-C-1: The *percentage* of vehicle records with no missing *critical* data elements. V-C-2: The *percentage* of vehicle records with no missing data elements. V-C-3: The *percentage* of unknowns or blanks in *critical* data elements for which unknown is not an acceptable value. V-C-4: The *percentage* of vehicle records from large trucks and buses that have all of the following data elements: Motor Carrier ID, Gross Vehicle Weight Rating/Gross Combination Weight Rating, Vehicle Configuration, Cargo Body Type, and Hazardous Materials (Cargo Only).	V-U-1: The *number* of standards-compliant* data elements entered into a database or obtained via linkage to other databases.	V-I-1: The *percentage* of appropriate records in the vehicle file that are linked to another system or file. Example: Vehicle registration *linked to* Driver file	V-X-1: To measure accessibility: • Identify the principal users of the vehicle database • Query the principal users to assess (a) their ability to obtain the data or other services requested and (b) their satisfaction with the timeliness of the response to their request • Document the method of data collection and the principal users' responses

TIMELINESS

Timeliness always reflects the span of time between the occurrence of some event and the entry of information from the event into the appropriate database. For the vehicle database, the State determines the events of principal interest that will be used to measure timeliness. For example, a State may determine that the transfer of the title of the vehicle constitutes a critical status change of that vehicle record. There are many ways to measure the timeliness of the entry of a report on the transfer of a vehicle title or any other critical status change. The model performance measures offer two general approaches to measuring vehicle database timeliness:

V-T-1: The *median* or *mean* number of days from (a) the date of a critical status change in the vehicle record to (b) the date the status change is entered into the database. The median value is the point at which 50 percent of the vehicle record updates were entered into the database within a period defined by the State. Alternatively, the arithmetic mean could be calculated for this measure.

V-T-2: The *percentage* of vehicle record updates entered into the database within XX days after the critical status change. The XX usually reflects a target or goal set by the State for entry of reports into the database. The higher percentage of reports entered within XX days, the timelier is the database. Many States set the XX for vehicle data entry at 1, 5, or 10 days, but any target or goal is equally acceptable.

ACCURACY

Accuracy reflects the number of errors in information in the records entered into a database. *Error* means the recorded value for some data element of interest is incorrect. Error does not mean the information is missing from the record. Erroneous information in a database cannot always be detected. Methods for detecting errors include: (a) determining that the values entered for a variable or element are not legitimate codes, (b) matching with external sources of information, and (c) identifying duplicate records have been entered for the same event. The model performance measures offer one approach to measuring vehicle database accuracy:

V-A-1: The *percentage* of vehicle records with no errors in *critical* data elements. The State selects one or more vehicle data elements it considers critical and assesses the accuracy of that element or elements in all of the vehicles records entered into the database within a period defined by the State. Below is a list of suggested critical data elements.

Critical Vehicle Data Elements Used by Many States	
• Vehicle Identification Number • Current registration status • Commercial or non-CMV • State of registration • State of title	• Stolen flag (as appropriate) • Motor carrier name • Motor carrier ID • Title brands

COMPLETENESS

Completeness has internal and external aspects. For the vehicle database, external vehicle completeness reflects the portion of the critical changes to the vehicle status reported and entered into the database. It is not possible to determine precisely external vehicle database completeness because one can never know how many critical status changes occurred but went unreported. Internal completeness reflects the amount of specified information captured by individual vehicle records. It is possible to determine precisely internal vehicle completeness; for example, one can calculate the percentage of vehicle records in the database that is missing one or more critical data elements. The model performance measures offer four approaches to measuring the completeness of a vehicle database:

V-C-1: The *percentage* of vehicle records with no missing *critical* data elements. The State selects one or more vehicle data elements it considers critical and assesses internal completeness by dividing the number of records not missing a critical element by the total number of records entered into the database within a period defined by the State.

V-C-2: The *percentage* of records on the State vehicle file that contain no missing data elements. The State can assess overall completeness by dividing the number of records missing no elements by the total number of records entered into the database within a period defined by the State.

V-C-3: The *percentage* of unknowns or blanks in critical data elements for which unknown is not an acceptable value. This measure should be used when States wish to track improvements on specific critical data values to reduce the occurrence of illegitimate null values.

V-C-4: The *percentage* of vehicle records from large trucks and buses that have all of the following data elements: Motor Carrier ID, Gross Vehicle Weight Rating/Gross Combination Weight Rating, Vehicle Configuration, Cargo Body Type, and Hazardous Materials (Cargo Only). This is a measure of database completeness in specific critical fields.

UNIFORMITY

Uniformity reflects the consistency among the files or records in a database and may be measured against some independent standard, preferably a national standard. The model performance measures offer one general approach to measuring vehicle database uniformity.

V-U-1: The *number* of standards-compliant data elements entered into a database or obtained via linkage to other databases. These standards include the MMUCC.

INTEGRATION

Integration reflects the ability of records in the vehicle database to be linked to a set of records in another of the six core databases—or components thereof—using common or unique identifiers.

V-I-1: The *percentage* of appropriate records in the vehicle file that are linked to another system or file. Linking the vehicle database with the five other core traffic record databases can provide important information. For example, a State may wish to determine the percentage of vehicle registration records that link to a driver record.

ACCESSIBILITY

Accessibility reflects the ability of legitimate users to successfully obtain desired data. The below process outlines one way of measuring the vehicle database's accessibility.

V-X-1: To measure accessibility:

- **Identify the principal users of the vehicle database**
- **Query the principal users to assess (a) their ability to obtain the data or other services requested and (b) their satisfaction with the timeliness of the response to their request**
- **Document the method of data collection and the principal users' responses**

For more detailed information on measuring accessibility, please see the in-depth discussion found in the introduction.

DRIVER DATABASE MODEL PERFORMANCE MEASURES

DRIVER DATABASE					
TIMELINESS	*ACCURACY*	*COMPLETENESS*	*UNIFORMITY*	*INTEGRATION*	*ACCESSIBILITY*
D-T-1: The *median* or *mean* or number of days from (a) the date of a driver's adverse action to (b) the date the adverse action is entered into the database. D-T-2: The *median* or *mean* number of days from (a) the date of receipt of citation disposition notification by the driver repository to (b) the date the disposition report is entered into the database.	D-A-1: The *percentage* of driver records that have no errors in *critical* data elements. Example: Date of Birth D-A-2: The *percentage* of records on the State driver file with Social Security Numbers (SSN) successfully verified using Social Security Online Verification (SSOLV) or other means.	D-C-1: The *percentage* of driver records with no missing *critical* data elements. D-C-2: The *percentage* of driver records with no missing data elements. D-C-3: The *percentage* of unknowns or blanks in *critical* data elements for which unknown is not an acceptable value.	D-U-1: The *number* of standards-compliant data elements entered into the driver database or obtained via linkage to other databases.	D-I-1: The *percentage* of appropriate records in the driver file that are linked to another system or file. Example: Driver in crash *linked to* adjudication file	D-X-1: To measure accessibility: • Identify the principal users of the driver database • Query the principal users to assess (a) their ability to obtain the data or other services requested and (b) their satisfaction with the timeliness of the response to their request • Document the method of data collection and the principal users' responses

TIMELINESS

Timeliness always reflects the span of time between the occurrence of some event and the entry of information from the event into the appropriate database. For the driver database, the State determines the events of principal interest that shall be used to measure timeliness. For example, the State may determine that an adverse action against a driver's license constitutes a critical status change of that driver record. There are many ways to measure the timeliness of the entry of a report on an adverse action against a driver's license or any other critical status change. The model performance measures offer two approaches to measuring the timeliness of the driver database. The first is a true measure of timeliness from time of conviction to entry into the driver database, while the second is a measure internal to the agency with custody of the driver database.

D-T-1: The *median* or *mean* number of days from (a) the date of a driver's adverse action to (b) the date the adverse action is entered into the database. This measure represents the time from final adjudication of a citation to entry into the driver database within a period defined by the State. This process can occur in a number of ways, from the entry of paper reports and data conversion to a seamless electronic process. An entry of a citation disposition into the driver database cannot occur until the adjudicating agency (usually a court) notifies the repository that the disposition has occurred. Since the custodial agency of the driver database in most States has no control over the transmission of the disposition notification many States may wish to track the portion of driver database timelines involving citation dispositions that it can control. Measure D-T-2 is offered for that purpose.

D-T-2: The *median* or *mean* number of days from (a) the date of receipt of citation disposition notification by the driver repository to (b) the date the disposition report is entered into the driver's record in the database within a period determined by the State. This measure represents the internal (to the driver database) time lapse from the receipt of disposition information to entry into the driver database within a period defined by the State.

ACCURACY

Accuracy reflects the number of errors in information in the records entered into a database. *Error* means the recorded value for some data element of interest is incorrect. Error does not mean the information is missing from the record. Erroneous information in a database cannot always be detected. Methods for detecting errors include: (a) determining that the values entered for a variable or element are not legitimate codes, (b) matching with external sources of information, and (c) identifying duplicate records have been entered for the same event. The model performance measures offer two approaches to measuring driver database accuracy:

D-A-1: The *percentage* of driver records with no errors in *critical* data elements. The State selects one or more driver data elements it considers critical and assesses the accuracy of that element or elements in all of the driver records entered into the database within a period defined by the State. Below is a list of suggested critical data elements.

D-A-2: The *percentage* of records on the State driver file with Social Security Numbers (SSN) successfully verified using Social Security Online Verification (SSOLV) or other means.

Critical Driver Data Elements Used by Many States	

Driver Identification
• Name
• Date of birth
• Sex
• Driver license number
• State of driver license issuance
• Date license issued or renewed
• SSN
• License type
• Restrictions
	Events History
	• Crash involvement
	• Conviction offenses
	• Violation date per event
	• Conviction date per event
	• Driver control actions
	  o Suspensions
	  o Revocations
	  o Withdrawals
	• Date of each action

COMPLETENESS

Completeness has internal and external aspects. For the driver database, external completeness reflects the portion of critical driver status changes that are reported and entered into the database. It is not possible to determine precisely the external completeness of driver records because one can never know how many critical driver status change occurred but went unreported. Internal completeness reflects the amount of specified information captured in individual driver records. It is possible to determine precisely internal driver record completeness. One can, for example, calculate the percentage of driver records in the database that is missing one or more critical data elements. The model performance measures offer three approaches to measuring the internal completeness of the driver database:

D-C-1: The *percentage* of driver records with no missing *critical* data elements. The State selects one or more driver elements it considers critical and assesses internal completeness by dividing the number of records not missing a critical element by the total number of records entered into the database within a period defined by the State.

D-C-2: The *percentage* of driver records with no missing data elements. The State can assess overall completeness by dividing the number of records missing no elements by the total number of records entered into the database within a period defined by the State.

D-C-3: The *percentage* of unknowns or blanks in *critical* data elements for which unknown is not an acceptable value. This measure should be used when States wish to track improvements on specific critical data values and reduce the occurrence of illegitimate null values.

UNIFORMITY

Uniformity reflects the consistency among the files or records in a database and may be measured against an independent standard, preferably a national standard. The model performance measures offer one general approach to measuring driver database uniformity:

D-U-1: The *number* of standards-compliant data elements entered into the driver database or obtained via linkage to other databases. The relevant standards include MMUCC.

INTEGRATION

Integration reflects the ability of records in the driver database to be linked to a set of records in another of the six core databases—or components thereof—using common or unique identifiers.

D-I-1: The *percentage* of appropriate records in the driver file that are linked to another system or file. Linking the driver database with the five other core traffic record databases can provide important information. For example, a State may wish to determine the percentage of drivers in crashes linked to the adjudication file.

ACCESSIBILITY

Accessibility reflects the ability of legitimate users to successfully obtain desired data. The below process outlines one way of measuring the driver database's accessibility.

D-X-1: To measure accessibility:

- **Identify the principal users of the driver database**
- **Query the principal users to assess (a) their ability to obtain the data or other services requested and (b) their satisfaction with the timeliness of the response to their request**
- **Document the method of data collection and the principal users' responses**

For more detailed information on measuring accessibility, please see the in-depth discussion found in the introduction.

ROADWAY DATABASE MODEL PERFORMANCE MEASURES

ROADWAY DATABASE					
TIMELINESS	*ACCURACY*	*COMPLETENESS*	*UNIFORMITY*	*INTEGRATION*	*ACCESSIBILITY*
R-T-1: The *median* or *mean* number of days from (a) the date a periodic collection of a critical roadway data element is complete (e.g., Annual Average Daily Traffic) to (b) the date the updated critical roadway data element is entered into the database. R-T-2: The *median* or *mean* number of days from (a) the date a roadway project is completed to (b) the date the updated critical data elements are entered into the database.	R-A-1: The *percentage* of all road segment records with no errors in *critical* data elements. Example: Surface/Pavement	R-C-1: The *percentage* of road segment records with no missing *critical* data elements. R-C-2: The *percentage* of public road miles or jurisdictions identified on the State's basemap or roadway inventory file. R-C-3: The *percentage* of unknowns or blanks in *critical* data elements for which unknown is not an acceptable value. R-C-4: The *percentage* of total roadway segments that include location coordinates, using measurement frames such as a GIS basemap.	R-U-1: The *number* of Model Inventory of Roadway Elements (MIRE)-compliant data elements entered into a database or obtained via linkage to other databases.	R-I-1: The *percentage* of appropriate records in a specific file in the roadway database that are linked to another system or file. Example: Bridge inventory *linked to* roadway basemap	R-X-1: To measure accessibility of a specific file within the roadway database: • Identify the principal users of the roadway file • Query the principal users to assess (a) their ability to obtain the data or other services requested and (b) their satisfaction with the timeliness of the response to their request • Document the method of data collection and the principal users' responses

TIMELINESS

Timeliness always reflects the span of time between the occurrence of some event and the entry of information from the event into the appropriate database. For the roadway database, the State determines the events of principal interest that will be used to measure timeliness. A State may determine that the completion of periodic collection of a critical roadway data element or elements constitutes a critical status change of that roadway record. For example, one critical roadway data element that many States periodically collect is annual average daily traffic (AADT). Roadway database timeliness can be validly gauged by measuring the time between the completion of data collection and the entry into the database of AADT for roadway segments of interest. There are many ways to do this. The model performance measures offer two general approaches to measuring vehicle database timeliness:

R-T-1: The *median* or *mean* number of days from (a) the date a periodic collection of a critical roadway data element is complete (e.g., Annual Average Daily Traffic) to (b) the date the updated critical roadway data element is entered into the database. The median value is the duration within which 50 percent of the changes to critical roadway elements were updated in the database. Alternatively, the arithmetic mean is the average number of days between the completion of the collection of critical roadway elements and when the data are entered into the database.

R-T-2: The *median* or *mean* number of days from (a) roadway project completion to (b) the date the updated critical data elements are entered into the roadway inventory file. The median value is the point at which 50 percent of the updated critical data elements from a completed roadway project were entered into the roadway inventory file. Alternatively, the arithmetic mean could be calculated for this measure. Each State will determine its short list of critical data elements, which should be a subset of MIRE. For example, it could be some or all of the elements required for Highway Performance Monitoring System (HPMS) sites. The database should be updated at regular intervals or when a change is made to the inventory. For example, when a roadway characteristic or attribute (e.g., traffic counts, speed limits, signs, markings, lighting, etc.) that is contained in the inventory is modified, the inventory should be updated within a reasonable period of time.

ACCURACY

Accuracy reflects the number of errors in information in the records entered into a database. *Error* means the recorded value for some data element of interest is incorrect. Error does not mean the information is missing from the record. Erroneous information in a database cannot always be detected. Methods for detecting errors include: (a) determining that the values entered for a variable or element are not legitimate codes, (b) matching with external sources of information, and (c) identifying duplicate records have been entered for the same event. The model performance measures offer one approach to measuring roadway database accuracy:

R-A-1: The *percentage* of all road segment records with no errors in *critical* data elements. The State selects one or more roadway data elements it considers critical and assesses the

accuracy of that element or elements in all of the roadway records within a period defined by the State. Many States consider the HPMS standards listed below to be critical.

Critical Highway Data Elements Used by Many States	
• Owner • Route • Surface/Pavement • Median • Turning Lanes • Traffic Lanes • Functional Classification • Shoulder • Access Control • County	• Intersections • Divided/Undivided • Horizontal Alignment Restriction • Average Annual Daily Traffic • National Highway System • Vertical Alignment • Pavement Serviceability Index • Linear Reference System • Mileage • International Roughness Index

COMPLETENESS

Completeness has internal and external aspects. For the roadway database, external roadway completeness reflects the portion of road segments in the State for which data are collected and entered into the database. It is very difficult to determine precisely external roadway completeness because many States do not know the characteristics or even the existence of roadway segments that are non-State owned, maintained, or reported in the HPMS. Internal completeness reflects the amount of specified information that is captured in individual road segment records. It is possible to determine precisely internal roadway completeness. One can, for example, calculate the percentage of roadway segment records in the database that is missing one or more critical elements (e.g., number of traffic lanes. The model performance measures offer four general approaches to measuring the roadway database's internal completeness:

R-C-1: The *percentage* of road segment records with no missing *critical* data elements. The State selects one or more roadway elements it considers critical and assesses internal completeness by dividing the number of records not missing a critical element by the total number of roadway records in the database.

R-C-2: The *percentage* of public road miles or jurisdictions identified on the State's basemap or roadway inventory file. A jurisdiction may be defined by the limits of a State, county, parish, township, Metropolitan Planning Organization, or municipality.

R-C-3: The *percentage* of unknowns or blanks in *critical* data elements for which unknown is not an acceptable value. This measure should be used when States wish to track improvements on specific critical data elements and reduce the occurrence of illegitimate null values.

R-C-4: The *percentage* of total roadway segments that include location coordinates, using measurement frames such as a GIS basemap. This is a measure of the database's overall completeness.

UNIFORMITY

Uniformity reflects the consistency among the files or records in a database and may be measured against some independent standard, preferably a national standard. The model performance measures offer one general approach to measuring roadway database uniformity:

R-U-1: The *number* of Model Inventory of Roadway Elements (MIRE)-compliant data elements entered into a database or obtained via linkage to other databases.

INTEGRATION

Integration reflects the ability of records in the roadway database to be linked to a set of records in another of the six core databases—or components thereof—using common or unique identifiers.

R-I-1: The *percentage* of appropriate records in a specific file in the roadway database that are linked to another system or file. For example, a State may wish to determine the percentage of records in the State's bridge inventory that link to the basemap file.

ACCESSIBILITY

Accessibility reflects the ability of legitimate users to successfully obtain desired data. The below process outlines one way of measuring roadway database accessibility:

R-X-1: To measure accessibility of a specific file in the roadway database:

- **Identify the principal users of the file**
- **Query the principal users to assess (a) their ability to obtain the data or other services requested and (b) their satisfaction with the timeliness of the response to their request**
- **Document the method of data collection and the principal users' responses**

For more detailed information on measuring accessibility, please see the in-depth discussion found in the introduction.

CITATION/ADJUDICATION DATABASE MODEL PERFORMANCE MEASURES

<table>
<tr><th colspan="6">CITATION/ADJUDICATION DATABASE</th></tr>
<tr><th>TIMELINESS</th><th>ACCURACY</th><th>COMPLETENESS*</th><th>UNIFORMITY*</th><th>INTEGRATION*</th><th>ACCESSIBILITY*</th></tr>
<tr>
<td>C/A-T-1: The median or mean number of days from (a) the date a citation is issued to (b) the date the citation is entered into the statewide citation database, or a first available repository.

C/A-T-2: The median or mean number of days from (a) the date of charge disposition to (b) the date the charge disposition is entered into the statewide adjudication database, or a first available repository.

Note: Many States do not have statewide databases for citation or adjudication records. Therefore, in some citation and adjudication data systems, timeliness and other attributes of data quality should be measured at individual first available repositories.</td>
<td>C/A-A-1: The percentage of citation records with no errors in critical data elements.

Example:
Time Citation Issued

C/A-A-2: The percentage of charge disposition records with no errors in critical data elements.

Example:
Citation reference number</td>
<td>C/A-C-1: The percentage of citation records with no missing critical data elements.*

C/A-C-2: The percentage of citation records with no missing data elements.*

C/A-C-3: The percentage of unknowns or blanks in critical citation data elements for which unknown is not an acceptable value.*</td>
<td>C/A-U-1: The number of Model Impaired Driving Record Information System (MIDRIS)-compliant data elements entered into the citation database or obtained via linkage to other databases.

C/A-U-2: The percentage of citation records entered into the database with common uniform statewide violation codes.</td>
<td>C-I-1: The percentage of appropriate records in the citation file that are linked to another system or file.

Example:
DWI citation
linked to
Adjudication file</td>
<td>C/A-X-1: To measure accessibility of the citation database:
Identify the principal users of the citation database
Query the principal users to assess (a) their ability to obtain the data or other services requested and (b) their satisfaction with the timeliness of the response to their request
Document the method of data collection and the principal users' responses</td>
</tr>
<tr><td colspan="5">*These measures of completeness, uniformity, integration, and accessibility are also applicable to the adjudication file.</td></tr>
</table>

TIMELINESS

Timeliness always reflects the span of time between the occurrence of some event and the entry of information from the event into the appropriate database. For the citation and adjudication databases, the State determines the events of principal interest that will be used to measure timeliness. Many States will include the critical events of citation issuance and citation disposition among those events of principal interest used to track timeliness. There are many ways to measure the timeliness of either citation issuance or citation disposition. The model performance measures offer one general approach to measuring citation and adjudication database timeliness:

C/A-T-1: The *median* or *mean* number of days from (a) the date a citation is issued to (b) the date the citation is entered into the statewide citation database, or a first available repository. The median value is the point at which 50 percent of the citation records were entered into the citation database within a period defined by the State. Alternatively, the arithmetic mean could be calculated for this measure.

C/A-T-2: The *median* or *mean* number of days from (a) the date of charge disposition to (b) the date the charge disposition is entered into the statewide adjudication database, or a first available repository. The median value is the point at which 50 percent of the charge dispositions were entered into the statewide database. Alternatively, the arithmetic mean could be calculated for this measure.

Note: Many States do not have statewide databases for citation or adjudication records. Therefore, in some citation and adjudication data systems, timeliness and other attributes of data quality should be measured at individual first available repositories.

ACCURACY

Accuracy reflects the number of errors in information in the records entered into a database. *Error* means the recorded value for some data element of interest is incorrect. Error does not mean the information is missing from the record. Erroneous information in a database cannot always be detected. Methods for detecting errors include: (a) determining that the values entered for a variable or element are not legitimate codes, (b) matching with external sources of information, and (c) identifying duplicate records have been entered for the same event. The State selects one or more citation data elements and one or more charge disposition data elements it considers critical and assesses the accuracy of those elements in all of the citation and adjudication records entered into the database within a period of interest. The model performance measures offer two approaches to measuring citation and adjudication database accuracy:

C/A-A-1: The *percentage* of citation records with no errors in *critical* data elements. The State selects one or more citation data elements it considers critical and assesses the accuracy of that element or elements in all of the citation records entered into the database within a period defined by the State. Below is a list of suggested critical data elements.

C/A-A-2: **The *percentage* of charge disposition records with no errors in *critical* data elements**. The State selects one or more charge disposition data elements it considers critical and assesses the accuracy of that element or elements for the charge-disposition records entered into the database within a period defined by the State. Below is a list of suggested critical data elements.

Critical Citation/Adjudication Data Elements Used by Many States	
Citation Data: Issuing Agency • Offense/charge code • Date • Time • Officer • Agency • Citation number • Crash report number (as applicable) • BAC (as applicable) **Citation Data: Offender** • Name • Driver license number • Age • Sex	**Charge Disposition/Adjudication: Offender** • Name • Driver license number • Age • Sex • Citation number **Charge Disposition/Adjudication: Court** • Date of receipt • Date of disposition • Disposition • Date of transmittal to DMV (as applicable)

COMPLETENESS*

Completeness has internal and external aspects. For the citation/adjudication databases, external completeness can only be assessed by identifying citation numbers for which there are no records. Missing citations should be monitored at the place of first repository. Internal completeness reflects the amount of specified information that is captured in individual citation and charge disposition records. It is possible to determine precisely internal citation and adjudication completeness. One can, for example, calculate the percentage of citation records in the database that are missing one or more critical data elements. The model performance measures offer three approaches to measuring internal completeness:

C/A-C-1: The *percentage* of citation records with no missing *critical* data elements. The State selects one or more citation data elements it considers critical and assesses internal completeness by dividing the number of records not missing a critical element by the total number of records entered into the database within a period defined by the State.

C/A-C-2: The *percentage* of citation records with no missing data elements. The State can assess overall completeness by dividing the number of records missing no elements by the total number of records entered into the database.

C/A-C-3: The *percentage* of unknowns or blanks in *critical* citation data elements for which unknown is not an acceptable value. This measure should be used when States wish to track improvements on specific critical data elements and reduce the occurrence of illegitimate null values.

These measures of completeness are also applicable to the adjudication file.

UNIFORMITY*

Uniformity reflects the consistency among the files or records in a database and may be measured against some independent standard, preferably a national standard. The model performance measures offer two general approaches to measuring database uniformity:

C/A-U-1: The *number* of Model Impaired Driving Record Information System (MIDRIS)-compliant data elements entered into the citation database or obtained via linkage to other databases.

C/A-U-2: The *percentage* of citation records entered into the database with common uniform statewide violation codes. The State identifies the number of citation records with common uniform violation codes entered into the database within a period defined by the State and assesses uniformity by dividing this number by the total number of citation records entered into the database during the same period.

These measures of uniformity are also applicable to the adjudication file.

INTEGRATION*

Integration reflects the ability of records in the citation database to be linked to a set of records in another of the six core databases—or components thereof—using common or unique identifiers.

C/A-I-1: The *percentage* of appropriate records in the citation files that are linked to another system or file. Linking the citation database with the five other core traffic record databases can provide important information. For example, a State may wish to determine the percentage of DWI citations that have been adjudicated.

This measure of integration is also applicable to the adjudication file.

ACCESSIBILITY*

Accessibility reflects the ability of legitimate users to successfully obtain desired data. The below process outlines one way of measuring the citation database's accessibility.

C/A-X-1: To measure accessibility of the citation database:

- **Identify the principal users of the citation database**
- **Query the principal users to assess (a) their ability to obtain the data or other services requested and (b) their satisfaction with the timeliness of the response to their request**

- **Document the method of data collection and the principal users' responses**

For more detailed information on measuring accessibility, please see the in-depth discussion found in the introduction.

This measure of accessibility is also applicable to the adjudication file.

EMS/INJURY SURVIELLANCE DATABASE MODEL PERFORMANCE MEASURES

EMS/INJURY SURVEILLANCE					
*TIMELINESS**	*ACCURACY**	*COMPLETENESS**	*UNIFORMITY*	*INTEGRATION**	*ACCESSIBILITY**
I-T-1: The *median* or *mean* number of days from (a) the date of an EMS run to (b) the date when the EMS patient care report is entered into the database. I-T-2: The *percentage* of EMS patient care reports entered into the State EMS discharge file within XX* days after the EMS run. *e.g., 5, 30, or 90 days	I-A-1: The *percentage* of EMS patient care reports with no errors in *critical* data elements. Example: Response Time	I-C-1: The *percentage* of EMS patient care reports with no missing critical data elements. I-C-2: The *percentage* of EMS patient care reports with no missing data elements. I-C-3: The *percentage* of unknowns or blanks in critical data elements for which unknown is not an acceptable value.	I-U-1: The *percentage* of records on the State EMS data file that are National Emergency Medical Service Information System (NEMSIS)-compliant.* I-U-2: The *number* of records on the State EMS data file that are National Emergency Medical Service Information System (NEMSIS)-compliant.* *Where applicable, analogous national standards for uniformity may be used as follows: State Emergency Dept. File & Universal Billing 04 (UB04) State Hospital Discharge File & Universal Billing 04 (UB04) State Trauma Registry File & National Trauma Data Standards (NTDS) State Vital Records & National Association for Public Health Statistics and Information Systems (NAPHSIS)	I-I-1: The *percentage* of appropriate records in the EMS file that are linked to another system or file. Example: EMS response *linked to* Trauma file	I-X-1: To measure accessibility of the EMS file: • Identify the principal users of the file • Query the principal users to assess (a) their ability to obtain the data or other services requested and (b) their satisfaction with the timeliness of the response to their request • Document the method of data collection and the principal users' responses
****These measures of timeliness, accuracy, completeness, integration, and accessibility are also applicable to the following files: State Emergency Dept. File, State Hospital Discharge File, State Trauma Registry File, State Vital Records.***					

The EMS/Injury Surveillance database is actually a set of related databases. The principal files of interest are:

- Pre-hospital Emergency Medical Services (EMS) data
- Hospital Emergency Department Data Systems
- Hospital Discharge Data Systems
- State Trauma Registry File
- State Vital Records

States typically wish to measure data quality separately for each of these files. These measures may be applied to each of the EMS/Injury Surveillance databases individually.

TIMELINESS*

Timeliness always reflects the span of time between the occurrence of some event and the entry of information from the event into the appropriate database. For the EMS/Injury Surveillance databases, the State determines the events of principal interest that will be used to measure timeliness. A State may, for example, determine that the occurrence of an EMS run constitutes a critical event to measure the timeliness of the EMS database. As another example, a State can select the occurrence of a hospital discharge as the critical event to measure the timeliness of the hospital discharge data system. There are many ways to measure the timeliness of the EMS/Injury Surveillance databases. The model performance measures offer two general approaches to measuring timeliness:

I-T-1: The *median* or *mean* number of days from (a) the date of an EMS run to (b) the date when the EMS patient care report is entered into the database. The median value is the point at which 50 percent of the EMS run reports were entered into the database within a period defined by the State. Alternatively, the arithmetic mean could be calculated for this measure.

I-T-2: The *percentage* of EMS patient care reports entered into the State EMS discharge file within XX* days after the EMS run. The XX usually reflects a target or goal set by the State for entry of reports into the database. The higher percentage of reports entered within XX days, the timelier the database. Many States set the XX for EMS data entry at 5, 30, or 90 days, but any target or goal is equally acceptable.

This measure of timeliness is also applicable to the following files: State Emergency Dept. File, State Hospital Discharge File, State Trauma Registry File, and State Vital Records.

ACCURACY*

Accuracy reflects the number of errors in information in the records entered into a database. *Error* means the recorded value for some data element of interest is incorrect. Error does not mean the information is missing from the record. Erroneous information in a database cannot always be detected. Methods for detecting errors include: (a) determining that the values entered for a variable or element are not legitimate codes, (b) matching with external sources of information, and (c) identifying duplicate records have been entered for the same event.

The model performance measures offer one general approach to measuring the accuracy of the injury surveillance databases that is applicable to each of the five principal files:

I-A-1: The *percentage* of EMS patient care reports with no errors in *critical* data elements. The State selects one or more EMS data elements it considers critical—response times, for example—and assesses the accuracy of that element or elements for all the records entered into the database within a period defined by the State. Below is a list of suggested critical data elements.

This measure of accuracy is also applicable to the following files: State Emergency Dept. File, State Hospital Discharge File, State Trauma Registry File, and State Vital Records.

Critical EMS/Injury Surveillance Data Elements Used by Many States	
Hospital Emergency Department/Inpatient Data (UB04 standard) • E-code • date of birth • name • sex • admission date/time • ZIP Code of hospital • emergency dept. disposition • inpatient disposition • diagnosis codes • discharge date/time **EMS Data (National Emergency Medical Services Information System standard)** • date of birth • name • sex • incident date/time • dispatch date/time • scene arrival date/time • provider's primary impression • injury type • scene departure date/time • destination arrival date/time • county/ZIP Code of hospital • county/ZIP Code of injury	**Trauma Registry Data (National Trauma Data Bank standard)** • E-code • date of birth • name • sex • ZIP Code of injury • admission date • admission time • inpatient disposition • diagnosis codes • ZIP Code of hospital • discharge date/time • EMS patient report number **Death Certificate (Mortality) Data (National Center for Health Statistics standard)** • date of birth • date of death • name • sex • manner of death • underlying cause of death • contributory cause of death • county/ZIP Code of death • location of death

COMPLETENESS*

Completeness has internal and external aspects. For EMS/Injury Surveillance databases, external completeness reflects the portion of critical events (e.g., EMS runs, hospital

admissions, etc.) that are reported and entered into the databases. It is not possible to determine precisely external EMS/injury surveillance completeness because once can never know the how many critical events occurred but went unreported. internal completeness reflects the amount of specified information that is captured in individual EMS run records, State Emergency Department records, State Hospital Discharge File records, and State Trauma Registry File records. It is possible to determine precisely internal EMS/Injury Surveillance completeness. One can, for example, calculate the percentage of EMS run records in the database that are missing one or more critical data elements. The model performance measures offer three approaches to measuring completeness for each of the files:

I-C-1: The *percentage* of EMS patient care reports with no missing *critical* data elements. The State selects one or more EMS data elements it considers critical and assesses internal completeness by dividing the number of EMS run records not missing a critical element by the total number of EMS run records entered into the database within a period defined by the State.

I-C-2: The *percentage* of EMS patient care reports with no missing data elements. The State can assess overall completeness by dividing the number of records missing no elements by the total number of records entered into the database.

I-C-3: The *percentage* of unknowns or blanks in *critical* data elements for which unknown is not an acceptable value. This measure should be used when States wish to track improvement on specific critical data values and reduce the occurrence of illegitimate null values. E-code, for example, is an appropriate EMS/Injury Surveillance data element that may be tracked with this measure.

These measures of completeness are also applicable to the following files: State Emergency Dept. File, State Hospital Discharge File, State Trauma Registry File, and State Vital Records.

UNIFORMITY

Uniformity reflects the consistency among the files or records in a database and may be measured against an independent standard, preferably a national standard. The model performance measures offer one approach to measuring uniformity that can be applied to each discrete file using the appropriate standard as enumerated below.

I-U-1: The *percentage* of National Emergency Medical Services Information System-compliant data elements on EMS patient care reports entered into the database or obtained via linkage to other databases.

I-U-2: The *number* of National Emergency Medical Services Information System-compliant data elements on EMS patient care reports entered into the database or obtained via linkage to other databases.

The national standards for many of the other major EMS/Injury Surveillance database files are listed below:

EMS/Injury Surveillance File	Suggested Standard
State Emergency Department Discharge File	UB04
State Hospital Discharge File	UB04
State Trauma Registry File	National Trauma Data Standards
State Vital Records	National Association for Public Health Statistics and Information Systems

INTEGRATION*

Integration reflects the ability of records in the EMS database to be linked to a set of records in another of the six core databases—or components thereof—using common or unique identifiers.

I-I-1: The *percentage* of appropriate records in the EMS file that are linked to another system or file. Linking the EMS file to other files in the EMS/Injury Surveillance database or any of the five other core databases can provide important information. For example, a State may wish to determine the percentage of EMS records that link to the trauma file that are linked to the EMS file.

This measure of integration is also applicable to the following files: State Emergency Dept. File, State Hospital Discharge File, State Trauma Registry File, and State Vital Records.

ACCESSIBILITY*

Accessibility reflects the ability of legitimate users to successfully obtain desired data. The below process outlines one way of measuring the EMS file's accessibility:

I-X-1: To measure accessibility of the EMS file:

- **Identify the principal users of the EMS file**
- **Query the principal users to assess (a) their ability to obtain the data or other services requested and (b) their satisfaction with the timeliness of the response to their request**
- **Document the method of data collection and the principal users' responses**

For more detailed information on measuring accessibility, please see the in-depth discussion found in the introduction.

This measure of accessibility is also applicable to the following files: State Emergency Dept. File, State Hospital Discharge File, State Trauma Registry File, and State Vital Records.

CONCLUDING RECOMMENDATIONS

While use of the performance measures is voluntary, States will be better able to track the success of upgrades and identify areas for improvement in their traffic records systems if they elect to utilize the measures appropriate to their circumstances. Adopting the measures will also put States ahead of the curve should performance metrics be mandated in any future legislation.

The measures are not exhaustive. They describe what to measure and suggest how to measure it, but do not recommend numerical performance goals. The measures attempt to capture one or two key performance features of each data system performance attribute. States may wish to use additional or alternative measures to address specific performance issues.

States that elect to use these measures to demonstrate progress in a particular system should start using them immediately. States should begin by judiciously selecting the appropriate measures and modifying them as needed. States should use only the measures for the data system performance attributes they wish to monitor or improve. No State is expected to use a majority of the measures, and States may wish to develop their own additional measures to track State-specific issues or programs.

Once States have developed their specific performance indices, they should be measured consistently to track changes over time. Since the measures will vary considerably from State to State, it is unlikely that they could be used for any meaningful comparisons between States. In any event, NHTSA does not anticipate using the measures for interstate comparison purposes.

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