Mapping to MMUCC: A Process for Comparing Police Crash Reports and State Crash Databases to the Model Minimum Uniform Crash Criteria

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16. Abstract (MAXIMUM 200 WORDS)

The Model Minimum Uniform Crash Criteria (MMUCC) Guideline, Fourth Edition (2012), is a voluntary guideline designed to help States determine what crash data to collect on their police accident reports (PARs) and what data to code and carry in their crash databases.

The MMUCC Guideline does not provide States with guidance on implementation. States have their own data collection guidelines, which has resulted in substantial variation among States regarding how and what crash data is collected across jurisdictions and what data is maintained on their crash databases. States often use different formats and names for data elements and attributes or they may combine (or split) elements and attributes. As a result, it is very difficult to compare or share crash data among States, between State and Federal data sets, and—in some cases—even between different agencies within a State.

To assist States in evaluating their consistency with MMUCC, NHTSA and GHSA have developed a methodology for mapping the data collected on PARs and the data entered and maintained on crash databases to the data elements and attributes in the MMUCC Guideline. This methodology is intended to standardize how States compare both their PARs and their crash databases to MMUCC. The process recognizes that while State data systems often use different terminology and formatting, different data sets often can be mapped to the recommended MMUCC data elements and attributes.

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Contents

Executive Summary

The Model Minimum Uniform Crash Criteria (MMUCC) Guideline, Fourth Edition (2012), is designed to help States determine what crash data to collect. MMUCC recommends a specific minimum set of data elements and attributes to describe a crash. MMUCC was first developed in 1998, and since the enactment of Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), MMUCC has increasingly become a de facto crash data standard. Since 2009, MMUCC data elements have been part of the National Information Exchange Model (NIEM), which facilitates cross-platform information sharing. But because MMUCC is voluntary States often use different formats and names for data elements and attributes or they may combine (or split) MMUCC elements and attributes. As a result, it can be very difficult to compare or share crash data among States, between State and Federal data sets, and—in some cases—even between different agencies within a State.

To assist States in evaluating their consistency with MMUCC, NHTSA and GHSA have developed a methodology for mapping the data collected on PARs and the data entered and maintained on crash databases to the data elements and attributes in the MMUCC Guideline. This methodology is intended to standardize how States compare both their PARs and their crash databases to MMUCC. The process recognizes that while State data systems often use different terminology and formatting, different data sets often can be mapped to the recommended MMUCC data elements and attributes.

Mapping to MMUCC has been developed and revised through the application of the process and rules herein to State crash report forms and databases. The results gained from multiple applications of Mapping to MMUCC will be used to revise the existing MMUCC elements, and sharpened through use the mapping process methodology will be incorporated into the *Fifth Edition of the MMUCC Guideline*.

SECTION I - INTRODUCTION

1.1 Background

The Model Minimum Uniform Crash Criteria Guideline, Fourth Edition (2012),
(*MMUCC Guideline*) is a voluntary guideline designed to help States determine what
crash data to collect on their police accident reports (PARs) and what data to code and
carry in their crash database. It provides a minimal set of recommended data elements
and attributes[1] for reporting on motor vehicle crashes. The *MMUCC Guideline* was
developed collaboratively by the National Highway Traffic Safety Administration and the
Governors Highway Safety Association (GHSA), and other traffic safety experts.

The *MMUCC Guideline* does not provide States with guidance on implementation.
States have their own data collection guidelines. This has resulted in substantial
variation among States regarding how and what crash data is collected across
jurisdictions and what data are maintained on their crash databases. States often use
different formats and names for data elements and attributes or they may combine (or
split) elements and attributes. As a result, it is very difficult to compare or share crash
data among States, between State and Federal data sets, and—in some cases—even
between different agencies within a State. Consequently, States are encouraged, but
not required, to be more consistent with the elements and their attributes listed in the
MMUCC Guideline, both on the data elements and attributes collected on their PARs
and for those that are carried in their crash database. Greater standardization of crash
data would enable State highway safety agencies to:

- more easily and cost-effectively share data with other agencies in their States
  (such as public safety),
- compare their crash data with other States, and
- exchange crash data with Federal data systems.

1.2 MMUCC Contributes to National Data Standardization

The effort to standardize crash data has become part of a larger government-wide
activity to promote data sharing. As a result of 9/11, it became clear that for government

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[1] An element is a variable (or data field) that describes a specific aspect of a crash, e.g., when or where the crash
took place, who was involved or what the conditions were under which a crash occurred. In MMUCC, each element
has a definition, rationale, and set of possible values or attributes.

agencies at all levels to work together to address security concerns, they must be able to communicate more effectively. This vital need led the U.S. Departments of Justice and Homeland Security to develop the National Information Exchange Model (NIEM). NIEM facilitates cross-platform information sharing by providing a common format and data elements that allow participating agencies to exchange data while maintaining their own data systems. For example, implementing a NIEM-like structure for crash data would permit a fluid transfer between a unique data *source* (a State PAR), to a *target* data standard (MMUCC). Since the launch of NIEM in 2005, 19 Federal agencies and all 50 States and the District of Columbia have committed to using some component of NIEM. Information is exchanged using a common language (XML) and is organized into Information Exchange Documentation Packages (IEDP). A data set structure based on MMUCC Fourth Edition is available as a free downloadable IEPD through the NIEM Web site (release.niem.gov/niem/codes/mmucc/). The U.S. Department of Transportation (DOT) is a part of this effort and is working to establish a NIEM Surface Transportation Domain. More information about the information sharing environment can be found at ise.gov/building-blocks-content/justice-information-sharing-iepd-clearinghouse.

1.3 Purpose

To assist States in evaluating their consistency with MMUCC, NHTSA and GHSA have developed a methodology for mapping the data collected on PARs and the data entered and maintained on crash databases to the data elements and attributes in the *MMUCC Guideline*. This methodology is intended to standardize how States compare both their PARs and their crash databases to MMUCC. The process recognizes that while State data systems often use different terminology and formatting, different data sets often can be mapped to the recommended MMUCC data elements and attributes. Thus, if an element or attribute on a State PAR or in its crash database does not match a MMUCC element or attribute verbatim, but is essentially the same, it is assumed to be "mapped" to that MMUCC element or attribute.

A draft of the process included in *Mapping to MMUCC* was circulated to GHSA members and to the highway safety community and was discussed at a meeting following the 2014 Traffic Records Forum in St. Louis, MO. A subsequent draft of the Crash Database-to-MMUCC Mapping procedure was also circulated. In addition the PAR-to-MMUCC Mapping process was tested by two States using a spreadsheet developed by NHTSA to assist States in their MMUCC mapping effort.

1.4 Benefits of the Process

The process outlined in *Mapping to MMUCC* can be used by the States to identify where they diverge from MMUCC at both the element and attribute levels. The information they gain from the mapping process can be used to plan updates or revisions to their PAR or to their crash database. By evaluating how well their elements

and attributes map (or don't map) to MMUCC, the States can then determine, and prioritize, changes that could be implemented to increase their MMUCC conformance. Thus, it can give States a roadmap for implementing MMUCC, thereby encouraging greater standardization of crash data by all States.

In addition to the benefits listed above, a State following the process and mapping its PAR or its crash database to MMUCC could help NHTSA and GHSA improve MMUCC. By identifying and informing NHTSA and GHSA of which MMUCC elements and attributes are problematic for them, modifications to the *MMUCC Guideline* could be considered the next time the *MMUCC Guideline* is updated.

1.5 Overview of Mapping to MMUCC

There are three types of elements listed in the *MMUCC Guideline*: those to be collected at the scene (on a PAR); those to be derived from other elements (usually those collected at the scene); and those obtained by linking data collected at the scene to other data files maintained by the State.

Section II of *Mapping to MMUCC* is directed at mapping States' PARs to the 77 MMUCC data elements designated to be collected at the scene. This method, hereafter called the *Process,* maps (compares and matches) elements and attributes from the State PAR to these 77 MMUCC elements. It results in lists of which elements and attributes map (are of equivalent meaning) and which do not map. Although it can be done at any time the State deems necessary, the *Process* will be best used when a State evaluates and revises its PAR. Using information gained from mapping, States can determine which elements can be shared across systems and which cannot, as well as what to change if they wish to share additional elements

Section III of *Mapping to MMUCC* provides the process for mapping the elements and attributes on State crash databases to all 110 MMUCC elements. Data collected in its "raw" form, i.e., on PARs, is not very valuable unless made available in a usable form so they can be accessed and used analytically. Typically, this is done through a computerized database. While Section II directly addresses mapping to the 77 MMUCC elements that are typically found on State PARs, there are 33 additional MMUCC elements that are either derived from the 77 or obtained by linking some of these 77 elements to other data sources. These 33 elements are more commonly found in crash databases rather than on PARs. However, the methodology for the process is the same as that for mapping to the PAR. Consequently, the instructions included in Section II are not repeated in Section III. The mapping of a crash database to MMUCC must include all 110 MMUCC elements and must be done **independently** of the mapping of a PAR to MMUCC**.**

Section IV of *Mapping to MMUCC* contains instructions for computing MMUCC element mapping compatibility ratings and overall PAR-to-MMUCC and Crash Database-to-

MMUCC mapping compatibility ratings. Section V provides brief information about how the *Mapping to MMUCC* will inform future efforts to update the MMUCC Guideline.

NHTSA will provide assistance to States that wish to map either their PARs or their crash databases to MMUCC. States seeking assistance should contact their NHTSA Regional Office.

2. SECTION II - PROCESS FOR MAPPING STATE PARS TO MMUCC

2.1 Overview

The mapping process involves three steps: gather documentation, set up mapping tables, and execute a thorough review following mapping rules and notes. Each step is discussed in more detail.

2.2 Gather Documentation

Documentation for both the source and target data elements is required for mapping. The source domain documents include:

1) a PAR with all fields/variables and attributes;
2) an associated PAR overlay that lists available attributes per field; and
3) any instruction manual (or manuals) provided for that PAR, which clearly lists definitions for elements on the PAR as well as all available attributes per field.

The target domain document is the *MMUCC Guideline, Fourth Edition (2012)*.

2.2.1 Set up Mapping Tables

Mapping tables are used to compare the State PAR and MMUCC elements and attributes and are typically built in Excel but can be done with paper and pencil. NHTSA has developed an Excel spreadsheet, *MMUCC_Mapping_V4*, which can be used for this purpose. For convenience, this discussion and the example in Section III follow the form outlined in *MMUCC_Mapping_V4.*

In *MMUCC_Mapping_V4*, the 77 MMUCC elements are divided into separate worksheets by their MMUCC classification – **Crash** Data Elements, **Vehicle** Data Elements, and **Person** Data Elements. Within each worksheet:

- Column A – Lists the number of each MMUCC element, e.g., **C1**, in order.

- Column B – Lists the MMUCC element name, e.g., **Case Identifier**.

- Column C -- Lists all the MMUCC attributes for the MMUCC element.

  - **Note**: If the MMUCC element has subfields, Column C is the list of attributes for that first subfield of that element.

- Column D -- Provides a space to indicate whether the PAR had an element/attribute that mapped to that MMUCC element/attribute or not. A "1" is entered if the PAR element/attribute matches ("Yes"). A "0" is entered if the PAR does not have a matching element/attribute ("NO"). These entries are used to compute and provide the compatibility scores that will be discussed in Section III.

- Column E provides space for recording which element and attribute from the State's PAR mapped to that MMUCC element/attribute.

  Note: In the basic spreadsheet, the word "Test" is initially listed as the "Source." When using the spreadsheet, the State enters its name in the box shown in the "README" worksheet. The name will replace the word "Test" in all subsequent worksheets.

- Columns G, H, and I (and subsequent column groups) list MMUCC attributes for additional subfields of a MMUCC element, if that element has a multiple subfields.

- Column S computes the "% Mappable" for each MMUCC element. This is equivalent to the value "MMUCC Mapping Score" that is discussed in Section 4.2.1.

Note: *MMUCC_Mapping_V4* has the 33 MMUCC elements obtained by derivation or by linking to other State databases. Hence, when mapping a State crash database to MMUCC, it can be used to map all 110 MMUCC elements and their attributes. Crash Derived (CD) elements are listed in the "Crash" Worksheet following the Crash MMUCC element to be collected on the PAR. Similarly, the Person Derived (PD) and Linked (PL) elements follow the Person elements to be collected on a PAR in the "Person" worksheet. There is a separate worksheet, "Roadway" for the Roadway Linked (RL) elements.

Most State PARS will not match all MMUCC elements and attributes, and a certain amount of "cutting and pasting" will be required to align elements and attributes from a PAR to MMUCC. Specific guidance is offered in the mapping rules section.

2.2.2 Execute a Thorough Review Based on the Mapping Rules

Mapping is the process to determine how consistent a PAR is to MMUCC. The *Process* recommends a "top-down mapping" approach. Top-down mapping starts

with the data elements, and works down to attributes. Individual elements with zero attributes (i.e., VIN) either will map to a corresponding MMUCC element/attribute or will not. There is no partial mapping for these elements. However, elements with multiple attributes can partially map, if at least one State PAR attribute can be mapped to an attribute for that MMUCC element.

Many States have PARs that collect more data elements than are in MMUCC. This means that these additional data elements need not be mapped to MMUCC. Mapping is complete once it has been determined whether the PAR can map to the 77 MMUCC data elements and their associated attributes that are designated to be collected at the crash scene.

2.3 General PAR-to-MMUCC Mapping Rules

1. MMUCC assumes that States will collect data for all types of crashes, e.g., fatalities, serious injuries, non-motorist, commercial motor vehicle, etc. State data elements collected (or coded onto a crash database) for certain subsets of all crash types (e.g. only crashes involving a fatality) are to be **excluded** from the MMUCC mapping process.

2. The State PAR element name need not match the MMUCC element name, but the definition should be (essentially) the same. The reverse is not true. If a PAR element or attribute has the same name as a MMUCC element or attribute, the definitions must be the same for a match. Hence, it is strongly recommended that States do not map using name only.

3. Similarly, a State PAR element/attribute may be mapped to a MMUCC element/attribute even if the same term (or name) is not used as long as the State term is synonymous and unambiguous, or has the same definition.

4. An element/attribute on a State PAR that is "close enough" should not be mapped because it will be difficult for others to understand and will corrupt data integrity.

5. If the MMUCC element has multiple reporting iterations (subfields), the matching State element must have opportunities to code as many times as the MMUCC element has subfields.

   For example, the MMUCC element **Contributing Circumstances, Road (C15)** has three subfields: **Road Circumstances 1, Road Circumstance 2 and Road Circumstances 3**. If the State PAR only allows for the reporting of one Contributing Circumstance, Road, then the PAR would map only to the first subfield for MMUCC Element **C15** and would not map completely.

6. A single attribute of a State element may be mapped only to one MMUCC element/attribute.

   For example, suppose a State element "Roadway Conditions" has an attribute of "Snow." It may not be mapped to both the attribute "**Snow**" in MMUCC element **Weather Conditions (C11)**" and the MMUCC element **Roadway Surface Condition (C13)** attribute "**Snow.**" Because the State element is "Roadway Conditions," mapping to MMUCC Element **C13** may be more appropriate.

7. If a State element has an attribute that combines several terms (i.e., it has a broad definition), it may not be mapped to MMUCC element/attributes that are included in that broad definition.

   For example, a State's attribute "Frozen precipitation" may not be mapped to any of the four MMUCC element **Weather Conditions (C11)** attributes "**Snow**," "**Blowing Snow**," "**Sleet or Hail**," or "**Freezing rain or freezing drizzle**" because it does not distinguish between the four possibilities.

8. Two or more elements on a PAR may map to a single MMUCC element. For example, the MMUCC element **Restraint Systems/Motorcycle Helmet Use (P8)** may be listed as separate State elements, "Restraint Systems" (or "Occupant Protection") and "Motorcycle Helmet," on the State PAR.

9. If an element on a State PAR has attributes that map to attributes included in separate MMUCC elements, they are permitted to match to those attributes in those MMUCC elements (as long as individual State PAR element attributes are not mapped to more than one MMUCC element/attribute).

10. A State PAR data element that is reported as an open text field – the officer either writes in the information or types it in and is not limited to a specific set of possible values – may be used to map to a MMUCC element only if the PAR instruction manual clearly indicates what should be written/typed in the field.

11. PAR-to-MMUCC mapping is done only at the element/attribute level. If a MMUCC element/attribute is present on the PAR in some way, including as a "freeform" or "text" field, then the State element/attribute maps to the MMUCC element/attribute. The number of characters allowed shouldn't matter.

12. For a State element/attribute "Other" to map to a MMUCC element/attribute "Other," the State element must possess all of the specific attributes for the MMUCC element in question.

    For example, Subfield 1 of MMUCC element **Transported to First Medical Facility By (P28)** has the following attributes: **Not Transported, EMS Air, EMS Ground, Law Enforcement, Other,** and **Unknown**. If the State element being mapped has the first four MMUCC attributes, then the State attribute "Other" would map to the MMUCC "Other." But if the State element does not have an

attribute that mapped to **Law Enforcement**, then **Other** would also not map because the State "Other" includes **Law Enforcement** as a possible undefined value.

13. If a MMUCC element has both attributes **Other** and **Unknown**, then the State attribute "Unknown" (of the State element being mapped to this MMUCC element) will map only if the State element also has the attribute "Other," regardless of whether or not "Other" mapped. For the example cited in General Rule 12 (above), it does not matter if the State element being mapped has all five MMUCC attributes (including **Other**), only that the State element has an attribute "Other."

14. However, if a MMUCC element has the attribute **Unknown**, but does not have an attribute **Other**, then the situation is similar to that outlined in General Rule 12 for the attribute **Other**.

    For example, MMUCC element **Speeding Related (P13)** has the attributes **Racing, Exceeded Speed Limit, Too Fast for Conditions, No,** and **Unknown**. If the PAR element being matched has an attribute "Unknown," it must have matches to the first four MMUCC attributes exactly with no other attributes in order to have a match to Unknown.

15. If the list of element attributes on a PAR does not include a value for "Other" or "Unknown," they can be mapped to a the MMUCC element/attribute list if the instructions for completing the State PAR directs the officer to enter a code, e.g., "00," "99," "UNK," etc., in the event the appropriate response is "unknown" or falls into an "other" category.

2.4 Specific MMUCC Element Mapping Rules

2.4.1 Crash Elements:

C2. Crash Classification: State PARs may have a "Private Property" check box. This can be mapped with the first subfield (that is, not selecting "Private Property" would be equivalent to indicating that the crash occurred on public property). Additionally, if the State does not have a separate element to identify public vs private property, but has an element that classifies the location by the type of road on which the crash occurred, e.g., Interstate, Primary, Secondary, etc., then that element can be used to match to this subfield if it includes the attribute "Private Road" or something similar.

C3. Crash Date and Time: The State PAR may use separate crash date and crash time fields.

C6. Crash Location: To map to this MMUCC element, the State PAR needs to have at least one of the three location types listed in the *MMUCC Guideline* for this element – latitude and longitude coordinates, a linear referencing system (LRS), or a Link Node System. The State is permitted to use more than one method.

C7. First Harmful Event: To map to this MMUCC element, the State PAR MUST have a similar element at the crash level. This MMUCC element refers to the first harmful event occurring in the entire crash.

C9. Manner of Crash/Collision Impact: Diagrams of collision types are acceptable if what is diagrammed by the State unambiguously represents the same collision types as the corresponding MMUCC attributes and as explained in Appendix F of the *MMUCC Guideline*.

C10. Source of Information: The State will get credit for mapping to this MMUCC element if it allows only law enforcement personnel to complete crash reports.

C13. Roadway Surface Condition and **C15. Contributing Circumstances, Road**: Attributes from these elements should not be combined in one field.

C14. Contributing Circumstances, Environment: Weather conditions reported in a separate element corresponding to the MMUCC element **Weather Conditions (C11)** should not be counted for the "Weather Conditions" attribute of MMUCC element **Contributing Circumstances, Environment (C14)**.

C18. School Bus-Involved: The State PAR must have a similar element at the crash level. Having "School Bus" as a Vehicle Type should not be credited for either of the two "Yes" attributes. **School Bus-Involved (C18)** is intended to identify not just school buses involved in collisions, but also crashes indirectly involving school buses (e.g., children walking away or toward a school bus, or a car rear-ending another car stopped for a school bus).

C19. Work Zone Related: If the State PAR combines Subfield 4, **Workers Present** and Subfield 5, **Law Enforcement Present**, of this MMUCC element into one field, it must allow at least two entries since MMUCC is looking for both the presence of workers and of some type of law enforcement presence.

2.4.2 Vehicle Elements:

V2. Motor Vehicle Unit Type and Number: Most States will have "Unit Number" separate from "Unit Type." States with PARs that have the same attributes under separate elements can map these attributes to those in MMUCC element **Motor Vehicle Unit Type and Number (V2)**.

V3. Motor Vehicle Registration State and Year: State of registration and year of registration are often two separate fields on State PARs. This is acceptable.

V9. Total Occupants in Motor Vehicle: If the State PAR does not have a specific element equating to this MMUCC element, but requires that all vehicle occupants be recorded on the PAR (regardless of injury status), then the State is given credit for mapping to this element, since it can be "derived" by counting the number of vehicle occupants.

V13. Direction of Travel Before Crash: Arrow diagrams are sufficient if they clearly equate to the MMUCC attributes and follow the MMUCC definition of this element.

V16. Roadway Alignment and Grade: If the State PAR has an element that is a combination of Subfield 1, **Horizontal Alignment,** and Subfield 2, **Grade,** of this MMUCC element, for example, "uphill curve left," it will map to both subfields as long as all possible combinations (there are 15) are listed on the PAR. This requires each PAR attribute to be compared to the possible MMUCC subfield combined attributes to determine if any are missing. If the alignment attribute is "curve" but no direction is given, it will not be mapped for either Curve Left or Curve Right.

V19. Vehicle Damage: A State diagram may be used to report both Subfield 1, **Initial Contact Point on Vehicle,** as well as for Subfield 2, **Damaged Areas,** if the former is unambiguously identified. A State diagram may contain more than the recommended 12 points (as long as those points can be mapped to the MMUCC 12-point diagram), but the State diagram may not contain fewer points to map to MMUCC.

V20. Sequence of Events: MMUCC element **V20** includes non-harmful events as attributes, whereas State PARs may include only harmful events. If this is the case, the PAR will not match to the non-harmful MMUCC attributes. Also note that **V20** includes four subfields. Consequently, the State PAR must allow for four entries for its element to fully map to this MMUCC element.

V21. Most Harmful Event for this Vehicle: The State PAR must have a similar element for each vehicle involved for the PAR to match to this MMUCC element.

V22. Bus Use: Note that this MMUCC element describes use, not body type. So a State PAR that only lists motor vehicle body types such as "motorcoach" or "school bus" is not an acceptable mapping for those corresponding **Bus Use (V22)** attributes.

V24. Towed Due to Disabling Damage: A State PAR that has an element "Towed" as a checkbox or "Towed, Y/N" will map to this MMUCC element.

However, the attributes which map will depend on how the PAR instruction manual indicates that "Towed" is to be defined. If it means only "towed due to disabling damage" and not for other reasons, then it can only be mapped to the MMUCC attribute "**Towed Due to Disabling Damage.**" The State PAR cannot map to the other two MMUCC attributes. If the PAR instruction manual is unclear as to whether being towed is due to damage, then the State PAR can only map to the State PAR attributes "unchecked box" or "N" to the MMUCC attribute "**Not Towed**."

V27. Gross Vehicle Weight Rating / Gross Combination Weight Rating: For mapping purposes, a State PAR may either report the Gross Vehicle Weight Rating (GVWR) – the manufacturer's operational weight limit for a motor vehicle and any cargo – or the Gross Combination Weight Rating (GCWR) – the sum of all GVWRs for each unit in a combination unit motor vehicle, such as a truck tractor pulling a semi-trailer.

2.4.3 Person Elements:

P1. Name of Person Involved: The State PAR must have a place to record the name of EACH person involved in the crash including all drivers, all occupants, and all non-occupants. A "Driver Name" field alone is insufficient. Name fields in separate sections of the PAR, i.e., Driver section, Occupant section, etc., are acceptable

P2. Date of Birth: Note that the MMUCC definition for this element States that Subfield 2, **Age,** is "to be used only if the date of birth cannot be obtained." Consequently, if the State PAR has Subfield 1, **Date of Birth**, it need not have Subfield 2. **Age**.

P4. Person Type: If the State PAR has separate motorist and non-motorist sections, and in the non-motorist section it has separate attributes for pedestrians and pedalcyclists, then the State is given credit to mapping to this MMUCC element as **Person Type** can be derived.

P5. Injury Status: In accordance with the MAP-21 requirement that the U.S. DOT establish performance measures for reporting fatalities and serious injuries, the Federal Highway Administration (FHWA) released a Notice of Proposed Rulemaking on March 10, 2014, indicating that States will be required to use the definition of the MMUCC attribute, **Suspected Serious Injury (A),** of the MMUCC element **Injury Status (P5)** to report serious injuries (to be effective 18 months after the final rulemaking).

For that reason, a State PAR serious injury attribute equivalent (for example, "Incapacitating Injury") must have the same definition as the MMUCC attribute, **Suspected Serious Injury (A).** Other Injury Status attributes may be mapped to

MMUCC attributes using synonymous terms, such as "Dead" for "Fatal Injury (K)" or "Non-incapacitating Injury" for "Suspected Minor Injury (B)."

P7. Seating Position: A diagram is acceptable for mapping as long as all MMUCC position attributes are represented.

P10. Ejection: An "Ejected" checkbox or "Ejected, Y/N" is sufficient to map to this MMUCC element. However, the MMUCC ejection attributes to which the State PAR maps depends upon how PAR instruction manual defines "Ejected." For example, if "Ejected" means completely or totally ejected, then "Y" maps to the MMUCC attribute "**Ejected Totally**." The State PAR will not be able to map to any of the other MMUCC attributes for this element.

P11. Driver License Jurisdiction: An open text field is acceptable for mapping for the attribute "**State**." For an open text field to be acceptable for mapping to the other MMUCC attributes, the PAR instruction manual must indicate that a reporting officer may report the other specific jurisdiction types.

P12. Driver License Number, Class, CDL and Endorsements: This is commonly given as three or four different fields on a State PAR.

P13. Speeding Related: The State PAR must have a similar separate element to map. However, if it does not and one or more of these attributes is found under a "Contributing Circumstances," a "Contributing Factors," or a "Driver Actions" element, they may be mapped to this MMUCC element only if officers are not limited on the number of factors or circumstances they can report. If the PAR has an element "Speeding: Y/N" or equivalent, that PAR element can be mapped to this MMUCC element, but only the State attribute "No" can be mapped to the MMUCC attributes.

P14. Driver Action at Time of Crash: Driver Action attributes are sometimes included under Contributing Circumstances or other more general State elements. In such cases, State PAR attributes may be mapped to Driver Action at Time of Crash (P14) attributes, but will fully map only if at least four circumstances/factors/actions may be reported. It will map partially if fewer than four are reported.

P16. Driver Distracted By: State attributes equivalent to "No Apparent Distraction" or "None" may be mapped to the MMUCC attribute for this element "**Not Distracted**." "Cell Phone" by itself cannot be mapped to any MMUCC attribute. "Driver inattention" or "Inattentive" will not be mapped to any **Driver Distracted By (P16)** attributes.

P18. Law Enforcement Suspects Alcohol Use and **P20. Law Enforcement Suspects Drug Use:** A State PAR element that combines these two MMUCC

elements will not be mapped unless the reporting officer may unambiguously indicate whether alcohol or drug use or both is involved.

P19. Alcohol Test and **P21. Drug Test**: These elements, their subfields and associated attributes must be on the PAR in order to get credit for mapping. Test results are often obtained after completing and filing the PAR, in which case (until result is obtained), Subfield 3 on the PAR, **BAC Test Result** or **Drug Test Result**, would be coded "Pending."

P22. Non-Motorist Number: A State PAR that does not have a designated non-motorist number, but counts a struck non-motorist as a unit that is given a unit number, may be mapped to this element as long as it is possible to distinguish non-motorists from vehicles (such as by person type) and to distinguish each individual non-motorist.

P23. Non-Motorist Action/Circumstance Prior to Crash and **P24. Non-Motorist Actions/Circumstances at Time of Crash**: If the State PAR combines these MMUCC elements as one State PAR element, it will map (to both elements partially) only if the PAR permits coding of at least three actions/circumstances (because of the subfields in these MMUCC elements). To map completely the State PAR needs a separate field for **Going to or from School (K12)** (Subfield 2 of MMUCC Element **P23**.).

P25. Non-Motorist Location at Time of Crash: **Non-Motorist Location (P25)** should not be mapped based on a State PAR Non-Motorist Action or Circumstance element. For mapping purposes, the State PAR must have a specific Non-Motorist Location element ("at Time of Crash" is not necessary).

P26. Non-Motorist Safety Equipment: Some or all of the attributes of this MMUCC element may be listed under a more general State PAR element that combines motorist and non-motorist equipment. This is acceptable as long as the Person Type for the reported individual is unambiguously a non-motorist.

2.5 PAR-to-MMUCC Mapping Example:

For the purposes of explaining the mapping process and rules, the following example will map a PAR data element 'Weather Condition' to the MMUCC element **Weather Conditions (C11)**.

2.5.1 Step 1 – Source and Target Documents

Collect both source and target documents. The relevant excerpt of each is shown below.

2.5.2 Step 2 – Set up a Mapping Table

Set up a mapping table so that data elements and attributes from both the *MMUCC Guideline* and the PAR are arranged for ease of comparison.

Crash Data Elements								
A	B	C	D	E	F	G	H	I
	Target Data: MMUCC		Ability to Map? 1 = Yes 0 = No	Source: State PAR		Target Data: MMUCC	Ability to Map? 1 = Yes 0 = No	Source: State PAR
	Data Element	Data Attribute (Subfield 1)		Data Element*/ Data Attribute		Data Attribute (Subfield 2)		Data Element / Data Attribute
C11	Weather Conditions	Clear		(1) No Adverse Condition (Clear, Cloudy)		Clear		
		Cloudy		(3) Fog		Cloudy		
		Fog, Smog, Smoke		(4) Mist		Fog, Smog, Smoke		
		Rain		(5) Rain		Rain		
		Sleet or Hail		(6) Snow		Sleet or Hail		
		Freezing Rain or Freezing Drizzle		(7) Sleet/Hail		Freezing Rain or Freezing Drizzle		
		Snow		(8) Smoke/ Dust		Snow		
		Blowing Snow		(9) Other		Blowing Snow		
		Severe Crosswinds		(10) Blowing Sand, Soil, Dirt, or Snow		Severe Crosswinds		
		Blowing Sand, Soil, Dirt		(11) Severe Crosswinds		Blowing Sand, Soil, Dirt		
		Other						
		Unknown						

*To save space, the name and number of the State element, **Weather Condition**, **C2**, are not listed in the table.

2.5.3 Step 3 – Map the Attributes

Map the data attributes from the PAR to the MMUCC Attributes.

The PAR attribute "**(1) No Adverse Condition (Clear, Cloudy)**" cannot be mapped to the MMUCC attributes "**Clear"** or "**Cloudy"** because the PAR combines these MMUCC attributes.

Likewise, the PAR attribute "**(10) Blowing Sand, Soil, Dirt, or Snow**" from the PAR cannot be mapped to the MMUCC attributes "**Blowing Snow"** or "**Blowing Sand, Soil, Dirt**."

However, the PAR attributes "**(3) Fog**," and "**(8) Smoke/Dust**" can be mapped to the MMUCC attribute "**Fog, Smog, Smoke**," without a loss in data integrity.

Four attributes from the State PAR were mapped "one-to-one" to a MMUCC attribute.

The PAR did not have an attribute to map to the MMUCC attribute "**Unknown."**

MMUCC included two subfields for **Weather Conditions (C11)**, reporting the same 12 attributes in each subfield. However, the PAR collects only one value. Thus, the PAR did not match to any of the Subfield 2 attributes and "0" scores were entered.

A	B	C	D	E	F	G	H	I
		Target Data: MMUCC	Ability to Map? 1 = Yes 0 = No	Source: State PAR		Target Data: MMUCC	Ability to Map? 1 = Yes 0 = No	Source: State PAR
	Data Element	Data Attribute (Subfield 1)		Data Element* / Data Attribute		Data Attribute (Subfield 2)		Data Element / Data Attribute
C11	Weather Conditions	Clear	0	(1) No Adverse Condition (Clear, Cloudy)		Clear	0	
		Cloudy	0	(1) No Adverse Condition (Clear, Cloudy)		Cloudy	0	
		Fog, Smog, Smoke	1	(3) Fog (8) Smoke / Dust		Fog, Smog, Smoke	0	
		Rain	1	(5) Rain		Rain	0	
		Sleet or Hail	1	(7) Sleet / Hail		Sleet or Hail	0	
		Freezing Rain or Freezing Drizzle	0	n/a		Freezing Rain or Freezing Drizzle	0	
		Snow	1	(6) Snow		Snow	0	
		Blowing Snow	0	(10) Blowing Sand, Soil, Dirt, or Snow		Blowing Snow	0	
		Severe Crosswinds	1	(11) Severe Crosswinds		Severe Crosswinds	0	
		Blowing Sand, Soil, Dirt	0	(10) Blowing Sand, Soil, Dirt, or Snow		Blowing Sand, Soil, Dirt	0	
		Other	0	(9) Other		Other	0	
		Unknown	0	n/a		Unknown	0	

*To space, the name and number of the State element, **Weather Condition**, **C2**, are not listed in the table.

As a result, of the 24 total attributes for this MMUCC element (there are 12 MMUCC Attributes for each of two subfields) this PAR can only be mapped to five attributes.

3. SECTION III - PROCESS FOR MAPPING STATE CRASH DATABASES TO MMUCC

3.1 Overview of Process

The overall purpose of MMUCC is to provide a minimal set of data elements that can be used to explain and evaluate the status of highway safety within a State, and enable comparisons of those results with those from other States. In order to do this evaluation, data collected (and derived or linked) must be entered into to some form of a crash database. Using current technology, this crash database is typically some form of computerized or electronic file.

The purpose of this section in "*Mapping to MMUCC*" is to map the elements and attributes carried in a State's database that is comprised of the corresponding data collected on PARs and obtained from other sources. The elements and attributes contained in a State's crash database should be mapped to all 110 MMUCC elements and their attributes.

As stated in the Introduction, the *MMUCC Guideline, Fourth Edition,* is partitioned into 77 elements that are intended to be collected at the crash scene (on PARs) as well as 33 elements that are to be obtained by either deriving them from those 77 elements or by linking and obtaining them from other State maintained databases. These are divided into four types: Crash, Vehicle, Person and Roadway Linked or Derived Elements.

3.1.1 Crash Data Elements Derived From Collected Data (CD Elements)

These are data elements that are not generally collected by law enforcement at the scene but are derived from computerized crash scene information. Depending on the system used, they could be derived automatically by electronic data collection systems or they could be generated when the data are computerized and merged at the local, regional or State level. There are 9 **CD Elements.**

3.1.2 Person Data Elements Derived From Collected Data (PD Element)

This data element is easily generated after the crash data are collected at the scene and computerized. Depending on the system used, it could be derived automatically by

electronic data collection systems, or it could be generated when data are merged at the local, regional and/or State level. There is one **PD Element**.

3.1.3 Person Data Elements Obtained After Linkage to Other Data (PL Elements)

Person "linked" data elements are obtained after linkage to crash, driver history, injury and/or other State data. When a State does not have the capability to link to other State data, as many of the person "linked" data elements as possible should be collected at the scene. There are six **PL Elements.**

3.1.4 Roadway Data Elements Obtained After Linkage to Other Data (RL Elements)

Roadway data elements are generated by linking crash to roadway inventory and highway data. The data elements used for linkage include **Crash Location (C6)** and others as necessary depending upon the type of roadway inventory system implemented by the State**.** When a State does not have a roadway inventory, as many of the data elements as possible should be collected at the scene. There are 17 **RL Elements**.

3.2 Required for Mapping a State Crash Database to MMUCC

- State Crash Data Dictionary
- State PAR and Police Instruction Manual (optional)

The data dictionary for the State crash database should list all data elements and element attributes used in the crash database. The police accident report form and police instruction manual are not needed for mapping if the data dictionary contains all relevant terms and definitions.

Note: How data is obtained does not affect mapping

As mentioned previously, MMUCC categorizes data elements into the 77 Crash, Vehicle, and Person Elements collected at the crash scene and the 33 elements according to a recommended means of derivation. The means by which a data field is populated – from data reported from the scene of the crash on a PAR, from data gained through linkage to another database, or data derived from other data fields – is irrelevant for mapping purposes when mapping MMUCC to the crash database. The presence of a State data element and its associated

attributes that match to a MMUCC element and its attributes is sufficient to enable its mapping. Examples of possible acceptable non-conventional State crash database sources include: 1. Obtaining **PL4. Injury Area** from the State PAR (collected at the scene); 2. Deriving **P28. Transported to First Medical Facility By** through linkage to an EMS or hospital record; and 3. Obtaining **RL17. Total Volume of Entering Vehicles** through a combination of **RL6. Annual Average Daily Traffic** and **C6. Crash Location**.

3.3 State Crash Database-to-MMUCC Mapping Process

The process for mapping a State crash database to MMUCC follows the same process used for mapping a State PAR to MMUCC. Consequently, all of the discussion in Section II (pages 9 to 18) applies to mapping the crash database to MMUCC, except that the State crash data dictionary is to be used primarily (or exclusively) instead of the PAR for the mapping compatibility comparison. Thus, **all of the General PAR-to-MMUCC Mapping Rules and Specific Element Mapping Notes listed in Section II (pages 11 to 18) also apply to mapping a State crash database to MMUCC and will not be repeated in this section.** Whenever the Rule or Note in Section I refers to "a State PAR," it should be read as "a crash database" when applied to mapping the State crash database to all 110 MMUCC Elements.

Since elements collected on a PAR may not be captured or coded into a State's crash database, especially those that are text based, the State crash database is to be mapped to MMUCC independently of the State's PAR-to-MMUCC Mapping.

In addition to the Specific Mapping Notes for the MMUCC Crash, Vehicle and Person Elements (the 77 MMUCC elements recommended to be collected at the scene and are to be carried in the State crash database), the following mapping notes pertain to the 33 data elements that MMUCC recommends be derived or obtained through linkage:

3.4 State Crash Database-to-MMUCC Mapping – General Rules

1. If a State crash database does not carry a MMUCC derived element, but carries the MMUCC element that would allow the value to be determined, then the State can be given credit for mapping to this derived element. The State must demonstrate through its documentation that the element used to derive is present for *each case* on the database. For example, if a State does not calculate CD9 Day of Week, it can derive that information through CD3 Crash Date and Time, if carried on the crash database for all cases.

2. If the State does not carry linked elements on its crash database, but can demonstrate though its documentation that appropriate linkage elements are accessible to the crash database that would permit linkage for *each case* on the database, then the State may be given credit for mapping to those linked elements. For example, if the State can access data for all roadways (State and local) so that it can be linked to the crash database, then the State should get credit for mapping under the 17 Roadway Linked Elements.

3.5 Specific MMUCC Element Mapping Notes

3.5.1 Crash Data Elements Derived From Collected Data (CD Elements)

CD1. Crash Severity: This MMUCC element is expected to be derived from the maximum value of **Injury Status (P5),** or the State's equivalent to **P5**, for each person involved in the crash. However, it could be obtained through linkage to a record in a non-crash database of all injuries occurring in a given crash (e.g. emergency department database).

CD5. Number of Non-Fatally Injured Persons: This MMUCC element is intended to include not only persons who are coded as having sustained suspected serious (A) or suspected minor (B) injuries (or State equivalent terms), but also persons coded as having sustained possible injuries (C) as indicated in the MMUCC element **Injury Status (P5).**

CD7. Alcohol Involvement: A State data element that is mapped to MMUCC element **Law Enforcement Suspects Alcohol Use (P18)** or a State data element that maps to **Alcohol Test (P19)** cannot also be used to map to **CD7.** MMUCC intends **CD7** to be a separate element on the State crash database derived from **P18** and **P19**.

CD8. Drug Involvement: Similar to **CD7**, State elements that map to either **Law Enforcement Suspects Drug Use (P20)** or **Drug Test (P21)** cannot also map to **CD8**. There must be a separate element on the State crash database equivalent to **CD8**.

3.5.2 Person Data Elements Derived From Collected Data (PD Element)

PD1. Age: If the State collects age only, and not date of birth, this may be used to map to both Subfield 2 of **Date of Birth (P2)** and to PD1.

3.5.3 Person Data Elements Obtained After Linkage to Other Data (PL Elements)

PL3. Drug Test Result: As with **Alcohol Test (P19)**, Subfield 3, **BAC Test Result**, this data element may be entered directly on the PAR rather than being obtained through linkage. Mapping credit is given when the test results can be mapped into the MMUCC Drug Categories (attributes) listed, and four results (subfields) are carried on the State crash database.

PL6. Injury Severity: Note that this MMUCC element is explicitly intended to be obtained through linkage to clinical health records. A State data element that maps to **Injury Status (P5)** cannot also be used to map to **PL6**. The value(s) used here must be derived from the clinical scale used in the State's linked injury database.

3.5.4 Roadway Data Elements Obtained After Linkage to Other Data (RL Elements)

All Roadway data elements require linkage between the State's element mapping to the MMUCC element **Crash Location (C6)** and the State's Roadway Inventory database.

MAP-21 requires States to collect a subset of the Model Inventory of Roadway Elements (MIRE) to support their safety programs. In a proposed rulemaking, the FHWA has identified 37 or 38 MIRE Elements – known as the Fundamental Data Elements (FDEs) -- that are critical for States to collect on all public roads. States are not required to report these data elements to FHWA but must use them in their safety planning process.

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4. SECTION IV - COMPUTING COMPATIBILITY SCORES AND RATINGS

Once completed, a State PAR-to-MMUCC mapping or a State crash database-to-MMUCC mapping will yield a series of mapping tables that will show which State PAR elements and attributes mapped to each MMUCC element and attribute and which did not.

These tables can be used by the State to evaluate which of the MMUCC elements and their attributes on its PAR or crash database elements mapped best, which did not map very well, and which were not mapped at all.

The tables can also be used to compute first a MMUCC Element Mapping Compatibility Rating for each MMUCC element and then an Overall PAR-to-MMUCC Mapping Compatibility Rating or an Overall Crash Database-to-MMUCC Mapping Compatibility Rating.

Note: If the State chooses to use the NHTSA MMUCC Mapping Spreadsheet (*MMUCC_Mapping_V4)***, each of the scores and ratings described in this Section will be calculated automatically.**

4.1 MMUCC Element Mapping Score and Compatibility Rating

For each of the MMUCC elements, whether done in a PAR-to-MMUCC mapping or in a crash database-to-MMUCC mapping, the MMUCC Element Mapping Score is defined as:

$$\text{MMUCC Element Mapping Score} = \frac{\text{Number of Attributes for State PAR Element that Map to MMUCC Element}}{\text{Total Number of MMUCC Attributes for Element*}} * 100$$

*NOTE: If a MMUCC element has subfields, the value for "Total Number of MMUCC Attributes for Element" is the sum of the number of attributes across all off the subfields.

Table 1 provides a suggested Compatibility Rating Scale to be applied to each MMUCC element based on the MMUCC Element Mapping Score to provide a measure of how well the State PAR mapped to individual MMUCC elements.

Table 1 MMUCC Element Compatibility Rating Scale	
MMUCC Element Mapping Score	**Rating**
100	Full
70 – 99	High
40 – 69	Moderate
1 – 39	Low
0	Missing

For the PAR-to-MMUCC mapping example shown on pages 14-16:

$$\text{MMUCC Element Mapping Score} = \frac{\text{Number of Attributes for State PAR Element that Map to MMUCC Element}}{\text{Total Number of MMUCC Attributes for Element*}} * 100$$

$$= \frac{5}{24} * 100 = 20.83$$

The State's rating for mapping to MMUCC Element **C11** would be "**Low**."

4.2 Overall PAR-to-MMUCC Mapping Compatibility Rating

A State's **Overall PAR-to-MMUCC Mapping Compatibility Rating** is based on the number of target element attributes (MMUCC) that were mapped from the source (the State's PAR). Consequently, a score must be computed for each of the 77 MMUCC elements designated to be collected at the crash scene. This rating provides the State with a generalized score as to how well its PAR maps to MMUCC.

An **Overall PAR-to-MMUCC Mapping Compatibility Rating** is calculated by adding the **MMUCC Element Mapping Scores** for all 77 MMUCC elements to be collected on a PAR and divide by 7,700:

$$\text{Overall PAR-to-MMUCC Mapping Score} = \frac{\sum \text{MMUCC Element Mapping Score}}{7,700} * 100$$

(77 MMUCC Elements)

Table 2 provides a suggested Compatibility Rating Scale that can be applied to the **Overall PAR-to-MMUCC Mapping Score** to obtain a measure of how well the State's PAR mapped to MMUCC:

Table 2 PAR-to-MMUCC Mapping Compatibility Rating Scale	
PAR-to-MMUCC Mapping Score	Rating
100	Full
70 – 99	High
40 – 69	Moderate
1 - 39	Low

4.3 Overall Crash Database-to-MMUCC Mapping Compatibility Rating

A State's **Overall Crash Database-to-MMUCC Mapping Compatibility Rating** is based on the number of target element attributes (MMUCC) that were mapped from the source (the State's crash database). Consequently, a score must be computed for each MMUCC element. Keep in mind that the crash database must be mapped independently to MMUCC and all 110 MMUCC elements are the target. This rating provides the State with a generalized score as to how well its crash database maps to MMUCC.

An **Overall Crash Database-to-MMUCC Mapping Compatibility Rating** is calculated by adding the **MMUCC Element Mapping Scores** for all 110 MMUCC elements that are designated to be carried in a State's crash database PAR and divide by 11,000:

$$\text{Overall Crash Database-to-MMUCC Mapping Score} = \frac{\sum \text{MMUCC Element Mapping Score}}{11,000} * 100$$

(110 MMUCC Elements)

Table 3 provides a suggested Compatibility Rating Scale that can be applied to the **Overall Crash Database-to-MMUCC Mapping Score** to obtain a measure of how well the State's crash database mapped to MMUCC:

Table 3 Crash Database-to-MMUCC Mapping Compatibility Rating Scale	
Crash Database-to-MMUCC Mapping Score	Rating
100	Full
70 – 99	High
40 – 69	Moderate
1 - 39	Low

Once a State has calculated its element and overall scores, it should develop an action plan to update the PAR and database. Since it may not be possible or desirable to update everything, the State may choose to prioritize the elements that most need to be revised.

5. SECTION V - MAPPING AND UPDATING MMUCC

MMUCC is updated every five years, and the next update is scheduled to begin in calendar year 2016. Information gained from the mapping of State crash data to MMUCC will help determine what changes will be made to the Fourth Edition data elements, and the mapping process methodology will be incorporated into the *Fifth Edition of the MMUCC Guideline*.

States can benefit from applying *Mapping to MMUCC*, identifying how their State crash data can be made more compatible with MMUCC, which will improve their ability to exchange data. The greater traffic safety community will benefit also as more States apply *Mapping to MMUCC,* leading to State crash data becoming more uniform and MMUCC improving to better reflect the best in State crash data collection.

GHSA and NHTSA hope that States that wish to apply *Mapping to MMUCC* share their comments, questions and suggestions. States that have questions or feedback concerning *Mapping to MMUCC* or would like assistance in conducting a MMUCC mapping should contact GHSA or their NHTSA regional office. The State PAR to MMUCC Mapping Spreadsheet is available online at www.ghsa.org/html/files/xls/MMUCC_Mapping.xlsx.

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