

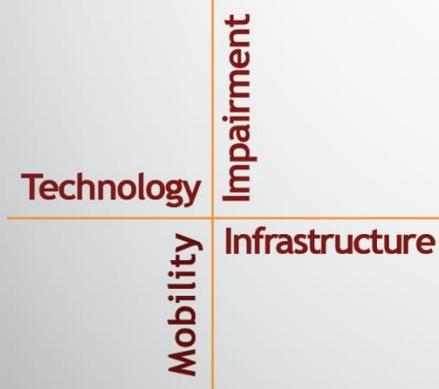
NSTSCCE

National Surface Transportation Safety Center for Excellence

Common Data Elements between the Large Truck Crash Causation Study Investigations and Commercially Available Onboard Monitoring Systems

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EXECUTIVE SUMMARY

At the heart of traffic safety is the identification of factors that lead to crashes. With this knowledge, interventions can be developed to mitigate or prevent these factors from occurring in the future. Post hoc reconstructions of crashes (e.g., the Large Truck Crash Causation Study; LTCCS) and naturalistic driving studies have provided information on crash genesis. However, there is another source of driving data that is currently untapped. Today, numerous commercial vehicle fleets, transit fleets, and personal vehicles use onboard safety monitoring (OBSM) systems to monitor and improve driving behavior. Data from these video-based OBSM systems could be used by researchers to learn more about crash genesis and address some of the limitations inherent in post-crash reconstruction. This study created a data directory of common data elements in the LTCCS, commercially available, video-based OBSM systems, and other public sources to be used together to provide researchers with more valid and reliable information on crash genesis.

Researchers used the LTCCS codebook as the structure of the new data directory. The LTCCS variables were analyzed by a trained researcher, who determined whether the variable could be collected with an OBSM system or through related information by using one of three responses: yes, no, and maybe. Lytx™ and SmartDrive were used as comparison OBSM system vendors to determine the kind and types of data they can capture. Other related sources such as Police Accident Reports (PARs) were used as possible sources of information for each variable when relevant. If a variable was labeled as “MAYBE,” the conditions under which the variable could be captured by a video-based OBSM system or through related information were outlined.

Analysis determined that approximately half of all 802 variables in the LTCCS codebook could be captured using video-based OBSM systems and related information. In addition, another almost 30% of the variables were labeled as “MAYBE.” An analysis of the data collected in the actual LTCCS revealed that only 75% of the crashes had data and 48% of the variables had the option to be coded as “unknown.” Based on the results in the current report, it appears that the use of OBSM systems and other data sources could yield a similar amount of data as that obtained by data analysts in the LTCCS.

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LIST OF ABBREVIATIONS AND SYMBOLS

AASHTO	American Association of State Highway and Transportation Officials
ABS	Antilock Brake System
ACD	AAMVAnet Code Dictionary
AIS	Abbreviated Injury Scale
BAC	Blood Alcohol Concentration
CDC	Collision deformation classification
CDLIS	Commercial Driver's License Information System
CDS	Crashworthiness Data System
CMV	Commercial motor vehicle
DMV	Department of Motor Vehicles
DOT	Department of Transportation
FMCSA	Federal Motor Carrier Safety Administration
GCS	Glasgow Coma Scale
GVWR	Gross vehicle weight rating
ITS	Intelligent Transportation Systems
LTCCS	Large Truck Crash Causation Study
MCMIS	Motor Carrier Management Information System
MVMT	Million Vehicle Miles Travelled
ND	Naturalistic driving
NHTSA	National Highway Traffic Safety Administration
OBSM	Onboard safety monitoring
OEM	Original equipment manufacturer

PAR	Police Accident Report
PSU	Primary sampling units
RPM	Revolutions per minute
SAFER	Safety and Fitness Electronic Records
SEA	Safety Evaluation Area
TCD	Traffic control device
TDC	Truck deformation classification
VHR	Vehicle history report
VIN	Vehicle Identification Number

CHAPTER 1. INTRODUCTION

BACKGROUND

In 2012, large trucks (gross weight greater than 10,000 lbs.) were involved in 333,000 vehicle crashes in the United States.⁽¹⁾ Out of these crashes, 3,802 were fatal, resulting in 3,921 fatalities. The rate of large trucks involved in fatal crashes in 2012 was 1.42 per 100 million vehicle miles traveled (MVMT), which was larger than the passenger vehicle rate of 1.31 per 100 MVMT.⁽¹⁾ Given their size and weight, large trucks pose a danger to all those who share our nation's roadways. Eighty-two percent of all fatalities involving large trucks result in persons other than the driver of the large truck being killed. Current rates of fatal crashes involving large trucks are far lower than 10 years ago (2.31 fatal crashes per 100 MVMT), but to continue the downward trend in truck crashes, detailed information on crash genesis and development must be investigated further. In 2006, the Federal Motor Carrier Safety Administration (FMCSA) and the National Highway Traffic Safety Administration (NHTSA) collaborated on conducting the Large Truck Crash Causation Study (LTCCS) to investigate large truck crash genesis.

Large Truck Crash Causation Study (LTCCS)

The LTCCS examined the reasons for serious crashes involving large trucks in the United States. The study was based on a nationally representative sample of nearly 1,000 injury and fatal crashes involving large trucks that occurred between April 2001 and December 2003.⁽²⁾ For each crash, detailed descriptions were collected on almost 1,000 elements, such as the condition of the truck, driver, and roadway, as well as the trucking companies involved. These data were gathered from physical reconstructions and interviews with drivers and witnesses in the crashes as soon as possible after a crash occurred. Truck inspectors also investigated the crash by inspecting the vehicles involved, logbooks, and relevant documentation. Using these methods, the LTCCS was able to gather in-depth information on a large number of serious truck crashes in the United States. However, no matter how detailed and thorough these investigations were, this approach still involved the collection of data after the crash occurred (i.e., post-crash reconstruction). Crash investigation, no matter how thorough and in-depth, has the inherent limitation of being an "after-the-fact" reconstruction rather than direct observation. Drivers may be less than truthful about what they were doing prior to the crash and they may have limited recall due to the time passed and/or injuries received in the crash. Witness testimony has the same issues. These issues limit the accuracy of pre-crash driver behavior and related information compared to direct observation. Naturalistic driving (ND) data collection can act as a form of direct observation and eliminate the limitations in post-crash reconstruction.

Naturalistic Driving Data

ND data collection involves instrumenting a vehicle with cameras and sensors that record all driving behavior while the vehicle is on and in motion. This type of data collection can provide various information on exactly what happened leading up to, during, and after the crash depending on what type of sensors the vehicle is equipped with and the location of the video cameras. The video captured through this process allows for detailed assessment of driver behaviors and the kinematics (driver inputs) associated with the crash. Collecting ND data continuously allows for the collection of baseline data (when the vehicle is not in a crash

situation). However, instrumenting vehicles for ND data collection can be time consuming, cost prohibitive, and yields few high-severity incidents since crashes are rare. However, there are commercially available sources of ND data from onboard safety monitoring (OBSM) systems that collect data from tens of thousands of trucks that could address these limitations (e.g., yield thousands of yearly crashes in a time-efficient and cost-effective manner).

Onboard Safety Monitoring Systems

Today, numerous commercial vehicle fleets, transit fleets, and personal vehicles use OBSM systems to help monitor and improve driving behavior. Lytx™ and SmartDrive are two leading video-based OBSM systems installed in thousands of commercial vehicles around the world. Figure 1 shows the two camera-based event recorders for Lytx and SmartDrive (left and right, respectively). If available to researchers, data from these video-based OBSM systems could be used to learn about crash genesis and address some of the limitations in post-crash reconstruction.



Figure 1. Photo. Image of the Lytx (left) and SmartDrive event recorders (right).

These commercially available OBSM systems collect and store driving data only if there has been a triggering event, such as a hard brake or swerve that exceeds a predetermined threshold. In-cab feedback is given to the driver regarding his/her driving behavior, usually in the form of a light that indicates an event has been saved and/or gives a measure of overall driving performance over a trip. Once a triggered event has been saved, video of the driver and the forward roadway, along with audio and kinematic data of several seconds before and after the trigger, is sent to data analysts at the OBSM company. These analysts review and record what took place during the event, including driver behaviors. If the event is deemed to include safety-relevant information, the video is uploaded to a secure website where fleet personnel can review the videos and coach the driver to improve the driver's driving skill. Figure 2 shows a flowchart of this process.



Figure 2. Diagram. Schematic of the coaching process (adapted from Lytx).

Currently, the number of variables coded by OBSM vendors is limited. The OBSM vendors require a quick turnaround on video analysis in order for the results to be returned to the client (and possibly used to coach drivers) in a timely manner. In order to accomplish this given the large volume of data, they use a simple coding scheme that facilitates large volumes of throughput. However, these vendors typically do not code crashes for liability concerns (the video is made available to the client without reduction). As the video and kinematics data are an “instant replay” of the crash, more in-depth coding is possible using the data collected by video-based OBSM systems. Thus, this data could be coded with similar variables as those used in the LTCCS and other crash databases to learn more about the genesis of large truck crashes.

SUMMARY OF CURRENT STUDY

This study created a data directory of common data elements in the LTCCS, commercially available, video-based OBSM systems, and other public sources so that these information sources could be integrated to provide researchers with more valid and reliable information on crash genesis.

CHAPTER 2. METHODOLOGY

LTCCS CODEBOOK

The LTCCS codebook, developed by the U.S. Department of Transportation, was used as the “gold standard” to create the new data directory of common elements (between the LTCCS and video-based OBSM vendors). More specifically, the data variables in the LTCCS were used as the basis for all comparisons. The LTCCS codebook was used in the LTCCS by inspectors at the crash scene and in the related crash investigations and assessments. The LTCCS data were collected in two stages. The first stage was sampling by geographical areas within the United States. These samples were called the primary sampling units (PSUs).⁽²⁾ The second stage sampled crashes from within each PSU if they met two criteria: (1) involved at least one large truck with a gross weight over 10,000 pounds, and (2) involved at least one fatality, incapacitating, or non-incapacitating but evident injury. All data that were collected during these investigations were combined with the Motor Carrier Management Information System (MCMIS) crash and inspection files, which contained records of crashes reported by each state. The LTCCS codebook also contained variables that were gathered from FMCSA’s Safety and Fitness Electronic Records System database (SAFER). The SAFER database evaluates the fitness of motor carriers and their history of crashes, violations, inspections, and safety reviews. The data in SAFER are collected from interstate carrier data and existing government motor carrier safety cases, such as vehicle registration data. All LTCCS codebook variables were organized into 43 data sets. For example, the variables that describe the class of roadway, light conditions, traffic control, etc. are all grouped into a data set labeled “Environment” (as they all give information on the physical parameters of the roadway near the crash).⁽³⁾ The LTCCS codebook contained a total of 802 variables organized into the 43 data sets. Table 1 shows the 43 data sets and the number of variables contained in each data set.

Table 1. LTCCS data set titles and the number of variables in each data set.

Data Set	Number of Variables	Data Set	Number of Variables
Airbags	22	MCMIS Driver Data	6
Brakes	11	MCMIS Violation Data	4
Cargo Shift Assessments	28	Non-Motorists	20
CDC Crush	20	Occupants	60
Crash	16	Overview	32
Crash Assessment	13	PAR Violations	2
Crash Discussion	1	SAFER Authority Status	3
DMV Violation	8	SAFER Carrier	20
Driver Assessment	54	SAFER Crash Summary	4
Driver Decision Aggression	29	SAFER Driver Crash Report	29
Driver Drugs	4	SAFER Driver Inspection	7
Driver Health	27	SAFER Driver Violation	4

Data Set	Number of Variables	Data Set	Number of Variables
Driver Recognition Distraction	24	SAFER Inspections Summary	13
Driver Sleep	19	SAFER Insurance	8
Environment	36	SAFER Review	4
Events	7	Safe Stat	8
Factor Assessment	65	Truck Exterior	27
General Vehicle	56	Truck Inspection	5
HazMat	3	Truck Units	26
HazMat Insp	5	Vehicle Events	11
Injuries	13	Vehicle Exterior	32
Jackknife Assessments	16		

ONBOARD SAFETY MONITORING SYSTEMS

Two OBSMs (Lytx and SmartDrive) were used as comparison vendors to determine the kind and types of data they can capture. Both systems record continuous video of drivers and the surrounding roadway as well as kinematic data. However, data are only stored when a trigger threshold is exceeded. These OBSM systems record up to 30 seconds of video and kinematic data, including 8 to 15 seconds before and 4 to 15 seconds after the triggered threshold. Example videos supplied by Lytx and SmartDrive were used to investigate what data could be captured using these systems (such as camera angle, kinematic data, etc.).

PROCEDURE

A copy of the LTCCS codebook was used as the structure for the new data directory. Each variable and its associated operational definition in the LTCCS codebook were analyzed by a trained researcher. If the definition of a variable was unclear, an expert in the LTCCS codebook was consulted (R. Craft, personal communication, April 2013). A trained researcher then determined if that specific LTCCS variable could also be collected with an OBSM system or other related information (e.g. police reports, carrier information etc.) using one of three responses: yes, no, and maybe. Related information included other available data sources that would be available to researchers, such as:

- Vehicle Identification Number (VIN), a serial number on a vehicle that can identify its make and model, and provide more information, such as engine, seat belts, etc. VINs for cars are usually more informative than large trucks because of the high likelihood of after-market customization in large trucks.
- Carrier information, such as after-market customization of trucks, load information, etc.
- Vehicle history report (VHR), which contains information about the vehicle's past, such as prior crashes.

- Police Accident Report (PAR), which is completed by police and give details surrounding the crash, including vehicle, driver, environment, and a general summary of the crash circumstances.
- Commercial Driver’s License Information System (CDLIS), a database that tracks commercial motor vehicle (CMV) licensed drivers and their driving history, including prior crashes and violations.
- MCMIS, a database that tracks violations and Department of Transportation (DOT) recordable crashes.

All of these resources were used to glean more information regarding a crash and were considered accessible to researchers when categorizing the LTCCS variables. If the LTCCS variable was able to be reliably captured by an OBSM system or through related information, it was labeled as “YES.” If the variable was not able to be captured by an OBSM system or through related information, it was labeled as “NO.” If the variable could potentially be captured by an OBSM system under certain circumstances or through related information, it was labeled as “MAYBE.” If an LTCCS variable was labeled as a MAYBE, the conditions under which the variable could be captured by an OBSM system were outlined (e.g., consumption of alcohol could only be captured if the video clearly showed the driver consuming alcohol during the triggered event or if an alcohol test was given to the driver).

CHAPTER 3. RESULTS

Below are 43 tables from the analysis of LTCCS variables and the capabilities of OBSM systems. Each table represents a separate data set from the LTCCS codebook. The tables are presented in the order they appear in the LTCCS codebook. Each row in the tables is a unique LTCCS variable. The second column in the table gives a description of the variable, and the third column reflects the ability of the OBSM system (or related information) to capture the LTCCS variable (yes, no, maybe). The fourth column in the table denotes any comments regarding the ability to capture the information from the OBSM system or related information.

Table 2 shows the variables in the Airbag data set and the ability of an OBSM system and related information to capture these variables. This data set contains all the airbag-related information for each vehicle involved in the crash as well as each airbag.

Table 2. LTCCS Airbag data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
AirbagNumber	Identifies the number of the airbag in the vehicle.	Yes	Obtained from VIN
OccupantNumber	Represents the occupant associated with this airbag, identified by occupant number.	Yes	
SeatRow1	Identifies an airbag deployment that occurred in the first row of seats in the vehicle.	Yes	In video
SeatLocation1	Identifies the seat location in the first row of the vehicle where an airbag deployment occurred.	Yes	
SeatRow2	Identifies an airbag deployment that occurred in the second row of seats in the vehicle.	Maybe	Only if there is a clear view of the second row seats via video
SeatLocation2	Identifies the seat location in the second row of the vehicle where an airbag deployment occurred.	Maybe	Only if there is a clear view of the second row seats via video
AirbagLocation	Identifies the location of a particular airbag.	Yes	Obtained from VIN
AirbagStatus	Documents the availability of the airbag.	Maybe	Obtained from VIN
AirbagType	Describes the type of airbag present.	Maybe	Obtained from VIN

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
Depowered	Indicates whether or not the vehicle was equipped with a redesigned airbag for this location.	Yes	Carrier information
Deployment	Describes when in the crash sequence the airbag deployed.	Yes	In video
AirbagFailure	Documents whether or not something abnormal has occurred to the airbag system. It may not necessarily mean that the airbag system was defective.	No	
SwitchType	Describes the type of airbag cutoff switch present in the vehicle.	Yes	Obtained from VIN
SwitchStatus	Describes the status of the airbag cutoff switch at the time of the crash.	No	
FlapsOpen	Documents whether or not the airbag properly opened at its tear points.	Maybe	Only if there is a clear view of airbag via video
FlapsDamaged	Indicates whether or not the airbag cover flaps sustained damage during deployment.	No	
AirbagDamage	Documents any damage to the airbag during the crash sequence.	Maybe	Only if there is a clear view of airbag via video
DamageSource	Documents the source of damage to the airbag during the crash sequence.	Maybe	Only if there is a clear view of airbag via video
PriorCrashes	Documents whether the vehicle had been in any previous crashes.	Yes	Obtained from VHR
PriorMaintenance	Indicates whether or not the airbag had received any maintenance or service work prior to the crash.	Maybe	Obtained from a VHR
CDC	Indicates the Collision Deformation Classification's (CDC's) delta-V rating for the	Yes	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	impact associated with this airbag's deployment.		
ContactOther	Documents whether another occupant (besides the intended occupant) contacted this particular airbag.	Maybe	Only if there is a clear view of airbag via video

Table 3 shows the variables in the Brakes data set and the ability of an OBSM system and related information to capture these variables. This data set contains information about the brake equipment on the vehicles, broken out by axle, for each truck involved in the crash.

Table 3. LTCCS Brakes data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
Axle	Identifies the axle to which the brake information is related.	No	
BrakeType	Documents the type of brake system present at a particular axle.	Yes	Carrier information
BRAPosition	Identifies on which unit of the truck configuration a particular axle is located.	No	
ABSInstalled	Indicates whether or not an Antilock Brake System (ABS) is available at a particular axle.	Yes	Carrier information
ABSFunctional	Indicates whether or not the ABS is functioning properly at a particular axle.	No	
AdjustorType	Indicates the type of brake adjustment system that is present at a particular axle.	Yes	Carrier information
ChamberSize	Documents the size of the brake chamber for the braking system at a particular axle.	Yes	Carrier information
ChamberType	Documents the type of chamber for a braking system at a particular axle.	Yes	Carrier information

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
StrokeType	Indicates whether a particular chamber type is categorized as long or short.	Yes	Carrier information
LeftLength	Documents the length (in centimeters) of the left brake chamber at a particular axle. This value is measured and provided by the FMCSA Truck Inspector.	No	
RightLength	Documents the length (in centimeters) of the right brake chamber at a particular axle. This value is measured and provided by the FMCSA Truck Inspector.	No	

Table 4 shows the variables in the Cargo Shift Assessments data set and the ability of an OBSM system and related information to capture these variables. This data set contains detailed information on cargo shift events for all vehicles involved in the crash.

Table 4. LTCCS Cargo Shift Assessments data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
ACSType	Documents the occurrence of a pre-crash cargo shift and the type of freight that shifted. The cargo shift must occur prior to any impact event.	Maybe	If cargo shift was captured on video.
ACSLocation	Establishes the vehicle location at the start of the cargo shift sequence.	Maybe	If cargo shift was captured on video.
MovementCount	Documents the number of circumstances that were identified in which the cargo shift event occurred. This variable refers to the movements	Maybe	If cargo shift and movements that occurred were captured on video.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	of the vehicle prior to the cargo shift.		
CauseCount	Documents the number of circumstances associated with a cargo shift for this vehicle. Refers to the possible causes of the cargo shift.	Maybe	If movements captured on video.
ACSSpillage	Establishes the occurrence of cargo spillage during the pre-crash phase.	Maybe	If cargo shift was captured on video.
ACSConstant	Establishes whether or not the driver is attempting to maintain a constant velocity at the time that the cargo begins to shift.	Maybe	If cargo shift was captured on video.
ACSCurve	Establishes whether or not the driver is traversing a curve at the time that the cargo begins to shift.	Maybe	If cargo shift was captured on video.
ACSTurn	Establishes whether or not the driver is attempting to turn at the time that the cargo begins to shift.	Maybe	If cargo shift was captured on video.
ACSLightBraking	Establishes whether or not the driver is decelerating using light braking effort at the time that the cargo begins to shift. While the term “light braking” is a subjective evaluation, it generally implies that the level of braking is less than the level typically associated with a normal traffic stop.	Maybe	If cargo shift was captured on video.
ACSAccelerating	Establishes whether or not the driver is accelerating at the time	Maybe	If cargo shift was captured on video.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	that the cargo begins to shift.		
ACSAvoidance	Establishes whether or not the driver initiates a pre-crash avoidance maneuver at or prior to the time that the cargo begins to shift.	Maybe	If cargo shift was captured on video.
OtherMovement	Establishes whether or not the driver/vehicle action or velocity is not described by the other cargo shift occurrence variables.	No	
ACSDecelerating	Establishes whether or not the driver is decelerating and decelerates solely by reducing throttle input at the time that the cargo begins to shift.	No	
ACSModerateBraking	Establishes whether or not the driver is decelerating using a moderate level of braking effort at the time that the cargo begins to shift. A moderate level of braking effort generally implies that the level of braking effort is similar to the level typically associated with a normal traffic stop.	Maybe	If cargo shift was captured on video.
ACSHeavyBraking	Establishes whether or not the driver is decelerating using a heavy level of braking effort (e.g., panic stop) at the time that the cargo begins to shift. The vehicle will typically experience wheel “lock-up” in this circumstance; however, wheel lock is	Maybe	If cargo shift was captured on video.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	not a requirement for using this designation.		
ACSStraight	Establishes whether or not the driver is traversing a straight roadway segment at the time that the cargo begins to shift.	Maybe	If cargo shift was captured on video.
ImproperGeneralLoading	Establishes whether or not the cargo shift is associated with improper loading of general freight cargo. Usually, the cargo is not properly balanced during the loading process (e.g., large boxes on top of small boxes, inappropriate gaps between cargo units, etc.). This element is also used when the freight is not properly distributed over the length of the cargo area.	No	
ImproperBulkLoading	Establishes whether or not the cargo shift is associated with improper loading of bulk freight cargo. Usually, the cargo consists of one or several large items that are not properly balanced	No	
SparseTieDowns	Establishes whether or not the cargo shift is associated with an inadequate number of tie downs used. This circumstance is most typically associated with bulk freight items.	No	
WeakTieDowns	Establishes whether or not the cargo shift is associated with inadequate strength of the	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	tie downs that are used. This circumstance is most typically associated with bulk freight items.		
OtherSolids	Establishes whether or not the cargo shift (solid freight) is associated with a specific factor that is not covered under the loading or securement variables.	No	
Sloshing	Establishes whether or not the cargo shift (liquids) is associated with liquid slosh due to the truck carrying less than a full load. This affects vehicle stability.	No	
BaffleFailure	Establishes whether or not the cargo shift (liquids) is associated with a baffle failure that affects vehicle stability.	No	
CompartmentFailure	Establishes whether or not the cargo shift (liquids) is associated with a failure of a partition for at least one of the vehicle's compartments. This failure subsequently affects vehicle stability.	No	
TankFailure	Establishes whether or not the cargo shift (liquids) is associated with a tank failure (e.g., seam failure). The failure may or may not affect vehicle stability.	No	
OtherLiquids	Establishes whether or not the cargo shift (liquid freight) is associated with a specific factor that is not covered under the	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	other liquid cargo shift variables.		
OtherCargos	Establishes whether or not the cargo type is neither solid nor liquid (e.g., grains, bulk powders, etc.) and the vehicle experiences a cargo shift.	No	
UnknownCause	Establishes whether or not there is insufficient information to determine if a cargo shift occurred.	No	

Table 5 shows the variables in the Collision Deformation Classification (CDC) Crush data set and the ability of an OBSM system and related information to capture these variables. This data set contains detailed information about the crush profile for each impact on each vehicle damaged in the crash.

Table 5. LTCCS CDC Crush data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
EventNumber	Identifies a particular event in a sequence in the accident.	Maybe	If captured on video
PositionNumber	Identifies the unit number on the vehicle associated with a CDC/Truck deformation classification (TDC). For example, a truck-trailer's power unit would be Position Number "1," and the first trailer would be Position Number "2." A passenger vehicle would be assigned Position Number "1."	Maybe	If captured on video
DCType	Indicates whether the deformation classification is related to a car or a truck.	Maybe	If captured on video
ObjectContactClass	Describes the category of object involved in a	Maybe	If captured on video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	particular impact to a vehicle.		
CDCObjectContact	Identifies the object that was contacted for this event/impact.	Maybe	If captured on video
ForceDirection	<p>Indicates the direction of force exerted upon the vehicle by an object. If the force is applied directly upon the center of the front bumper, the force of direction is said to be "0."</p> <p>The direction of force rotates to the right around the vehicle in increments of 10 degrees, circling around the vehicle until it returns to the front (360 degrees). This value is used to create the variable "Clock Force."</p>	Maybe	If captured on video
ClockForce	Identifies the direction from which the principal force is applied for a particular impact. The direction of force is based on the face of a clock (e.g., an impact to the front bumper is classified as "12") and is the first two columns of each impact's CDC/TDC.	Maybe	If captured on video
OverrideDesc	Indicates that this vehicle overrode or underrode another vehicle. "Override" is coded when this vehicle overrides (i.e., goes on top of) the bumper of another vehicle, and "underride" is coded when this vehicle underrides (i.e., goes below) the bumper of another vehicle. For override/underride in combination cases	Yes	In video and/or PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	(Crashworthiness Data System [CDS]/Truck cases), the attribute “Medium/heavy truck or bus override” is used.		
DeformLocation	Documents the initial plane of contact to the vehicle and represents the general area of the vehicle. This is the third column in a coded CDC/TDC.	Maybe	If captured on video
DeformLong	Documents the lateral or longitudinal area of the vehicle that contains the contact deformation. This is the fourth column in a coded CDC/TDC.	Maybe	If captured on video
DeformVertical	Documents either the vertical or lateral area of the vehicle that contains the contact deformation. The vertical location is used for vertical planes (F, B, L, R) and the lateral location is used for horizontal planes (T, U). This is the fifth column in a coded CDC/TDC.	Maybe	If captured on video
DeformDistribution	Documents the general type of damage distribution for the impact. This classification provides a qualitative description of the type of damage sustained by the vehicle. This is the sixth column of a coded CDC/TDC.	Maybe	If captured on video
DeformExtent	Documents the extent of damage for the impact. The extent of residual deformation is classified using a nine-zone extent system. Extent is a mathematical determination	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	of which zone the crush extends into, beginning with Zone "1." This is the seventh column of a coded CDC/TDC.		
DeformCode	Code created from results of six deform codes: ClockForce, DeformLocation, DeformLong, DeformVertical, DeformDistribution, and DeformExtent.	No	
ImpactNumber	Identifies each particular impact in the crush profile for a vehicle.	Maybe	Only those for front and side of cab area
DamageLocation	Describes the location of the direct damage on the vehicle for each impact. This information is used to determine the CDC/TDC for the impact.	Maybe	Only those for front and side of cab area
FieldLocation	Describes the location of Field L on the vehicle. Field L represents direct and induced deformation. This information is used to determine the CDC/TDC for the impact.	No	
MaxCrushLocation	Describes the location in the crush profile of the maximum crush of this impact to the vehicle. This information is used to determine the CDC/TDC for the impact.	No	
CDCCategory	Describes the information provided by columns 3–7 in a coded CDC/TDC.	No	
CDCWidth	Indicates the direct damage width in centimeters. This is a measured value on the vehicle that is used in	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	determining the CDC/TDC for this impact/event.		

Table 6 shows the variables in the Crash data set and the ability of an OBSM system and related information to capture these variables. This data set contains details related to the crash itself and not to individual vehicles involved in the crash.

Table 6. LTCCS Crash data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
CrashDate	Identifies the date of the crash.	Yes	Using video and/or PAR
CrashTime	Identifies the time of day of the crash.	Yes	Using video and/or PAR
VehicleCount	Documents the total number of vehicles that were involved in the crash. This includes all CDS, non-CDS, in-transport, and not in-transport vehicles.	Yes	Using video and/or PAR
TruckCount	Represents the total number of heavy trucks involved in the crash.	Yes	Using video and/or PAR
CarCount	Represents the total number of passenger vehicles involved in the crash.	Yes	Using video and/or PAR
NonMotoristCount	Identifies the number of non-motorists involved in the crash.	Yes	Using video and/or PAR
CrashType	This variable is a combination of two variables separated by “-+.” The first is a description of the overall crash scenario. The second is a general description of the crash configuration.	Yes	Using video and/or PAR
CrashPARSevCode	Represents the highest injury severity rating in the case, as determined by police on the PAR.	Yes	In PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
CrashRESsevCode	Represents the highest injury severity rating in the case, as determined by injury coding and case narratives. This code is based on occupant medical records and/or case narratives and may differ from the police-reported injury severity code.	No	
Summary	The researcher's description of the crash events/sequence.	Yes	Using video and/or PAR
Day	Identifies the day of the week that the crash occurred.	Yes	Using video and/or PAR
CollisionType	Describes the type of vehicles involved in the crash using vehicle classifications.	Yes	In PAR
Treatment	Represents the highest level of treatment of any occupant in the case.	No	
OCCFatality	Documents if there were any occupant fatalities in the case.	Maybe	If in PAR
CRAAlcohol	Documents whether or not alcohol was involved in the crash.	Maybe	If captured on video or in PAR
AnyDrugsCrash	Documents whether or not any drugs (legal or illegal) were present or involved in the crash.	Maybe	If captured on video or in PAR

Table 7 shows the variables in the Crash Assessment data set and the ability of an OBSM system and related information to capture these variables. This data set contains assessment information for each vehicle and driver involved in the crash.

Table 7. LTCCS Crash Assessment data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
PreEventMovement	Establishes the subject vehicle's pre-critical event	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	movement pattern. The pre-event movement pattern is usually described as the point that precedes both the critical pre-crash envelope and vehicle motions that place the involved vehicle(s) on an imminent collision path.		
ACRCriticalEvent	Identifies the event which made the crash imminent (i.e., something occurred that made the collision inevitable). A pre-crash critical event is coded for each vehicle in the crash and documents the circumstances leading to this vehicle's first impact in the crash sequence.	Yes	In video
CriticalEventCat	Groups the individual attributes of the critical pre-crash event into categories. These categories are helpful in deciding the critical pre-crash event.	Yes	In video
ACRReason	Establishes the critical reason for the occurrence of the critical event. The critical reason is the immediate reason for this event and is often the last failure in the causal chain (i.e., closest in time to the critical pre-crash event). Although the critical reason is an important part of the description of crash events, it is not the cause of the crash nor does it imply the assignment of fault.	Yes	In video and/or PAR
ReasonCat	Groups the attributes for the variable Critical Reason	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	for the Critical Event variable into categories.		
ACRAvoidance	Documents the driver's actions initiated in response to the realization of impending danger. Attempted avoidance maneuvers are movements/actions initiated by the subject driver, within the crucial crash envelope, in response to a critical pre-crash event. Attempted avoidance maneuvers occur after the driver has realization of an impending danger.	Yes	In video
ACRStability	Focuses upon this vehicle's dynamics after the critical event. The purpose of this variable is to assess the stability of the vehicle after the critical event. The stability of the vehicle prior to an avoidance action is not considered except in the following situation: A vehicle that is out of control (e.g., yawing clockwise) prior to an avoidance maneuver is coded "Other vehicle loss of control" only if an avoidance action was taken in response to an impending danger.	Yes	In video
ACRLocation	Reports the location of the subject vehicle at the point where its pre-impact stability is determined.	Yes	In video and/or PAR
ACRRightOfWay	Establishes vehicle right-of-way characteristics, from a legal perspective, for the subject vehicle.	Yes	In video and/or PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	Specifically, did this vehicle have the right-of-way?		
CrashCode	<p>Used in categorizing the collisions of drivers involved in crashes. A collision is defined here as the first harmful event in a crash between a vehicle and some object, accompanied by property damage or human injury. The object may be another vehicle, a person, an animal, a fixed object, the road surface, or the ground.</p> <p>If the first collision is a rollover, the impact is with the ground or road surface.</p> <p>The collision may also involve plowing into soft ground, if severe deceleration results in damage or injury. A road departure without damage or injury is not defined as a collision. This variable encompasses the “Configuration” variable, which is a component of this variable.</p>	Maybe	If captured on video
AccidentCat	<p>Used in categorizing the collisions of drivers involved in crashes. A collision is defined here as the first harmful event in a crash between a vehicle and some object, accompanied by property damage or human injury. The object may be another vehicle, a person, an animal, a fixed object, the road surface, or the ground.</p>	Maybe	If captured on video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	If the first collision is a rollover, the impact is with the ground or road surface. The collision may also involve plowing into soft ground, if severe deceleration results in damage or injury. A road departure without damage or injury is not defined as a collision. This variable is part of the larger variable "Crash Type." The "Crash Type" variable is actually broken down into three components: the crash category, the crash configuration, and the accident type. This variable only deals with the configuration of the crash.		
ACRJackknife	Documents the presence/absence of a jackknife for this vehicle.	Yes	
ACRCargoshift	Documents the presence/absence of a cargo shift for this vehicle.	Maybe	If captured on video

Table 8 shows the variables in the Crash Discussion data set and the ability of an OBSM system and related information to capture these variables. This data set contains the researcher’s assessment summary for each vehicle and driver involved in the crash.

Table 8. LTCCS Crash Discussion data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
Discussion	The Case Summary is intended to provide a detailed description of the crash sequence, including pre-crash vehicle movement patterns and driver pre-crash actions. In addition to describing crash	Yes	Limited to what is captured on video and in reports

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	events for each vehicle/driver, the summary is intended to provide a detailed accounting of all causal-related information for this vehicle/driver. This includes describing the critical pre-crash event, the critical reason for the critical event, and all critical event associated factors.		

Table 9 shows the variables in the Department of Motor Vehicles (DMV) Violation data set and the ability of an OBSM system and related information to capture these variables. This data set contains a record of information on each of the driver's prior record of motor vehicle violations.

Table 9. LTCCS DMV Violation data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
ViolationNumber	Identifies the violation number.	Yes	In CDLIS and PAR
LicState	Identifies the State in which the driver's (driving) license was issued.	Yes	In CDLIS and PAR
CitDate	Identifies the date that the driver received a citation for a particular violation.	Yes	In PAR
ConvDate	Identifies the date that the driver was convicted of a particular violation.	Yes	In CDLIS
ACDcode	Represents DMV violation codes.	Yes	In CDLIS and PAR
ACDdetail	The five-digit code that provides further detail of the AAMVAnet Code Dictionary (ACD) code.	Yes	In CDLIS and PAR
DriverNumber	Uniquely identifies each driver; however, since a driver can have more than one violation and be involved in more than one	Yes	In PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	crash, this variable does not uniquely identify each record.		
ViolDescription	Describes each violation and corresponds to the ACD Code.	Yes	In CDLIS and PAR

Table 10 shows the variables in the Driver Assessment data set and the ability of an OBSM system and related information to capture these variables. This data set contains information on the driver regarding the level of attention, behavior, and mental and emotional state prior to the crash.

Table 10. LTCCS Driver Assessment data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
SightLine	Establishes the driver's sight line to the other vehicle in terms of being clear or being obstructed in some manner	Yes	In video
Obscured	Establishes the driver's view of the other vehicle in terms of having a clear view or having a view that is obscured in some manner.	Yes	In video
StopRequired	Establishes if this driver was required to stop prior to entering an intersection, initiating a turn, or prior to the crash.	Yes	In video
TimeStopped	Establishes the period of time the driver was stopped prior to entering an intersection, initiating a turn, or prior to the crash.	Maybe	Dependent on length of video and duration of stop
Focused	Documents the circumstance where the driver focuses on an extraneous location after initially checking for approaching traffic.	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
ADRWorkSchedule	Establishes whether or not the driver's sleep pattern is primarily related to his/her work schedule.	No	
SocialSchedule	Establishes whether or not the driver's sleep pattern is related to a social schedule.	No	
PersonalProblems	Establishes whether or not the driver's sleep pattern is primarily related to a set of personal problems.	No	
FamilyProblems	Establishes whether or not the driver's sleep pattern is related to problems of other family members or to interpersonal relationships between the driver and other family members.	No	
Illness	Establishes whether or not the driver's sleep pattern is related to illness. The illness may involve either the driver or other family members.	No	
NoDriverPresent	Establishes whether or not there was a driver present in the driver's seated position at the time of the crash.	Yes	In video
ADROtherFactor	Establishes whether or not the driver's sleep pattern is related to a factor not described by the other sleep pattern variables.	No	
UnknownFactor	Establishes whether or not the driver's sleep pattern was related to an unknown factor.	No	
AlcoholUse	Establishes the presence of alcohol for this driver.	Maybe	If captured on video or in PAR
AlcoholTest	Records the results of an alcohol test (either blood	Maybe	If in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	alcohol test or Breathalyzer test) in percent times 100.		
TestSource	Documents the source of the Blood Alcohol Concentration (BAC) test results.	Maybe	If in PAR
TestDelay	Documents the time delay between the crash and the time the BAC test is administered.	Maybe	If in PAR
ADRDrugTest	Documents the administration of a drug test for this driver.	Maybe	If in PAR
Fatigue	Assesses driver fatigue at the time of the crash. The assessment is based on an evaluation of the driver's current and preceding sleep schedules, current and preceding work schedules, and a variety of other fatigue-related factors including recreational and non-work activities.	No	
Upset	Establishes whether or not the driver was upset prior to the crash and the specific reason for this emotional state.	Maybe	If captured on video
Hurrying	Establishes if the driver was in a hurry prior to crash occurrence. Assessments of this type are reflected in the driver's pre-crash driving behavior (e.g., speeding, sudden starts/stops, weaving in and out of traffic, etc.)	Maybe	If captured on video
Emotional	Establishes if there were other emotional factors	Maybe	If captured on video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	relevant to this driver's pre-crash behavior.		
KnewVehicle	Establishes driver familiarity with the vehicle being operated at the time of the crash.	No	
KnewRoad	Establishes the driver's familiarity with the approach to the crash site.	No	
WorkPressureCount	A count of the number of work pressure variables. This includes attributes from the original variable "Driver Under Work-Related Pressure," which were broken out into individual variables.	No	
NewPosition	Establishes whether or not the driver was under pressure from his/her employer as a result of learning a new position in his/her primary work place.	No	
ShippingDeadline	Establishes whether or not the driver experienced work pressure as a result of being under time-related pressures associated with production/shipping deadlines.	No	
EXPWorkSchedule	Establishes whether or not the driver was experiencing any pressure on the job as it relates to his/her work schedule.	No	
Quotas	Establishes whether or not the driver experienced any work pressure with regard to additional production or sales requirements.	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
ExtraLoads	Establishes whether or not the driver was under pressure from his/her employer to accept loads with little or no advance notice.	No	
Demoted	Establishes whether or not the driver had recently been forced to accept a demotion and/or pay decrease.	No	
SelfInducedIllegal	Establishes whether or not the driver experienced self-induced work pressure, as opposed to employer-induced pressure. The driver was pressuring himself to do things that are considered illegal (e.g., a truck driver continuing to drive even though he knows he is over his allowed driving hours).	No	
SelfInducedOther	Establishes whether or not the driver experienced self-induced work pressure, as opposed to employer-induced pressure.	No	
OtherPressure	Establishes whether or not the driver experienced any work-related pressure that was not captured under other work-pressure variables.	No	
ComfortCount	Establishes the total number of attributes coded for the variable "Other Factor Types," which had to do with a driver's comfort with traffic conditions and the vehicle.	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
TrafficDensity	Establishes whether or not the driver was uncomfortable with the surrounding traffic densities. The densities are usually very high as might be associated with rush hour traffic.	No	
TrafficSpeed	Establishes whether or not the driver was uncomfortable with the general speed of surrounding traffic. The discomfort is typically associated with the driver feeling that surrounding traffic is moving too fast.	No	
ADRTrafficFlow	Establishes whether or not the driver was uncomfortable with the general flow of surrounding traffic.	No	
VehicleLoad	Establishes whether or not the driver was uncomfortable with either the vehicle or the load.	No	
OtherComfortFactor	Establishes whether or not the driver had an “other” experience/exposure factor that was relevant to the crash that was not described by the other comfort variables.	No	
LoadPressure	Documents the circumstance where the driver is under some pressure from the carrier to accept additional loads.	No	
WorkFatigueCount	A count of the number of work fatigue-related variables. This includes attributes from the original variable “Under Pressure to Operate Even	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	if Fatigued,” which were broken out into individual variables.		
ScheduledExtensions	Establishes whether or not the driver experienced work pressure due to his/her carrier scheduling trips in a manner that requires extended work shifts to complete.	No	
RotatingShift	Establishes whether or not the driver experienced work pressure due to his/her carrier scheduling trips in a manner that requires the driver to work rotating shift schedules with an associated rotating sleep pattern.	No	
UnscheduledExtensions	Establishes whether or not the driver experienced work pressure due to his/her carrier pressing the driver to accept unscheduled loads/trips that require the driver to operate while fatigued.	No	
NoApplicableFatigue	Originally an attribute choice under the variable “Under Pressure to Operate Even if Fatigued” (a carrier-related variable).	No	
OtherFatigue	Establishes whether or not the driver experienced any pressure by the carrier to operate even if fatigued when that pressure did not fit under other fatigue variables.	No	
OtherPressureCount	Establishes the number of “other” pressures	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	specified in the “Other Work Pressure” variable.		
ShortNoticeTrips	Establishes whether or not the driver was required by his/her carrier to accept short notice trips.	No	
FillInTrips	Establishes whether or not the driver was under pressure by his/her carrier to fill in for other drivers (i.e., perform extra work) when other drivers are absent.	No	
UnpaidLoading	Establishes whether or not the driver was required by his/her carrier to complete uncompensated loading/unloading activities.	No	
VariableCompensation	Establishes whether or not the driver is compensated in accordance with a variable compensation package such that the driver is not paid on a consistent basis.	No	
NoApplicableRelations	Originally an attribute choice under the variable “Other Relation Factor Types” (a carrier-related variable).	No	
OtherRelations	Establishes whether or not there were other carrier relation factors not captured in other carrier relation variables that may have had a bearing on crash occurrence.	No	

Table 11 shows the variables in the Driver Decision Aggression data set and the ability of an OBSM system and related information to capture these variables. This data set contains data supporting the researcher’s assessment of the driver’s decisions and aggressive behavior.

Table 11. LTCCS Driver Decision Aggression data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
Speeding	Documents reasons given by the driver for traveling at his/her pre-crash travel speed. This variable is only relevant in the circumstance where the driver had been assessed as traveling too fast for conditions.	Maybe	If in PAR
Tailgating	Documents reasons given by the driver for traveling with less than the recommended gap interval to traffic forward of the driver's position.	Maybe	If in PAR
Misjudgment	Documents the involvement of a decision error in which the subject driver either misjudges the gap distance to the other vehicle or misjudges the velocity of the other vehicle.	Maybe	If in PAR
Approach	Establishes the direction from which the misjudged vehicle was approaching this driver's position.	Yes	In video
ADATravelSpeed	Documents the travel speed of this driver as reported on the police report (kph).	Yes	In PAR
ADAPostedSpeed	Establishes the pre-crash roadway's posted speed limit (kph).	Yes	In PAR
Assumption	Identifies false assumptions on the part of this driver with respect to other drivers' actions or intended actions.	Maybe	If in PAR
Evasion	Establishes inadequate evasive actions on the part of this driver. This variable does not deal with legal	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	requirements and the final assessment may be subjective.		
ADAOtherFactor	Establishes decision factors relevant to this crash that are not described in the other decision variables.	Maybe	If noted in narrative
ManeuverCount	Establishes the total number of illegal maneuvers conducted by this driver.	Yes	In video
CrossedLine	Documents whether or not the driver crosses full barrier lines to execute, or while executing, a passing maneuver.	Yes	In video
Undertaking	Documents whether or not the driver drives off the travel lane(s) to pass on the right (i.e., driver moves on to shoulder area to execute the passing maneuver).	Yes	In video
WrongTurnLane	Documents whether or not the driver executes a turn from the wrong lane (i.e., driver turns left from the right lane or turns right from the left lane of a multilane roadway).	Yes	In video
IllegalUTurn	Documents whether or not the driver initiates a U-turn in an area where these turns are not permitted.	Yes	In video
RanLights	Documents whether or not the driver does not stop for a displayed red traffic signal phase or does not stop for a stop sign.	Yes	In video
WrongWay	Documents whether or not the driver travels the wrong way on a one-way roadway.	Yes	In video
OtherManeuver	Documents whether or not the driver initiates an	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	illegal maneuver that is not described in the other illegal maneuver variables.		
AggressionCount	Establishes the total number of aggressive behaviors exhibited by this driver.	Yes	In video
SpeedingBehavior	<p>Documents whether or not the driver exhibited aggressive behavior in terms of exceeding the speed limit by a minimum of 5 mph (8.05 kph) and the vehicle's speed has a bearing on subsequent crash events. A degree of caution is required when assigning this element.</p> <p>Specifically, to be considered as a valid aggressive driving element, the act of speeding should pose some risk to surrounding traffic. If, for example, the driver is speeding in a stream of traffic, this act poses a risk to surrounding traffic. On the other hand, a driver who is speeding late at night, on a rural highway with no surrounding traffic, does not pose a risk to others and should not be considered as driving aggressively.</p>	Yes	In video
TailgatingBehavior	<p>Documents whether or not the driver exhibited aggressive behavior in terms of traveling in close proximity to a vehicle forward of his/her position.</p> <p>While the exact gap interval that qualifies for</p>	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	this assignment will vary with the velocity of the traffic stream, the interval should be sufficiently small/short to preclude the following vehicle/driver from executing a safe stop in an emergency stop circumstance.		
Weaving	Documents whether or not the driver exhibited aggressive behavior in terms of weaving in and out of traffic to pass slower-moving vehicles. While drivers engaging in this activity typically exceed the speed limit, speeding is not required for valid use of this element.	Yes	In video
LightViolations	Documents whether or not the driver exhibited aggressive behavior in terms of violating a displayed red signal phase or stop sign. Deliberate violation of a yield sign is captured under the “Other Aggressive Behavior” variable.	Yes	In video
RapidAcceleration	Documents whether or not the driver exhibited aggressive behavior in terms of engaging in these activities in a repeating fashion (i.e., braking late for a traffic control device [TCD] and then accelerating rapidly away from that location and repeating this behavior at the next TCD). This behavior pattern is often associated with being in a	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	hurry or being late for some engagement.		
Honking	Documents whether or not the driver exhibited aggressive behavior in terms of repeatedly honking the vehicle's horn at surrounding traffic to gain a time/space advantage.	Yes	In video
Flashing	Documents whether or not the driver exhibited aggressive behavior in terms of repeatedly flashing the vehicle's lights in an attempt to have traffic forward of this vehicle's position move either to the right or left so that this vehicle can "get by."	Yes	In video
ObsceneGestures	Documents whether or not the driver exhibited aggressive behavior in terms of making obscene gestures at other drivers.	Yes	In video
BlockingOthers	Documents whether or not the driver exhibited aggressive behavior in terms of using his/her vehicle to physically obstruct the path of another vehicle by pulling in front of that vehicle. In addition to physically blocking the path, the subject driver typically slows to force the other driver to take evasive action (e.g., steering and/or braking actions).	Yes	In video
OtherAggression	Documents whether or not the driver exhibited aggressive behavior that is not described by the other	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	aggressive driving behavior variables.		
AggressionReason	Establishes the reason for the aggressive driving behaviors reported in the corresponding variables.	Maybe	If in PAR

Table 12 shows the variables in the Driver Drugs data set and the ability of an OBSM system and related information to capture these variables. This data set contains information supporting the researcher's assessment on the driver's use of any drug prior to the crash.

Table 12. LTCCS Driver Drugs data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
DrugType	Establishes the type of drug specified in the Drug Name variable.	Maybe	If in PAR
DrugName	Name of drug(s) used – includes illegal drugs, over-the-counter drugs, and prescription drugs.	Maybe	If in PAR
DriverReported	Establishes whether or not the drug usage was reported by the driver.	Maybe	If in PAR
TestResult	Documents the results of drug tests performed on the driver.	Maybe	If in PAR

Table 13 shows the variables in the Driver Health data set and the ability of an OBSM system and related information to capture these variables. This data set contains data supporting the researcher's assessment on driver health.

Table 13. LTCCS Driver Health data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
ADHCorrectedVision	Documents the driver's corrected vision level.	No	
IllnessFactorCount	Documents the number of illness factors coded for this driver.	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
HeartAttack	Establishes whether or not the driver experienced a heart attack prior to the crash event.	Maybe	If in PAR
EpilepticSeizure	Establishes whether or not the driver experienced an epileptic seizure prior to the crash event.	Maybe	If captured on video or in PAR
OtherSeizure	Establishes whether or not the driver experienced a seizure prior to the crash event that was not related to epilepsy.	Maybe	If captured on video or in PAR
DiabeticBlackout	Establishes whether or not the driver experienced a blackout prior to the crash event and that this event can be traced to a medically diagnosed diabetic condition (e.g., driver blacks out as a result of insulin shock).	Maybe	If in PAR
OtherBlackout	Establishes whether or not the driver experienced a blackout prior to the crash event and that this event is not related to a diabetic condition.	Maybe	If in PAR
ColdFlu	Establishes whether or not the driver is operating the vehicle while experiencing severe cold/flu symptoms that influence his/her driving performance.	Maybe	If in PAR
OtherIllness	Establishes whether or not the driver experiences an illness or physical symptoms that are not described under the other illness variables.	Maybe	If in PAR
NormalVision	Establishes whether or not the driver wears corrective lenses to improve vision levels.	Maybe	If in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
LegallyBlind	Establishes whether or not the driver has been diagnosed with an uncorrected vision level that exceeds 20/2800.	No	
Myopic	Establishes whether or not the driver wears corrective lenses (including contact lenses) to compensate for a near-sighted condition.	No	
Hyperopic	Establishes whether or not the driver wears corrective lenses (including contact lenses) to compensate for a far-sighted condition.	No	
Glaucoma	Establishes whether or not the driver has been diagnosed as having glaucoma.	No	
ColorBlind	Establishes whether or not the driver has been diagnosed as being color blind.	No	
Astigmatic	Establishes whether or not the driver has been diagnosed as having astigmatism.	No	
OtherVision	Establishes whether or not the driver has a vision problem that is not described by the other vision variables.	No	
UnknownVision	Establishes whether or not the driver was coded as "Vision problem unknown." This code is used when there is insufficient information to determine if the driver has a vision-related problem/deficiency.	No	
OtherFactorCount	Documents the number of other physical factors coded to this driver.	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
NoFactors	Documents whether or not there were no other physical factors coded to this driver.	No	
HearingImpairment	Establishes whether or not the driver has a diagnosed hearing impairment.	Maybe	If in PAR
Prosthesis	Establishes whether or not the driver is wearing a prosthesis.	Maybe	If in PAR
Paraplegia	Establishes whether or not the driver has paralysis of the lower limbs.	Maybe	If in PAR
StrenuousRecreation	Establishes whether or not the driver participated in strenuous recreational activities during the 7-day interval preceding the crash.	No	
StrenuousNonWork	Establishes whether or not the driver participated/engaged in strenuous non-work activities (e.g., household chores) during the 7-day interval preceding the crash.	No	
SleepApnea	Establishes whether or not the driver has an obstructive sleep apnea disorder.	Maybe	If in PAR
OtherFactorPhysical	Establishes whether or not the driver has a relevant physical factor that is not described in the other physical factor variables.	Maybe	If in PAR

Table 14 shows the variables in the Driver Recognition Distraction data set and the ability of an OBSM system and related information to capture these variables. This data set contains a variety of data supporting the analyst’s assessment focusing particularly on the driver’s recognition and distraction.

Table 14. LTCCS Driver Recognition Distraction data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
Inattention	Documents driver inattention (i.e., focusing on internal thought processes) and the nature of the involved thought processes.	Yes	In video and/or PAR
Conversation	Documents driver participation in conversation. The conversation can be associated with a variety of sources, including conversing with passengers, talking on a cell phone, or talking on a CB radio.	Yes	In video
Subject	Documents the nature of the conversation the driver is involved in during the pre-crash phase.	Maybe	If captured on video
Conversant	Documents the relationship between the driver and the person with whom the driver was conversing during the immediate pre-crash phase.	Maybe	If captured on video
OutsideLocation	Documents the location of the exterior factor with respect to the driver's location at the time the distraction first occurred.	Yes	In video
ADDSSurveillance	Establishes inadequate surveillance behavior on the part of the driver of this vehicle.	Yes	In video
Tracking	Establishes how the driver tracked the exterior factor when this factor is located behind the vehicle.	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
ADDRecognition	Establishes the occurrence of other recognition factors related to this driver.	Yes	In video
InteriorDistractionCount	Documents the number of interior distractions that were coded for this driver.	Yes	In video
OccupantMovement	Documents whether or not the driver is distracted by other occupants in the vehicle.	Maybe	If captured on video
ADDialingPhone	Documents whether or not the driver is distracted as a result of either dialing or hanging up a phone during the pre-crash phase.	Yes	In video
ADDadjustingRadio	Documents whether or not the driver is distracted as a result of attempting to adjust the sound system controls during the pre-crash phase.	Yes	In video
OtherControls	Documents whether or not the driver is distracted as a result of attempting to adjust the heat, vent, or air conditioning controls during the pre-crash phase. This category also includes attempted adjustments to other original equipment manufacturer (OEM) and after-market controls.	Yes	In video
FloorRetrieval	Documents whether or not the driver is distracted as a result of trying to retrieve an object from either the floor or seat while driving. The objects in this category include everything with the exception of items related	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	to smoking or eating, which are addressed in the “Other” category.		
OtherRetrieval	Documents whether or not the driver is distracted as a result of trying to retrieve an object from a location other than the floor or seat while driving. Again, the objects in this category include everything with the exception of items related to smoking or eating, which are addressed in the “Other” category.	Yes	In video
OtherInternal	Documents whether or not the driver is distracted by internal factors not described in the other variables. Examples include smoking, eating, drinking, and reading-related activities.	Yes	In video
ExteriorDistractionCount	Documents the number of exterior distractions that were coded for this driver.	Yes	In video
ADDPreviousCrash	Documents whether or not the driver removes his/her focus from the driving task to look at a previous crash (i.e., rubbernecking).	Yes	In video
ApproachingTraffic	Documents whether or not the driver removes his/her focus from the driving task to look at approaching traffic either in an adjoining lane or across a median area.	Yes	In video
StreetAddress	Documents whether or not the driver removes his/her focus from the	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	driving task to search for a street address (usually searching for a specific building number).		
ExternalPerson	Documents whether or not the driver removes his/her focus from the driving task to look at a person who is exterior to this vehicle. The person can be a pedestrian, bicyclist, skater, and an occupant of another vehicle or even a person in a building.	Yes	In video
Building	Documents whether or not the driver removes his/her focus from the driving task to look at a building (usually as a result of seeing a feature of interest).	Yes	In video
UnspecifiedExternal	Documents whether or not the driver removes his/her focus from the driving task to focus on something exterior to the vehicle, but there is insufficient information to determine the direction or the specific object that is being examined.	Yes	In video
OtherExternal	Documents whether or not the driver was distracted by something that is exterior to the vehicle and that is not adequately described by the other variables.	Yes	In video

Table 15 shows the variables in the Driver Sleep data set and the ability of an OBSM system and related information to capture these variables. This data set contains data supporting the researcher's assessment of driver sleep patterns and fatigue.

Table 15. LTCCS Driver Sleep data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
LastSleepHours	Represents the number of hours the driver slept (most recent sleep interval).	No	
LastSleepStart	The time of day (military time) that the driver began his/her last sleep interval.	No	
LastSleepEnd	The time of day (military time) that the driver awoke from his/her last sleep interval.	No	
HoursSinceSleep	Represents the number of hours that have passed since the driver awoke from his/her last sleep interval.	No	
MainSleepHours	If the driver's last sleep interval was less than 4 hours, this is the number of hours that the driver slept in his/her previous sleep interval where that interval was greater than 4 hours (i.e., "main" sleep interval).	No	
MainSleepStart	The time of day (military time) that the driver's main sleep interval began. This variable should be coded when the driver's last sleep interval was less than 4 hours.	No	
MainSleepEnd	The time of day (military time) that the driver's main sleep interval ended. This variable should be coded when the driver's last sleep interval was less than 4 hours.	No	
HoursDriving	Represents the number of hours the driver has been driving since he/she last had a break of at least 8 hours.	Maybe	Carrier information

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
ADSHoursOnDuty	Represents the number of hours the driver has been on duty since he/she last had a break of at least 8 hours.	Maybe	Carrier information
WeekLongest	Represents the number of hours the driver worked on his/her longest workday in the 7-day interval preceding the crash.	Maybe	Carrier information
WeekShortest	Represents the number of hours the driver worked on his/her shortest workday in the 7-day interval preceding the crash.	Maybe	Carrier information
WeekAverage	Represents the average number of hours the driver worked per day in the 7-day interval preceding the crash.	Maybe	Carrier information
Rotation	Establishes the occurrence of a rotating sleep period (i.e., beginning of sleep interval changes during the period).	No	
HoursWorked	Represents the number of hours the driver worked on the day of the crash.	Maybe	Carrier information
ADSLongestDay	The number of hours the driver slept in the 7-day interval preceding the crash that represents his/her longest interval of daily sleep.	No	
ADSShortestDay	The number of hours the driver slept in the 7-day interval preceding the crash that represents his/her shortest interval of daily sleep.	No	
ADSAverageDay	Represents the average number of hours the driver slept per day in the 7-day	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	interval preceding the crash.		
LastWeekHours	Represents the total number of hours that the driver worked on his primary job during the 7-day interval preceding the crash.	Maybe	Carrier information
LastWeekMoonlight	Represents the number of hours the driver worked on his/her second job during the 7-day interval preceding the crash.	Maybe	Carrier information

Table 16 shows the variables in the Environment data set and the ability of an OBSM to capture these variables. This data set contains information on the physical parameters of the roadway in the vicinity of the crash, any adverse weather conditions, how the driver was operating the vehicle, and any distraction information if applicable.

Table 16. LTCCS Environment data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
RoadRelation	Describes the characteristics of this vehicle’s roadway environment just prior to the critical pre-crash event.	Yes	In video
Junction	Describes this vehicle’s roadway as it relates to a junction. A junction is, in general, the area formed by the connection of two roadways. It includes (1) all at-grade intersections, (2) connections between a driveway access or alley access and a roadway that is not a driveway access or an alley access, (3)	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	<p>connections between two alley accesses or driveway accesses, or (4) a connection between a driveway and an alley access. An interchange is an area around a grade separation that involves at least two trafficways. Included within its boundaries are (1) all ramps that connect the roadways, and (2) each roadway entering or leaving the interchange to a point 30 meters (100 feet) beyond the gore or curb return at the outermost ramp connection for the roadway. Included within an interchange area are intersections, driveway accesses, and roadway sections that are non-junction.</p>		
Interchange	<p>Determines whether or not the crash involved an interchange. An interchange is an area around a grade separation that involves at least two trafficways. Included within its boundaries are (1) all ramps that connect the roadways, and (2) each roadway entering or leaving the interchange to a point 30 meters (100 feet)</p>	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	beyond the gore or curb return at the outermost ramp connection for the roadway. Included within an interchange area are intersections, driveway accesses, and roadway sections that are non-junction.		
ENVTrafficFlow	Describes the flow of traffic as specified by the design of the roadway just prior to the critical pre-crash event.	Yes	In video
FlowRestriction	Identifies preexisting trafficway flow restrictions that hindered the general flow of traffic in some way. Selection of specific attributes does not imply that the restriction contributed to crash causation.	Yes	In video
IntersectionType	Defines the intersection type for those crashes that occur in an intersection or are intersection-related. For example, if there is a stream of traffic stopped on the approach to an intersection and a vehicle at the rear of this traffic stream is struck in the rear by a second vehicle, the crash is considered intersection-related	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	and intersection type is coded for this crash.		
TravelLanes	<p>Establishes the number of travel lanes that existed for this vehicle prior to the critical pre-crash event. The attribute related to this variable is determined from the same roadway that was used to determine the variable "Trafficway Flow." If traffic flows in both directions and is undivided, the number of lanes in both directions is indicated. If the trafficway is divided into two or more roadways, only the number of lanes for the roadway on which this vehicle was traveling is indicated. If turn bays, acceleration, deceleration, or center two-way left turn lanes exist and are physically located within the cross section of the roadway and these lanes are the most representative of the driver's environment just prior to the critical pre-crash event, then they are included in the number of lanes.</p>	Yes	In video
AccessControl	Describes the level of control maintained for	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	vehicles attempting to enter/exit the roadway. The attribute is determined for the same roadway as described in the variable "Number Of Travel Lanes."		
Signage	Describes the general class of roadway by noting the type of route signing. The attribute is determined for the same roadway described in the variable "Number Of Travel Lanes."	Yes	In video
FunctionalClass	This variable is based upon the Federal Highway Administration's classification system for identifying a roadway functional system. The basic functional systems are (1) rural areas, (2) urbanized areas, and (3) small urban areas (under 50,000 in population). Each system consists of various functional categories.	Yes	Using Global Positioning System (GPS) data and http://www.gis.fhwa.dot.gov/fhwaEfforts.asp
Daylight	Establishes the light conditions of the roadway at the time of the crash and represents both ambient and artificial sources of light.	Yes	In video
TrafficControl	Documents the aboveground traffic control(s) that regulate	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	vehicular traffic in the vehicle's environment just prior to this vehicle's critical pre-crash event.		
Railroad	Establishes whether or not a railroad-crossing device was present at the time of the crash.	Yes	In video
Functioning	Establishes whether or not the traffic control device that was identified in the variable "Traffic Control Device" was functioning properly (as it was designed to function).	Maybe	If captured on video
RoadwayClass	Designates the class of roadway within rural and urban categories. The "urban" designation includes urbanized and small urban areas (under 50,000 in population). In general, the "freeways" designation includes freeways, expressways, thruways, and other controlled-access roadway segments.	Yes	Using GPS data and http://www.gis.fhwa.dot.gov/fhwaEfforts.asp
RoadAlignment	Describes the alignment of the roadway just prior to the vehicle's critical pre-crash event.	Yes	In video
RoadProfile	Establishes the grade of the roadway just prior to the vehicle's critical pre-crash event. To determine	Yes	Using GPS data and the National Elevation Database (NED)

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	the grade, the vertical measurement is divided by the horizontal value; the result is a percentage value of the grade.		
RoadSurface	Describes the surface type of the roadway just prior to the vehicle's critical pre-crash event.	Yes	In video
SurfaceCondition	Describes the condition of the surface of the roadway just prior to the vehicle's critical pre-crash event.	Yes	In video
SurfaceDefect	Describes the presence of any surface defects of the roadway just prior to the vehicle's critical pre-crash event, regardless of the relative contribution of the defect(s) to crash causation.	Yes	In video
DesignDefect	Identifies design deficiencies of the roadway as they relate to established American Association of State Highway and Transportation Officials (AASHTO) standards.	Maybe	If captured on video
ShoulderType	Establishes stabilized shoulder presence at the crash site and the type of available shoulder surface. A shoulder is defined as that part of a trafficway that is (1)	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	contiguous with the roadway for emergency use, (2) for accommodation of stopped road vehicles, and (3) for lateral support of the roadway structure.		
ShoulderWidth	Establishes the width of the stabilized shoulder available to this vehicle. To qualify as a stabilized shoulder, the measured shoulder width must exceed two feet (0.61 meters).	Maybe	If captured on video
RumbleStrip	Establishes the presence of a rumble strip, the type of rumble strip, and whether or not the rumble strip was involved in the pre-crash circumstances in terms of this vehicle either departing or not departing the roadway.	Yes	In video
SightLineRestriction	Establishes sight line restrictions for the driver of this vehicle after measuring the sight distance and comparing it to AASHTO standards. This determination is based on recommended sight distances as established by AASHTO. For safety on a highway, the roadway designer	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	<p>must provide sight distance of sufficient length that drivers can control the operation of their vehicle to avoid striking an unexpected object on the travel way.</p>		
SightLineDistance	<p>The measured sight line distance (in meters) represents the distance along the roadway that an object of specified height is continuously visible to the driver. This distance is dependent on the height of the driver's eye above the road surface, the specified object height above the road surface, and the height of sight obstructions within the line of sight.</p>	No	
AASHTODistance	<p>Identifies the AASHTO-recommended sight distance (in meters) for the roadway on which the crash occurred. This variable will have a value attached to it when a sight line restriction is suspected and the actual sight distance is measured. The sight distance as measured is then compared to the recommended sight</p>	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	distance for that situation.		
ENVNoConditions	Documents whether or not there were no adverse atmospheric-related driving conditions just prior to the critical event. (This variable was originally an attribute choice under the variable “Atmospheric Conditions.”)	Yes	In video
ENVRain	Documents whether or not it was raining just prior to the critical event.	Yes	In video
ENVSnow	Documents whether or not it was snowing just prior to the critical event.	Yes	In video
ENVFog	Documents whether or not fog was present just prior to the critical event. (This variable was originally an attribute choice under the variable “Atmospheric Conditions.”)	Yes	In video
ENVWindGusts	Documents whether or not heavy wind gusts were present just prior to the critical event.	Maybe	If captured on video
ENVHail	Documents whether or not hail was falling just prior to the critical event.	Yes	In video
ENVSleet	Documents whether or not sleet (frozen or partially frozen raindrops) was falling just prior to the critical event.	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
ENVVDust	Documents whether or not heavy dust (with corresponding limited visibility) was present just prior to the critical event.	Yes	In video
ENVOtherConditions	Documents whether or not there were other adverse atmospheric-related driving conditions present just prior to the critical event that were not identified in the other atmospheric condition variables.	Maybe	If captured on video

Table 17 shows the variables in the Events data set and the ability of an OBSM system and related information to capture these variables. This data set contains all details that describe the events occurring during the crash.

Table 17. LTCCS Events data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
Stratum	Stratum is the letter identifying the CDS sampling classification to which the case is assigned.	Maybe	From NHTSA
EventSequence	Identifies a particular event in a sequence of the accident.	Yes	In video
ClassVehicle	Describes the class of vehicle for the first vehicle listed on the Case Form Events tab. This represents the	Yes	In PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	same attribute as that found in the General Vehicle Data Set (“Class Of Vehicle” variable) and that found in the Vehicle Exterior Data Set (“Class Of Vehicle” variable). This classification is based on the size of the vehicle.		
DamageArea	Describes the general area of damage on the first vehicle.	Yes	In PAR
EVEObjectContact	Describes the object or vehicle that was contacted by each vehicle in the case.	Yes	In PAR
ClassVehicle2	Describes the class of vehicle for the second vehicle listed on the Case Form Events tab (if the collision was between two vehicles). This represents the same attribute as that found in the General Vehicle Data Set (“Class Of Vehicle” variable) and that found in the Vehicle Exterior Data	Yes	In PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	Set (“Class Of Vehicle” variable). This classification is based on the size of the vehicle.		
DamageArea2	Describes the general area of damage on the second vehicle (if the collision was between two vehicles).	Yes	In PAR

Table 18 shows the variables in the Factor Assessment data set and the ability of an OBSM system and related information to capture these variables. This data set contains data supporting the researcher’s assessment on the roadway, environment, and vehicle-related factors.

Table 18. LTCCS Factor Assessment data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
NoTraffic	Establishes whether or not there are traffic flow interruption factors relevant to the crash.	Yes	In video
AFTPreviousCrash	Establishes whether or not traffic flow at the crash site is interrupted by a previous crash located near this site.	Maybe	If captured on video
ConstructionZone	Establishes whether or not traffic flow at the crash site is interrupted as a result of the crash site being located in a construction work zone.	Yes	In video
EmergencyVehicle	Establishes whether or not traffic flow at the crash site is interrupted as a result of an emergency vehicle	Maybe	If captured on video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	approaching from either direction.		
RushHour	Establishes whether or not traffic flow at the crash site is interrupted as a result of rush hour traffic congestion.	Yes	In video
OtherTraffic	Establishes whether or not traffic flow at the crash site is interrupted as a result of a factor not described in the other traffic flow variables.	Maybe	If captured on video
OtherTrafficSpecify	Documents the “specify” text that was included where the “Other Traffic Flow Interruption” variable (above) was coded as being present for this driver.	Maybe	If captured on video
VehicleDefectCount	Documents the total number of vehicle condition-related factors coded to this vehicle.	No	
LoadObstructedView	Establishes whether or not the driver experiences a view obstruction that is related to the vehicle’s load. Typically in this circumstance, the obstruction is related to oversize cargo. Less frequently occurring, however, is the circumstance where the obstruction is related to improper loading of the cargo. Both of these situations are included in this designation.	Maybe	If captured on video or in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
DesignedObstructedView	Establishes whether or not the driver experiences a view obstruction that is related to vehicle design (e.g., view blocked by upper A-pillar).	Maybe	If captured on video or in PAR
OtherViewObstruction	Establishes whether or not the driver experiences a view obstruction that is related to a factor not described in the other view obstruction variables.	Maybe	If captured on video or in PAR
TireFailure	Establishes whether or not the vehicle experiences a tire malfunction (e.g., blowout, airout, etc.) during the pre-crash phase.	Maybe	If captured on video or in PAR
BrakeFailure	Establishes whether or not the vehicle experiences a braking system malfunction during the pre-crash phase. NOTE: Degraded braking performance (i.e., out-of-adjustment) is coded under the “Brakes Out-Of-Adjustment” variable.	Maybe	If captured on video or in PAR
TransmissionFailure	Establishes whether or not the vehicle experiences a transmission malfunction during the pre-crash phase.	Maybe	If in the PAR
EngineProblem	Establishes whether or not the vehicle experiences an engine-related problem during	Maybe	If in the PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	the pre-crash phase. Examples of engine-related problems include stalling, misfiring, and throttle problems.		
OtherDefect	Establishes whether or not the vehicle experiences a problem/exhibits a condition during the pre-crash phase that is relevant to the crash occurrence, but is not described by other vehicle condition variables.	Maybe	If captured on video or in PAR
OtherDefectSpecify	Documents the “specify” text that was included where the “Other Vehicle Condition” variable (above) was coded as being present for this driver.	Maybe	If captured on video or in PAR
TireDeficiency	Establishes whether or not the vehicle had a tire deficiency prior to the crash event (e.g., low tread depth on one or more tires).	Maybe	If in PAR
BrakesOutOfAdjustment	Establishes whether or not any of the vehicle’s brakes were out-of-adjustment during the pre-crash phase. This variable applies only to heavy trucks.	Maybe	If in PAR
BrakesInoperative	Establishes whether or not any of the vehicle’s brakes were inoperative during the pre-crash phase. This variable	Maybe	If captured on video or in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	applies only to heavy trucks.		
BrakesSystemDeficiency	Establishes whether or not there were any braking system deficiencies prior to the crash that are not described in the other braking variables.	Maybe	If captured on video or in PAR
VehicleOverweight	Establishes whether or not the vehicle was overweight prior to the pre-crash phase. This variable applies to heavy trucks only, and has to do with local ordinances as they relate to a truck's gross vehicle weight rating (GVWR).	Maybe	If in PAR
VehicleLightingDeficiency	Establishes whether or not the vehicle had a lighting system deficiency during the pre-crash phase (e.g., a turn signal or headlight out).	Maybe	If in PAR
CargoLoadSecurement	Establishes whether or not the vehicle's cargo was improperly secured prior to the crash event.	Maybe	If in PAR
SuspensionFrameDeficiency	Establishes whether or not the vehicle had a suspension or frame deficiency prior to the crash event.	Maybe	If in PAR
TowingUnitProblem	Establishes whether or not there was a problem with the towing unit of an articulated vehicle (this variable usually applies only to trucks).	Maybe	If in PAR
ReflectiveTapeMissingObscured	Establishes whether or not the vehicle's	Maybe	If in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	reflective tape was missing or obscured in some manner. This variable only applies to heavy trucks and has to do with FMCSA reflective tape requirements.		
FuelSystemProblem	Establishes whether or not the vehicle experienced a problem that is related to its fuel system during the pre-crash phase.	Maybe	If in PAR
ExhaustLeak	Establishes whether or not the vehicle experienced an exhaust leak during the pre-crash phase.	Maybe	If in PAR
SteeringWheelProblem	Establishes whether or not the vehicle experienced a steering-related problem during the pre-crash phase.	Maybe	If captured on video or in PAR
MedianWidth	Documents the measured median width (in meters) when a roadway geometry factor has been identified involving a crossover. This value is provided when the “Roadway Geometry” variable is coded as being present.	No	
AFTCurveRadius	Documents the measured radius of curvature (in meters) for the roadway on which the crash occurred. This value is specified when the “Roadway Geometry	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	(Curve)” variable is coded as being present.		
SightDistance	Documents the measured sight distance in meters when the “Road Sight Distance Insufficient” variable is coded as being present.	No	
AASHTORcommended	Documents the AASHTO recommended sight distance in meters for this vehicle in the pre-crash phase. This value is specified when the “Road Sight Distance Insufficient” variable is coded as being present.	No	
RoadwayFactorCount	Documents the number of roadway-related factors that were coded for this vehicle.	No	
SignsMissing	Documents whether or not traffic signs/signals have been removed from the designated location and are not physically present. The removal can be associated with either a repair function or vandalism.	No	
ObjectObscured	Documents whether or not there is a view obstruction associated with roadway design, including such added devices as signal boxes, signal light support poles, guardrails, and crash cushions.	Maybe	If captured on video or in PAR
VehicleObscured	Documents whether or not the driver’s view is	Maybe	If captured on video or in the PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	obstructed by an intervening vehicle.		
RoadGeometry	Documents whether or not roadway geometry, usually in the form of a curve, is relevant to the crash.	Yes	In video and/or PAR
InsufficientSight	Documents whether or not the measured sight distance on this roadway does not meet the standard as specified in AASHTO.	No	
BadLaneMarkings	Documents whether or not the driver encounters difficulty as a result of lane delineation. The delineation markings in this circumstance may not be present, may be worn (i.e., reduced visibility), or may be covered in some manner (e.g., gravel, debris, etc.).	Maybe	If captured on video or in PAR
NarrowShoulders	Documents whether or not the driver experiences a problem as a result of a shoulder that is not sufficiently wide. While circumstances will vary depending on location, shoulder width should be less than 1.5 meters to qualify for this designation.	Maybe	If captured on video or in PAR
NarrowRoad	Documents whether or not the driver experiences a problem as a result of insufficient roadway width. While	Maybe	If captured on video or in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	<p>circumstances will vary depending on the type of roadway, two-lane roadways should be less than 20 feet (6.1 meters) in width to qualify for this designation.</p>		
<p>RampSpeed</p>	<p>Documents whether or not the posted ramp entrance/exit speed is inappropriate. This includes circumstances where the posted speed is adequate for one class of vehicle, but is too high for another class of vehicle (e.g., adequate for automobiles, but too high for large trucks).</p>	<p>No</p>	
<p>PoorCondition</p>	<p>Documents whether or not the driver encounters a problem as a result of a roadway maintenance condition. Specific areas of concern include potholes, deteriorated/broken road edges, washboard areas, and depressions where a localized area of the surface has sunk several inches or more.</p>	<p>Maybe</p>	<p>If captured on video or in PAR</p>
<p>SlickSurface</p>	<p>Documents whether or not the driver encounters a low friction surface most commonly associated with an icy condition. There are several other circumstances that can be associated with a pronounced reduction</p>	<p>Maybe</p>	<p>If captured on video or in PAR</p>

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	of friction values. These include loose gravel/sand spread over a paved surface and oil build-ups. Typically, wet surfaces are not included in this designation unless moisture adds to an existing condition such as an oil build-up.		
UnderWater	Documents whether or not one or more travel lanes are completely covered with water.	Yes	In video
WashedOut	Documents whether or not a portion of the roadway collapses/washes away as a result of exposure to running water.	Maybe	In video
OtherProblem	Documents whether or not the driver encounters a roadway problem that is not described by the other roadway-related variables.	Maybe	If captured on video or in PAR
OtherProblemSpecify	Documents the “specify” text that was included where the “Other Roadway Related Factor” variable (above) was coded as being present for this driver.	Maybe	If captured on video or in PAR
WeatherCount	Documents the number of weather related factors that were coded for this vehicle.	Maybe	If captured on video or in PAR
AFTRain	Establishes whether or not it was raining at the time of the crash.	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
AFTSnow	Establishes whether or not it was snowing at the time of the crash.	Yes	In video
AFTFog	Establishes whether or not the driver was operating in fog at the time of the crash.	Yes	In video
WindGust	Establishes whether or not a wind gust occurred prior to the crash and had some relevance to the crash.	Maybe	If captured on video or in PAR
AFTHail	Establishes whether or not the driver was operating in hail at the time of the crash.	Yes	In video
AFTSleet	Establishes whether or not the driver was operating in sleet at the time of the crash.	Yes	In video
OtherWeather	Establishes whether or not there is a relevant weather-related factor that is not described in the other weather variables.	Yes	In video
OtherWeatherSpecify	Documents the “specify” text that was included where the “Other Weather Related Factor” variable (above) was coded as being present for this driver.	Yes	In video
EnvironmentCount	Documents the number of environmental factors that were coded for this vehicle.	Maybe	If captured on video or in PAR
Glare	Establishes whether or not glare in some form is relevant to the crash for this driver. Examples include headlight glare, sun glare, and reflected	Maybe	If captured on video or in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	glare (i.e., sun reflecting off a windshield or other metal component).		
BlowingDebris	Establishes whether or not this driver is exposed to some form of blowing debris. Examples include paper, cardboard boxes, and tree limbs.	Yes	In video
Smoke	Establishes whether or not the driver's view is obscured by the presence of smoke (e.g., smoke from a grass fire, house fire, or forest fire).	Yes	In video
AFTNoDriver	Establishes whether or not there was no driver in the driver's seated position at the time of the crash.	Yes	In video
OtherChangeSpecify	Establishes whether or not the driver experiences a problem as a result of a sudden change in ambience.	Maybe	If captured on video or in PAR

Table 19 shows the variables in the General Vehicle data set and the ability of an OBSM system and related information to capture these variables. This data set contains general information about each vehicle involved in the crash.

Table 19. LTCCS General Vehicle data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
GVEMake	Identifies the vehicle make for this vehicle.	Yes	In PAR
GVEModel	Identifies the vehicle model for this vehicle.	Yes	In PAR
GVEYear	Establishes the model year that the vehicle was manufactured.	Yes	In PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
GVEBodyType	Identifies the body type for this vehicle.	Yes	In PAR
GVEVehicleClass	Establishes the class of vehicle. This classification is largely based on size.	Yes	In PAR
GVECurbWeight	Establishes the weight in kilograms of the vehicle as specified by the manufacturer.	Yes	In PAR
GVEWeightSource	Establishes the source for the weight of the vehicle as reported in the variable "Curb Weight."	Yes	
GVECargoWeight	Documents the weight in kilograms of any cargo that is present in the vehicle at the time of the crash. This number does not include the weight of any occupants in the vehicle. For CDS vehicles that are towing a trailer, this weight represents the weight of the trailer plus its cargo. To obtain the cargo weight (only) of cargo being transported by heavy trucks, the variable CMDBCargoWeight (Total Cargo Weight) in the TruckExterior data set should be used.	No	
GVECargoSource	Establishes the source from which the value reported in the variable "Cargo Weight" was obtained.	No	
GVEVIN	Identifies the VIN for this vehicle.	Yes	In PAR
GVESpecialUse	Establishes any uses for the vehicle outside of personal use.	Maybe	If in PAR
GVEInspection	Documents the type of inspection completed for this vehicle.	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
GVEInspectionDate	Documents the date that the vehicle was inspected by the researcher.	No	
GVEPARSevCode	Documents the highest injury severity code in the vehicle, as reported by police on the PAR.	Yes	In PAR
GVERESsevCode	Documents the highest injury severity code in the vehicle, as determined by injury coding and case narratives. This code is based on information obtained from medical records and/or case narratives and may differ from the police-reported injury severity code.	Maybe	If in PAR
VINMake	Vehicle make as determined by running the vehicle's VIN through the PCVINA computer program.	Yes	Using Polk computer program
VINModel	Vehicle model as determined by running the vehicle's VIN through the PCVINA computer program.	Yes	Using Polk computer program
VINYear	Vehicle year as determined by running the vehicle's VIN through the PCVINA computer program.	Yes	Using Polk computer program
Series	Vehicle series as determined by running the vehicle's VIN through the PCVINA computer program.	Yes	Using Polk computer program
VINBodyType	Vehicle body type as determined by running the vehicle's VIN through the PCVINA computer program.	Yes	Using Polk computer program
Roof1	Vehicle roof type as determined by running the vehicle's VIN through the	Yes	Using Polk computer program

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	PCVINA computer program.		
Roof2	Vehicle roof type as determined by running the vehicle's VIN through the PCVINA computer program.	Yes	Using Polk computer program
Roof3	Vehicle roof type as determined by running the vehicle's VIN through the PCVINA computer program.	Yes	Using Polk computer program
FrontWheelDrive	Presence of front-wheel drive in the vehicle as determined by running the vehicle's VIN through the PCVINA computer program.	Yes	Using Polk computer program
FourWheelDrive	Presence of four-wheel drive in the vehicle as determined by running the vehicle's VIN through the PCVINA computer program.	Yes	Using Polk computer program
GVERestraintType	Types of restraints available in the vehicle as determined by running the vehicle's VIN through the PCVINA computer program.	Yes	Using Polk computer program
Carburetion	Vehicle's carburetion determined by running the vehicle's VIN through the PCVINA computer program.	Yes	Using Polk computer program
FuelType	Vehicle's fuel type as determined by running the vehicle's VIN through the PCVINA computer program.	Yes	Using Polk computer program
VINWeight	Vehicle weight as determined by running the vehicle's VIN through the PCVINA computer program.	Yes	Using Polk computer program

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
VehicleType	Vehicle type as determined by running the vehicle's VIN through the PCVINA computer program.	Yes	Using Polk computer program
WheelConfig	The vehicle's wheel configuration as determined by running the vehicle's VIN through the PCVINA computer program.	Yes	Using Polk computer program
DayRunningLights	Presence of day running lights on vehicle as determined by running the vehicle's VIN through the PCVINA computer program.	Yes	Using Polk computer program
BaseWeight	Vehicle base weight as determined by running the vehicle's VIN through the PCVINA computer program. In kilograms.	Yes	Using Polk computer program
GVEMotorcycleDisplacement	Motorcycle displacement as determined by running the vehicle's VIN through the PCVINA computer program.	Yes	Using Polk computer program
GVETravelSpeed	Documents the travel speed (kph) of the vehicle (prior to the crash) as reported by police on the PAR.	Yes	In PAR
GVEPostedSpeed	Establishes the posted speed limit in effect for the crash location (kph).	Yes	In PAR
DriverPresent	Serves as a flag to identify driverless motor vehicles in transport.	Yes	In video
PARAlcoholPresent	Establishes whether or not the police report indicates that the driver had consumed an alcoholic beverage. Presence is not an indication that alcohol was in any way a cause of the crash, even though it might have been. Finding opened	Yes	In PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	or unopened alcoholic beverages in the vehicle does not by itself constitute presence.		
PARAlcoholTest	Establishes whether or not an alcohol test was administered to this driver.	Yes	In PAR
PARAlcoholTestResult	Reports the results of any analytical alcohol test conducted on the driver. Sources of information include the police report, medical records, and other official sources (in percent times 100).	Yes	In PAR
PARTestDelay	Documents the time delay between the time of the crash and the administration of an alcohol test.	Yes	In PAR
PARTestSource	Establishes the source of the data provided in the variable "Alcohol Test Results."	Yes	In PAR
PARDrugsPresent	Establishes whether or not the police report indicated that the driver had ingested an "other" drug prior to the crash. An "other" drug includes all prescriptions, over-the-counter medications, and "illicit" (illegal) drugs. Police-reported presence of an "other" drug is not an indication that the drug usage was in any way the cause of the crash, even though it might have been. Finding other drugs in the vehicle does not by itself constitute presence.	Yes	In PAR
ZipCode	Documents the five-digit zip code for the driver's primary residence.	Yes	In CDLIS

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
EthnicOrigin	Documents the self-identification of race/ethnic origin by the driver.	No	
CMVCrashes	Reports the number of crashes this driver has been involved in while driving a CMV in the past 5 years, as reported by the DMV.	Yes	In CDLIS
CMVViolations	Reports the number of CMV violations received by this driver in the past 5 years, as reported by the DMV.	Yes	In CDLIS
NonCMVCrashes	Reports the number of crashes this driver has been involved in while driving a non-commercial motor vehicle in the past 5 years, as reported by the DMV.	Yes	In CDLIS
NonCMVViolations	Reports the number of violations received by this driver while driving a non-commercial motor vehicle in the past 5 years, as reported by the DMV.	Yes	In CDLIS
TotalCrashes	Reports the total number of crashes this driver has been involved in while driving any type of vehicle in the past 5 years, as reported by the DMV.	Yes	In CDLIS
GVETotalViolations	Reports the total number of violations received by this driver (CMV and non-CMV) in the past 5 years, as reported by the DMV.	Yes	In CDLIS
PrevViolations	Reports the total number of violations received by this driver (CMV and non-CMV) in the years previous to the last 5 years, as reported by the DMV.	Yes	In CDLIS
UnkTypeCrashes	Reports the number of crashes this driver has been involved in while driving an	Yes	In CDLIS

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	unknown type of vehicle in the past 5 years, as reported by the DMV.		
MCMISCrashes	Reports the number of crashes this driver has been involved in while driving a CMV, as reported to the MCMIS.	Yes	In MCMIS
MCMIScmvViolations	Represents the total number of types of inspection violations cited to this driver (not including local violations), as reported by MCMIS.	Yes	In MCMIS
MCMIScmvNonViolations	Represents the total number of types of “local” inspection violations cited to this driver, as reported by the MCMIS.	Yes	In MCMIS

Table 20 shows the variables in the Hazardous Material data set and the ability of an OBSM system and related information to capture these variables. This data set contains information on hazardous material cargo (if the vehicles involved in the crash were carrying such material at the time of the crash).

Table 20. LTCCS Hazardous Material data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
Material	Establishes the type of hazardous material that the vehicle was transporting at the time of the crash, as reported by the Truck Inspector. The attributes are FMCSA-generated designations.	No	
Reportable	Establishes whether or not the hazardous material that was being transported was a reportable quantity, as reported by the Truck Inspector. This is an	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	FMCSA-generated variable.		
Waiver	Establishes whether or not the carrier had a waiver in place for the hazardous material that was being transported at the time of the crash, as reported by the Truck Inspector. This is an FMCSA-generated variable.	No	

Table 21 shows the variables in the Hazardous Material Inspection data set and the ability of an OBSM system and related information to capture these variables. This data set contains information about hazardous material inspections for trucks carrying such material at the time of the crash.

Table 21. LTCCS Hazardous Material Inspection data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
InspectionExists	Establishes whether or not the truck was inspected by a certified North American Commercial Vehicle Inspector, and that an official truck inspection document exists.	No	
HMIInspection	A listing of the inspection items required by FMCSA, to be completed by the Truck Inspector, when the truck is transporting hazardous materials. This is an FMCSA-generated variable.	No	
HMIViolation	Indicates whether or not the items listed in the variable “Hazardous Material Inspection” are in violation of FMCSA standards. This is an FMCSA-generated variable.	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
HMIOutOfService	Establishes whether or not a particular violation is classified as “out-of-service.” This variable is related to the “Violation” variable, which is related to the “Hazardous Material Inspection” variable. This is an FMCSA-generated variable.	No	
HMIDisposition	Documents the disposition of each violation (how it was handled) by the truck inspector. This variable is related to the “Violation” variable, which is related to the “Hazardous Material Inspection” variable. This is an FMCSA-generated variable.	No	

Table 22 shows the variables in the Injuries data set and the ability of an OBSM system and related information to capture these variables. This data set contains injury information for occupants of vehicles involved in the crash. Each occupant injury is assigned a sequential injury number.

Table 22. LTCCS Injuries data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
OccupantNumber	Number assigned to each occupant in a vehicle.	Yes	In PAR
InjuryNumber	Number assigned to each occupant’s injuries.	Yes	In PAR
OINDescription	Provides a description of each injury.	Yes	In PAR
AISCode	A listing of the Abbreviated Injury Scale (AIS) codes. The AIS is a numerical method for ranking and comparing injuries by severity.	Yes	In PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
Aspect	Documents the location on the body where the injury occurred.	Maybe	If in PAR
InjurySourceCat	Documents the general area of the vehicle in which the source of injury is located.	Maybe	If in PAR
InjurySource	Documents the object that caused a particular injury.	Maybe	If in PAR
IntrusionRow	Documents the seat row of the vehicle where the intrusion occurred.	Maybe	If in PAR
IntrusionLocation	Describes the location within a particular seat row of the vehicle into which the intrusion occurred.	Maybe	If in PAR
CrushDirection	Documents the direction of the intrusion of a particular component into the passenger compartment.	Maybe	If in PAR
CrushMagnitude	Documents a component's magnitude of intrusion into the passenger compartment.	Maybe	If in PAR
Component	Documents the vehicle component that intruded into the passenger compartment and caused a particular injury.	Maybe	If in PAR
InformationSource	Identifies the source of information used to complete AIS coding for each injury.	Yes	

Table 23 shows the variables in the Jackknife Assessments data set and the ability of an OBSM system and related information to capture these variables. This data set contains information on a jackknife if it occurred for any vehicle in the crash.

Table 23. LTCCS Jackknife Assessments data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
AJKType	Establishes the type of pre-crash jackknife event that is experienced by the subject vehicle. In general, the type	Maybe	If captured on video or in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	<p>of jackknife event is determined by the unit of the articulated combination that begins to rotate first.</p> <p>For example, if the tractor/cab unit is the first unit to begin rotating, the event is generally considered a tractor jackknife. If, on the other hand, the trailer unit is the first unit to begin rotating, the event is generally considered to be trailer swing.</p>		
AJKSource	Establishes the source of the jackknife impetus.	Maybe	If captured on video or in PAR
AJKLocation	Establishes the location of the vehicle at the start of the jackknife sequence.	Yes	In video
AJKDirection	Establishes the direction of rotation of the first unit within the articulated vehicle configuration to begin jackknifing.	Yes	In PAR
WhileCount	Documents the number of circumstances in which the jackknife occurred that were coded to this vehicle.	Maybe	If in PAR
AJKConstant	Establishes whether or not the driver is attempting to maintain a constant velocity at the time the vehicle begins to jackknife.	Yes	In video
AJKCurve	Establishes whether or not the driver is traversing a curve at the time the vehicle begins to jackknife.	Yes	In video
AJKTurn	Establishes whether or not the driver is attempting to turn at the time the vehicle begins to jackknife.	Yes	In video
AJKLightBraking	Establishes whether or not the driver is decelerating	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	using light braking effort at the time the vehicle begins to jackknife. While the term “light braking” is a subjective evaluation, it generally implies that the level of braking effort is less than the level typically associated with a normal traffic stop.		
AJKAccelerating	Establishes whether or not the driver is accelerating at the time the vehicle begins to jackknife.	Yes	In video
AJKAvoidance	Establishes whether or not the driver initiates a pre-crash avoidance maneuver at or prior to the time the vehicle begins to jackknife.	Yes	In video
AJKOther	Establishes whether or not the circumstance associated with the jackknife is not described by the other jackknife event variables.	Maybe	If captured on video or in PAR
AJKDecelerating	Establishes whether or not the driver is decelerating and decelerates solely by reducing throttle input at the time the vehicle begins to jackknife.	Maybe	If captured on video or in PAR
AJKModerateBraking	Establishes whether or not the driver is decelerating using a moderate level of braking effort at the time the vehicle begins to jackknife. A moderate level of braking effort generally implies that the level of braking effort is similar to the level typically associated with a normal traffic stop.	Yes	In video
AJKHeavyBraking	Establishes whether or not the driver is decelerating	Yes	In video

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	using a heavy level of braking effort (e.g., panic stop) at the time the vehicle begins to jackknife. The vehicle will typically experience wheel “lock-up” in this circumstance; however, wheel lock is not a requirement for using this designation.		
AJKStraight	Establishes whether or not the driver is traversing a straight roadway segment at the time the vehicle begins to jackknife.	Yes	In video

Table 24 shows the variables in the MCMIS Driver Data data set and the ability of an OBSM system and related information to capture these variables. This data set contains the number of prior crashes, vehicle inspections, and inspection violations associated with the driver as reported by MCMIS.

Table 24. LTCCS MCMIS Driver Data data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
Crashes	Represents the total number of crashes for this driver, as reported by MCMIS.	Yes	In MCMIS
Inspections	Represents the total number of inspections performed on a vehicle driven by this driver, as reported by MCMIS.	Yes	In MCMIS
InspDriverOOS	Represents the total number of “driver” out-of-service violations for this driver, as reported by MCMIS.	Yes	In MCMIS
InspVehOOS	Represents the total number of “vehicle” out-of-service violations for this driver, as reported by MCMIS.	Yes	In MCMIS
LocalViols	Represents the total number of types of “local”	Yes	In MCMIS

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	inspection violations cited to this driver, as reported by MCMIS.		
InspViols	Represents the total number of types of inspection violations cited to this driver (not including local violations), as reported by MCMIS.	Yes	In MCMIS

Table 25 shows the variables in the MCMIS Violation Data data set and the ability of an OBSM system and related information to capture these variables. This data set contains information on the inspection violations issued to a driver as reported by MCMIS.

Table 25. LTCCS MCMIS Violation Data data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
NumViols	Represents the number of violation codes cited to this driver, as reported by MCMIS.	Yes	In MCMIS
NumOOSViols	Represents the number of out-of-service codes cited to this driver, as reported by MCMIS.	Yes	In MCMIS
Code	Represents the violation codes cited to this driver, as reported by MCMIS. This coding structure was established by the FMCSA.	Yes	In MCMIS
ViolDesc	Provides a description of each type of violation received by this driver.	Yes	In MCMIS

Table 26 shows the variables in the Non-Motorists data set and the ability of an OBSM system and related information to capture these variables. This data set contains information on each non-motorist who was involved in the crash.

Table 26. LTCCS Non-Motorists data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
ANMAge	Establishes the non-motorist's age at the time of the crash. Age is recorded with respect to the non-motorist's last birthday.	Yes	In PAR
ANMHeight	Establishes the height of the non-motorist, recorded in centimeters.	Maybe	If in PAR
ANMWeight	Establishes the weight of the non-motorist, recorded in kilograms.	Maybe	If in PAR
ANMGender	Reports the gender of the non-motorist.	Yes	In PAR
ANMType	Establishes the specific type of non-motorist involved in the crash.	Maybe	If captured on video or in PAR
ANMPosition	Describes the non-motorist's vertical orientation just prior to the non-motorist's first avoidance action. If there was no avoidance action, this variable represents the non-motorist's vertical orientation just prior to first impact. Individuals who are standing in a stationary position, walking, or running are all classified as standing.	Maybe	If captured on video or in PAR
Motion	Describes the motion of the non-motorist just prior to the non-motorist's first avoidance action. If there was no avoidance action, this represents the non-motorist's motion just prior to the first impact.	Maybe	If captured on video or in PAR
Action	Describes the direction of the non-motorist's motion with respect to the vehicle,	Maybe	If captured on video or in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	prior to the first avoidance action. If there was no avoidance action, this variable represents the non-motorist's motion with respect to the vehicle just prior to first impact.		
Orientation	Describes the non-motorist's body orientation with respect to the striking vehicle prior to avoidance actions. "Facing vehicle" indicates the non-motorist's body (chest) is facing the path of travel of the striking vehicle (which may be tracking or yawing).	Maybe	If captured on video or in PAR
SightImpaired	Establishes non-motorist sight impairments. An individual is considered sight impaired if the corrected vision level exceeds 20/70 on a standard measurement scale.	Maybe	If captured on video or in PAR
SightRestricted	Establishes non-motorist sight restrictions with respect to the non-motorist's pre-crash view of the striking vehicle. Specifically, did the non-motorist have an unobstructed view regardless of whether or not the non-motorist actually checked for approaching traffic?	Maybe	If captured on video or in PAR
HearingImpaired	Establishes non-motorist hearing impairments. Total deafness is considered a hearing impairment.	Maybe	If in PAR
HearingRestricted	Establishes non-motorist hearing restrictions.	Maybe	If in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	This information is important with respect to the non-motorist hearing the approaching vehicle and/or warnings (horn) attempted by the vehicle driver.		
Distraction	Documents non-motorist pre-crash distraction as a result of engaging in a variety of activities.	Maybe	If captured on video or in PAR
ANMDecision	Documents decision errors made by the non-motorist during the pre-crash phase.	Maybe	If captured on video or in PAR
RiskTaking	Documents pre-crash risk-taking behavior by the non-motorist. This is a subjective evaluation based on the preponderance of evidence. Examples of risk-taking behavior would include crossing the street in a mid-block area without the benefit of a defined pedestrian crosswalk and associated TCD, crossing against a “Don’t Walk” pedestrian signal warning, and walking in the traffic lane.	Maybe	If captured on video or in PAR
ANMAvoidance	Documents the non-motorist’s first pre-crash avoidance action. To be considered an avoidance action, the non-motorist activity must be a conscious or instinctive action and not a kinematic response to the impact.	Maybe	If captured on video or in PAR
HandsUsed	Describes the non-motorist’s attempted use of his or her hands in completing the avoidance action. The primary	Maybe	If captured on video or in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	categories for attempted hand use are vaulting and bracing. These actions may or may not be successful and may or may not be appropriate. The primary factor here is non-motorist intent.		
ANMPARSevCode	Represents the police-reported injury severity code for the non-motorist.	Yes	In PAR
ANMRESsevCode	Represents the non-motorist's injury severity code, as determined by injury coding and case narratives. This code is based on occupant medical records and/or case narratives and may differ from the police-reported injury severity code.	Maybe	Need to rely on PAR

Table 27 shows the variables in the Occupants data set and the ability of an OBSM system and related information to capture these variables. This data set contains information related to each of the occupants in the vehicles involved in the crash.

Table 27. LTCCS Occupants data set and ability to capture via commercially available OBSMs.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
OccupantNumber	OccupantNumber is assigned to each occupant in a vehicle.	Yes	In PAR
OCCAge	Documents the age of the occupant at the time of the crash with respect to the occupant's last birthday.	Yes	In PAR
OCCHeight	Documents the height of the occupant to the nearest centimeter.	Maybe	If in PAR
OCCWeight	Documents the weight of the occupant to the nearest kilogram.	Maybe	If in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
OCCGender	Identifies the gender of the occupant and includes information regarding pregnancy.	Yes	In PAR
Role	Describes the role of the occupant within the vehicle – driver or passenger.	Yes	In PAR
Race	Represents the occupant's self-identification of his/her race or ethnic origin. Self-identification represents self-classification by people according to the race with which they identify themselves.	No	
EyeWear	Documents whether or not the occupant was wearing any type of eyewear, including contact lenses, at the time of the crash.	Maybe	If captured on video or in PAR
AirbagAvail	Captures what was documented on the police report regarding the availability and functioning of any airbag system.	Yes	In PAR
ParBeltUsed	Captures what was documented on the police report regarding occupant use of available vehicle restraints (i.e., manual belts, child safety seat, or automatic restraints).	Yes	In PAR
EjectionType	Describes the type of occupant ejection that was involved during the crash sequence. Ejection refers to the person being completely or partially thrown from the vehicle as a result of the impact or rollover.	Maybe	If captured on video or in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
EjectionArea	Describes the general area of the vehicle from where the occupant ejection occurred during the crash sequence. Ejection refers to the person being completely or partially thrown from the vehicle as a result of the impact or rollover.	Maybe	If captured on video or in PAR
Medium	Describes the component of the vehicle from which the occupant was ejected during the crash sequence. Ejection refers to the person being completely or partially thrown from the vehicle as a result of the impact or rollover.	Maybe	If captured on video or in PAR
MediumStatus	Describes the status of the component of the vehicle from which the occupant was ejected during the crash sequence. This variable represents the status of the component immediately prior to the impact.	Maybe	If captured on video or in PAR
MultiEjection	Indicates whether or not there were multiple ejections associated with a particular vehicle.	Maybe	If captured on video or in PAR
Entrapment	Documents whether or not the occupant was physically trapped inside the vehicle by an integral part of the vehicle (e.g., intruding component).	Maybe	If captured on video or in PAR
Mobility	Documents the mobility of the occupant (how the occupant exited the vehicle) after the crash.	Maybe	If captured on video or in PAR
Intrusions	Documents the number of vehicle components that	Maybe	If captured on video or in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	intruded into the passenger compartment of the vehicle as a result of the crash.		
Row	Identifies in which row in the vehicle the occupant was seated.	Maybe	If captured on video or in PAR
OCCLocation	Identifies in which seat in the vehicle the occupant was located. This variable is used in conjunction with the variable "Row" to determine the exact seating location for a particular occupant.	Maybe	If captured on video or in PAR
Posture	Describes the occupant's last known position in the vehicle just prior to impact. This variable is designed to capture those instances where an occupant was not in the usual upright, forward-facing seated position prior to the crash.	Maybe	If captured on video or in PAR
OCCRestraintType	Describes the type of head restraint available for a particular seating position.	Maybe	If captured on video or in PAR
RestraintDamage	Describes any type of damage to the head restraint by the occupant at a particular seating position.	Maybe	If captured on video or in PAR
SeatType	Describes the type of seat available for a particular occupant position.	Maybe	If captured on video or in PAR
SeatOrientation	Describes the orientation (the direction that it is facing) of a particular seat in the vehicle.	Yes	In video
TrackPosition	Describes the seat position (on its track) at the time of impact.	Maybe	If in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
SeatPerformance	Assesses the performance of the seat during the crash sequence. The attributes are indications of whether the seat failed or was deformed in any way.	Maybe	If captured on video or in PAR
IntegratedRestraints	Indicates whether or not the seat belts associated with a particular seat are an integral part of the seat. In other words, the belts are a part of the seat itself.	Maybe	If captured on video or in PAR
PriorInclination	Describes the pre-crash position of the seat back for a particular seat in the vehicle and is relevant only for adjustable (reclining) seat backs.	Maybe	If captured on video or in PAR
PostInclination	Describes the post-impact position of the seat back for a particular seat in the vehicle and is relevant only for adjustable (reclining) seat backs. This variable reflects the change in the seat back incline position as a result of forces upon it during the crash sequence.	Maybe	If captured on video or in PAR
ChildSeatAvailable	Indicates whether or not a particular occupant was seated in a child safety seat.	Maybe	If captured on video or in PAR
AirbagAvailable	Identifies whether an airbag was available for a particular seating position.	Yes	Obtained from VIN or carrier
ManualBeltAvailable	Identifies the type of manual belt system available for a particular seating position.	Yes	Obtained from VIN or carrier
ManualBeltUsed	Documents actual usage of a manual belt at a particular seating position.	Maybe	If captured on video or in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
ManualBeltProper	Documents if the manual belt system was used as it was intended to be used (as it was designed) at a particular seating location.	Maybe	If captured on video or in PAR
ManualBeltFailure	Indicates failure of a manual belt system during the crash sequence, based on physical evidence.	Maybe	If in PAR
AnchorAdjustment	Documents the position of the adjustable upper anchorage point of the manual shoulder belt at the time of the crash.	Maybe	If captured on video or in PAR
PretensionerAvailable	<p>Identifies whether or not a seat belt pretensioner is present for a manual belt. Pretensioners are designed to take up the slack in the seat belt during a crash of sufficient deceleration.</p> <p>When the vehicle is involved in a collision of sufficient force, a microprocessor causes current to flow through the seat belt deployment loops to the initiator. Current passing through the initiator ignites the material in the canister, producing a rapid generation of gas. The gas produced from this reaction deploys the seat belt pretensioners and shortens the seat belt pretensioner height, which removes all of the slack in the seat belts. The seat belt pretensioners will deploy immediately before the frontal initiator (airbag) modules deploy.</p>	Maybe	If captured on video or in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
PretensionerActuated	Documents whether or not a manual seat belt pretensioner activated during the crash.	Maybe	If captured on video or in PAR
PretensionerTravel	Documents the distance (in millimeters) the pretensioner moved from its original position during the crash.	Maybe	If captured in video
Retractor	Describes the type of retractor associated with a particular seat belt. Retractors wind up the loose webbing of the unused 3-point safety belt, take up the slack, and provide slight tension on belts that are in use.	Yes	Carrier information
ManualBeltSource	Documents from where the researcher obtained the preponderance of information to make the determination that the manual belt system was used.	Yes	
AutoBeltAvailable	Identifies the type of automatic belt system available for a particular seating position.	Maybe	If captured on video or in VIN but if destroyed not known
AutoBeltUsed	Documents actual usage of an automatic belt at a particular seating position.	Maybe	If captured on video or in PAR
BeltMotorized	Indicates whether the automatic belt system is motorized or non-motorized.	Maybe	If captured on video, with VIN, or from carrier information
AutoBeltProper	Documents if the automatic belt system was used as it was intended to be used (as it was designed) at a particular seating location.	Maybe	If captured on video or in PAR
AutoBeltFailure	Indicates failure of an automatic belt system	Maybe	If captured on video or in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	during the crash sequence based on physical evidence.		
AutoBeltSource	Documents from where the researcher obtained the preponderance of information to make the determination that the automatic belt system was used.	Yes	
OCCInjSeverityCode	Identifies the police-reported injury severity for a particular occupant.	Yes	In PAR
Mortality	Documents whether or not the occupant died as a result of the crash (either due to injuries received during the crash or due to a physical incapacitation that led to the crash).	Yes	In PAR
InitialTreatment	Describes the type of medical treatment an occupant received as a result of the crash.	Maybe	If in PAR
InitialFacility	Describes the category of medical facility that provided initial treatment to an occupant as a result of injuries from the crash.	Maybe	If in PAR
HospitalDays	Documents the number of days that the occupant was hospitalized (after being admitted) in a primary medical care facility.	Maybe	If in PAR
WorkDaysLost	Documents the actual number of “work” days lost due to the crash by an employed person or a full-time college student. Employed is defined to mean that the occupant was scheduled to work at least four hours on each of	Maybe	If in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	the days lost. The days lost need not be due to injury.		
DateOfDeath	Identifies the actual date of death for a fatally injured occupant.	Maybe	If in PAR
TimeOfDeath	Identifies the actual time of death for a fatally injured occupant (military clock time).	Maybe	If in PAR
InjuryCount	Represents the total number of coded injuries (coded by the Zone Center) for a particular occupant.	Maybe	If in PAR
GCSScore	Documents the actual value of the initial Glasgow Coma Scale (GCS) score obtained at a medical facility. The GCS assesses three neurological functions: eye opening, motor response, and verbal response. The GCS is taken from medical records.	No	
UnitsTransfused	Documents the number of blood units given to an occupant for treatment of injuries resulting from the crash.	No	
ABGTest	Documents the reported HCO ₃ (bicarbonate) value obtained for this occupant. This information is found on medical records.	No	

Table 28 shows the variables in the Overview data set and the ability of an OBSM system and related information to capture these variables. This data set contains a summary of factors coded to each vehicle involved in the crash from select variables in other data sets.

Table 28. LTCCS Overview data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
OVEMake	This variable identifies the vehicle make for this vehicle.	Yes	In PAR
OVEModel	Identifies the vehicle model for this vehicle (with OVEMake).	Yes	In PAR
OVEYear	Establishes the model year that the vehicle was manufactured.	Yes	In PAR
OVEConfiguration	Provides a summary of the configuration of the rig. Letter codes are “strung together” (listed from left to right) to represent the order of equipment in the rig. For example, a tractor pulling two trailers connected by an A-dolly would have a configuration of “TSAS.”	Yes	In PAR
Movement	Establishes the subject vehicle’s pre-critical event movement pattern. The pre-event movement pattern is usually described as the point that precedes both the critical pre-crash envelope and the vehicle motions that place the involved vehicle(s) on an imminent collision path.	Yes	In video and/or PAR
OVECriticalEvent	Identifies the event that made the crash imminent (i.e., something occurred which made the collision inevitable). A pre-crash critical event is coded for each vehicle in the crash and documents the circumstances leading to this vehicle’s first impact in the crash sequence.	Yes	In video and/or PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
OVEReason	<p>Establishes the critical reason for the occurrence of the critical event. The critical reason is the immediate reason for this event and is often the last failure in the causal chain (i.e., closest in time to the critical pre-crash event). Although the critical reason is an important part of the description of crash events, it is not the cause of the crash nor does it imply the assignment of fault.</p>	Yes	In video and/or PAR
OVEAvoidance	<p>Attempted avoidance maneuvers are movements/ actions initiated by the subject driver, within the crucial crash envelope, in response to a critical pre-crash event. Attempted avoidance maneuvers occur after the driver realizes the impending danger. Documents the driver's actions initiated in response to the realization of impending danger.</p>	Yes	In video and/or PAR
OVEStability	<p>The purpose of this variable is to assess the stability of the vehicle after the critical event. The stability of the vehicle prior to an avoidance action is not considered except in the following situation: A vehicle that is out of control (e.g., yawing clockwise) prior to an avoidance maneuver is coded "Other vehicle loss of control" only if an avoidance action was taken</p>	Yes	In video and/or PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	in response to an impending danger. Thus, the variable focuses upon this vehicle's dynamics after the critical event.		
OVELocation	Reports the location of the subject vehicle at the point where its pre-impact stability is determined.	Yes	In video and/or PAR
OVERightOfWay	Establishes vehicle right-of-way characteristics, from a legal perspective for the subject vehicle. Specifically, did this vehicle have the right-of-way?	Yes	In video and/or PAR
OVEAccidentType	Is used in categorizing the collisions of drivers involved in crashes. A collision is defined here as the first harmful event in a crash between a vehicle and some object, accompanied by property damage or human injury. The object may be another vehicle, a person, an animal, a fixed object, the road surface, or the ground. If the first collision is a rollover, the impact is with the ground or road surface. The collision may also involve plowing into soft ground, if severe deceleration results in damage or injury. A road departure without damage or injury is not defined as a collision. This variable is part of the larger variable "Crash Type." The "Crash Type" variable is actually broken down into three	Yes	In video and/or PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	<p>components: the crash category, the crash configuration, and the accident type. This variable only deals with the configuration of the crash.</p>		
OVECrashCode	<p>Is used in categorizing the collisions of drivers involved in crashes. A collision is defined here as the first harmful event in a crash between a vehicle and some object, accompanied by property damage or human injury. The object may be another vehicle, a person, an animal, a fixed object, the road surface, or the ground. If the first collision is a rollover, the impact is with the ground or road surface. The collision may also involve plowing into soft ground, if severe deceleration results in damage or injury. A road departure without damage or injury is not defined as a collision. This variable encompasses the “Crash Configuration” variable, which is a component of this variable.</p>	Yes	In video and/or PAR
OVEJackKnife	Indicates whether or not a jackknife occurred for this vehicle.	Yes	In video and/or PAR
OVECargoShift	Indicates whether or not a cargo shift occurred for this vehicle.	Maybe	If captured on video or in PAR
OVEAlcohol	Indicates whether or not there was any alcohol involvement for this vehicle/driver.	Maybe	If captured on video or in PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
AnyDrugsVeh	Indicates whether or not any drugs (either legal or illegal) were coded as present for this vehicle/driver.	Maybe	If captured on video or in PAR
DriverPhysical	Indicates whether or not there were any other physical factors coded for this vehicle/driver.	Maybe	If captured on video or in PAR
DriverFatigue	Indicates whether or not the driver in this vehicle was coded as being fatigued at the time of the crash.	Yes	In video and/or PAR
OVERecognition	Indicates whether or not any recognition-related factors were coded for this vehicle/driver.	Yes	In video and/or PAR
OVEDecision	Indicates whether or not any decision-related factors were coded for this vehicle/driver.	Yes	In video and/or PAR
Aggression	Indicates whether or not any aggression factors were coded for this vehicle/driver.	Yes	In video and/or PAR
OVESurveillance	Indicates whether or not any surveillance-related factors were coded for this vehicle/driver.	Yes	In video and/or PAR
EmotionExperience	Indicates whether or not there were any emotional or experience-related factors coded for this vehicle/driver.	Yes	In video and/or PAR
CarrierEmployer	Indicates whether or not any carrier or employer factors were coded for this vehicle/driver.	Maybe	If in PAR
Traffic	Indicates whether or not any traffic-related factors were coded for this vehicle/driver.	Yes	In video and/or PAR
VehicleState	Indicates whether or not any vehicle-related factors	Yes	In PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	(deficiencies or malfunctions) were coded for this vehicle.		
Roadway	Indicates whether or not any roadway-related factors were coded for this vehicle/driver.	Yes	In video and/or PAR
Weather	Indicates whether or not any weather-related factors were coded for this vehicle/driver.	Yes	In video and/or PAR
OVEEnvironment	Indicates whether or not there were any environmental factors coded for this vehicle/driver.	Yes	In video and/or PAR
OVESpeed	Indicates whether or not any speed-related or gap distance-related factors were coded for this vehicle/driver.	Yes	In video and/or PAR
NonMotorist	Indicates whether or not a non-motorist was involved in an impact with this vehicle.	Yes	In video and/or PAR

Table 29 shows the variables in the PAR Violations data set and the ability of an OBSM system and related information to capture these variables. This data set contains violations filed against the driver as a result of the crash as reported in the PAR.

Table 29. LTCCS PAR Violations data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
PARViolationCode	Indicates violation of the Vehicle Code as charged by the investigating officer and as noted on the police report.	Yes	In PAR
PARDescription	Describes the violations charged to the driver as indicated on the police report.	Yes	In PAR

Table 30 shows the variables in the SAFER Authority Status data set and the ability of an OBSM system and related information to capture these variables. This data set includes information on the insurance licensing authority for the driver’s carrier which is imported from FMCSA’s SAFER database.

Table 30. LTCCS SAFER Authority Status data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
CommonStatus	Describes the standing of the common carrier certificate (operating authority).	Yes	http://li-public.fmcsa.dot.gov/LIVIEW/pkg_carrquery.prc_carrlist
ContractStatus	Describes the standing of the contract carrier permit (operating authority).	Yes	http://li-public.fmcsa.dot.gov/LIVIEW/pkg_carrquery.prc_carrlis
BrokerStatus	Describes the standing of the broker license (operating authority).	Yes	http://li-public.fmcsa.dot.gov/LIVIEW/pkg_carrquery.prc_carrlis

Table 31 shows the variables in the SAFER Carrier data set and the ability of an OBSM system and related information to capture these variables. This data set contains information on the operations of the CMV driver’s carrier (obtained from FMCSA’s SAFER database).

Table 31. LTCCS SAFER Carrier data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
AuthorizedForHire	A commercial entity whose primary business activity is the transportation of property or passengers by motor vehicle for compensation.	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx
ExemptForHire	A for-hire entity transporting commodities or conducting	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	operations not subject to economic regulation by the Interstate Commerce Commission.		
PrivateProperty	An entity whose highway transportation activities are incidental to, and in furtherance of, its primary business activity.	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx
PrivatePassengersBusiness	A private entity engaged in the interstate transportation of passengers which is provided in the furtherance of a commercial enterprise and is not available to the public at large.	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx
PrivatePassengersNonBusiness	A private entity engaged in the interstate transportation of passengers that does not otherwise meet the definition of a private entity transporting passengers (business) (e.g., church buses).	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx
Migrant	An entity who transports in interstate or foreign commerce, at any one time, three or more	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	migrant workers to or from their employment (refers to “contract carrier by motor vehicle”).		
USMail	An entity which transports U.S. Mail.	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx
FederalGovernment	Transportation of property or passengers by a U.S. Federal Government Agency.	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx
StateGovernment	Transportation of property or passengers by a U.S. State Government Agency.	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx
LocalGovernment	Transportation of property or passengers by a local municipality.	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx
IndianTribe	Transportation of property or passengers by an Indian tribal government.	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx
Other	An entity which does not fall into one of the other listed classifications.	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx
Unknown	Entity type unknown.	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx
CargoCarried	Describes the specific type of cargo hauled by this carrier.	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx
SCAStatus	Describes the status of the carrier in MCMIS.	Yes	In MCMIS

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
CarrierOperationDescription	Describes the carrier's type of operation – it describes where the carrier is allowed to go (intrastate vs. interstate).	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx
CountDrivers	Documents the number of drivers employed by this carrier.	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx
CountPowerUnits	Documents the number of power units owned, trip-leased, and term-leased by this carrier.	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx
MileageYear	Documents the calendar year on the carrier's MCS-150 form that represents the year in which the carrier-reported mileage was obtained.	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx
Mileage	Documents the carrier's total fleet mileage to the nearest 10,000 miles for the last calendar year, as reported by the carrier on the MCS-150 form.	Yes	http://safer.fmcsa.dot.gov/CompanySnapshot.aspx

Table 32 shows the variables in the SAFER Crash Summary data set and the ability of an OBSM system and related information to capture these variables. This data set contains summary crash information for the CMV driver's carrier (obtained from FMCSA's SAFER database).

Table 32. LTCCS SAFER Crash Summary data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
SCSYear	Identifies the year from which the crash data are taken.	Yes	http://ai.fmcsa.dot.gov/sms/
SCSFatalities	Documents the number of crashes that caused at least one fatality for this carrier in a particular year. This number includes the carrier's driver(s) and occupants in any other involved vehicles.	Yes	http://ai.fmcsa.dot.gov/sms/
SCSInjuries	Documents the number of crashes that caused at least one injury for this carrier in a particular year. This number includes the carrier's driver(s) and occupants in any other involved vehicles.	Yes	http://ai.fmcsa.dot.gov/sms/
SCSTowaway	Documents the number of crashes that caused at least one vehicle to be towed from the scene of a crash involving one of this carrier's vehicles in a particular year. This number includes both the carrier vehicle and any other involved vehicles.	Yes	http://ai.fmcsa.dot.gov/sms/

Table 33 shows the variables in the SAFER Driver Crash Report data set and the ability of an OBSM system and related information to capture these variables. This data set contains historical information from previous crashes involving the CMV driver (obtained from FMCSA's SAFER database).

Table 33. LTCCS SAFER Driver Crash Report data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
SCDDate	Identifies the date of a particular crash.	Yes	https://safer.fmcsa.dot.gov/
SCDState	Identifies the State in which a particular crash occurred.	Yes	https://safer.fmcsa.dot.gov/
SCDDateOfBirth	Identifies the driver's year of birth for a particular crash.	Yes	https://safer.fmcsa.dot.gov/
SCDFatalities	Documents the total number of fatalities as a result of a particular crash.	Yes	https://safer.fmcsa.dot.gov/
SCDInjuries	Documents the total number of persons injured as a result of a particular crash.	Yes	https://safer.fmcsa.dot.gov/
SCDTowaway	Indicates whether or not a vehicle involved in a particular crash was towed away from the scene of the crash.	Yes	https://safer.fmcsa.dot.gov/
HazardousMaterial	Indicates whether or not there was any hazardous material involved/released in the crash.	Yes	https://safer.fmcsa.dot.gov/
ANL	Indicates whether or not the sequence of events in the crash included a collision with an animal.	Yes	https://safer.fmcsa.dot.gov/
BIK	Indicates whether or not the sequence of events in the crash included a collision with a pedal cycle.	Yes	https://safer.fmcsa.dot.gov/
CGO	Indicates whether or not the sequence of events in the crash included a non-collision event	Yes	https://safer.fmcsa.dot.gov/

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	involving a cargo loss or shift.		
EQF	Indicates whether or not the sequence of events in the crash included a non-collision event involving a vehicle failure (e.g., brake failure, blown tire, etc.).	Yes	https://safer.fmcsa.dot.gov/
FIR	Indicates whether or not the sequence of events in the crash included a non-collision event involving an explosion or fire.	Yes	https://safer.fmcsa.dot.gov/
FOB	Indicates whether or not the sequence of events in the crash included a collision with a fixed object.	Yes	https://safer.fmcsa.dot.gov/
JAK	Indicates whether or not the sequence of events in the crash included a non-collision event involving a jackknife.	Yes	https://safer.fmcsa.dot.gov/
MVH	Indicates whether or not the sequence of events in the crash included a collision with a motor vehicle in transport.	Yes	https://safer.fmcsa.dot.gov/
NCM	Indicates whether or not the sequence of events in the crash included a non-collision event where the vehicle crossed the centerline or the median.	Yes	https://safer.fmcsa.dot.gov/

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
NCO	Indicates whether or not the sequence of events in the crash included a non-collision event not described by the other Event variable choices.	Yes	https://safer.fmcsa.dot.gov/
OFR	Indicates whether or not the sequence of events in the crash included a non-collision event where the vehicle ran off the roadway.	Yes	https://safer.fmcsa.dot.gov/
OOB	Indicates whether or not the sequence of events in the crash included a collision with an “other” moveable object.	Yes	https://safer.fmcsa.dot.gov/
OTH	Indicates whether or not the sequence of events in the crash included an “other” type of collision.	Yes	https://safer.fmcsa.dot.gov/
OVR	Indicates whether or not the sequence of events in the crash included a non-collision event involving an overturn/rollover.	Yes	https://safer.fmcsa.dot.gov/
PED	Indicates whether or not the sequence of events in the crash included a collision with a pedestrian.	Yes	https://safer.fmcsa.dot.gov/
PVH	Indicates whether or not the sequence of events in the crash included a collision with a parked motor vehicle.	Yes	https://safer.fmcsa.dot.gov/

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
RUN	Indicates whether or not the sequence of events in the crash included a collision that involved a downhill runaway vehicle.	Yes	https://safer.fmcsa.dot.gov/
SEP	Indicates whether or not the sequence of events in the crash included a non-collision event involving a separation of units.	Yes	https://safer.fmcsa.dot.gov/
TRN	Indicates whether or not the sequence of events in the crash included a collision with a train.	Yes	https://safer.fmcsa.dot.gov/
UMO	Indicates whether or not the sequence of events in the crash included a collision with an unknown moveable object.	Yes	https://safer.fmcsa.dot.gov/
UNK	Indicates whether or not the sequence of events in the crash included a non-collision event of an unknown nature.	Yes	https://safer.fmcsa.dot.gov/
WZE	Indicates whether or not the sequence of events in the crash included a collision with work zone maintenance equipment.	Yes	https://safer.fmcsa.dot.gov/

Table 34 shows the variables in the Safer Driver Inspection data set and the ability of an OBSM system and related information to capture these variables. This data set contains inspection information for the driver while employed by this carrier (obtained from FMCSA’s SAFER database).

Table 34. LTCCS SAFER Driver Inspection data set and ability to capture via OBSMs.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
LevelCode	Indicates the level of the inspection for a particular inspection.	Yes	https://safer.fmcsa.dot.gov/
SDIDate	Documents the date of a particular inspection.	Yes	https://safer.fmcsa.dot.gov/
SDIState	Documents the State in which a particular inspection took place.	Yes	https://safer.fmcsa.dot.gov/
SDIDriverDOB	Documents the driver's year of birth as it relates to a particular inspection.	Yes	https://safer.fmcsa.dot.gov/
SDITotalViolations	Indicates the total number of violations found during a particular inspection.	Yes	https://safer.fmcsa.dot.gov/
TotalOOS	Indicates the total number of out-of-service violations found during a particular inspection.	Yes	https://safer.fmcsa.dot.gov/
SDIHazMat	Indicates whether or not a particular inspection involved hazardous materials.	Yes	https://safer.fmcsa.dot.gov/

Table 35 shows the variables in the SAFER Driver Violation data set and the ability of an OBSM system and related information to capture these variables. This data set includes information on any violation issued to the CMV driver while employed by this carrier (obtained from FMCSA's SAFER database).

Table 35. LTCCS SAFER Driver Violation data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
SDVViolation	Lists the different types of violations assigned to this particular driver within a particular time period.	Yes	https://safer.fmcsa.dot.gov/
UnitNumber	Is an identifier used to distinguish individual units inspected.	Yes	https://safer.fmcsa.dot.gov/

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
SDVUnitType	Indicates the type of unit on which a particular inspection is conducted.	Yes	https://safer.fmcsa.dot.gov/
SDVOutOfService	Documents the number of out-of-service violations for a particular driver within a particular time period.	Yes	https://safer.fmcsa.dot.gov/

Table 36 shows the variables in the SAFER Inspections Summary data set and the ability of an OBSM system and related information to capture these variables. This data set contains a summary of vehicle, driver, and hazardous material inspection information for the CMV driver's carrier (obtained from FMCSA's SAFER database).

Table 36. LTCCS SAFER Inspections Summary data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
DriverInspections	Documents the total number of driver inspections for this carrier in the 24 months prior to the date of inquiry.	Yes	https://safer.fmcsa.dot.gov/
DriverOutOfService	Documents the total number of driver out-of-service inspections where out-of-service violations were found for this carrier in the 24 months prior to the date of inquiry.	Yes	https://safer.fmcsa.dot.gov/
DriverOutOfServicePerc	Documents the percentage of inspections that resulted in one or more driver out-of-service violations for this carrier in the 24 months prior to the date of inquiry.	Yes	https://safer.fmcsa.dot.gov/
DriverViolationsAverage	Documents the average number of driver out-of-service	Yes	https://safer.fmcsa.dot.gov/

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	violations found per inspection for this carrier in the 24 months prior to the date of inquiry.		
VehicleInspections	Documents the total number of vehicle inspections for this carrier in the 24 months prior to the date of inquiry.	Yes	https://safer.fmcsa.dot.gov/
VehicleOutOfService	Documents the total number of vehicle out-of-service inspections where out-of-service violations were found for this carrier in the 24 months prior to the date of inquiry.	Yes	https://safer.fmcsa.dot.gov/
VehicleOutOfServicePerc	Documents the percentage of inspections that resulted in one or more vehicle out-of-service violations for this carrier in the 24 months prior to the date of inquiry.	Yes	https://safer.fmcsa.dot.gov/
VehicleViolationsAverage	Documents the average number of vehicle out-of-service violations found per inspection for this carrier in the 24 months prior to the date of inquiry.	Yes	https://safer.fmcsa.dot.gov/
HazmatInspections	Documents the total number of Hazmat inspections for this carrier in the 24 months prior to the date of inquiry.	Yes	https://safer.fmcsa.dot.gov/

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
HazmatOutOfService	Documents the total number of Hazmat out-of-service inspections where out-of-service violations were found for this carrier in the 24 months prior to the date of inquiry.	Yes	https://safer.fmcsa.dot.gov/
HazmatOutOfServicePerc	Documents the percentage of inspections that resulted in one or more Hazmat out-of-service violations for this carrier in the 24 months prior to the date of inquiry.	Yes	https://safer.fmcsa.dot.gov/
HazmatViolationsAverage	Documents the average number of Hazmat out-of-service violations found per inspection for this carrier in the 24 months prior to the date of inquiry.	Yes	https://safer.fmcsa.dot.gov/
SISTotal	Documents the total number of inspections (any type) for this carrier in the 24 months prior to the date of inquiry. The total number of inspections may not reflect a simple addition of all the driver, vehicle, and Hazmat inspections because two or more of these types of violations may occur on the same inspection.	Yes	https://safer.fmcsa.dot.gov/

Table 37 shows the variables in the SAFER Insurance data set and the ability of an OBSM system and related information to capture these variables. This data set includes information on the insurance type and status of the carrier that is involved in the crash (obtained from FMCSA’s SAFER database).

Table 37. LTCCS SAFER Insurance data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
BIPDRequired	Documents whether or not the carrier is required to have bodily injury & property damage insurance coverage.	Yes	https://safer.fmcsa.dot.gov/
BIPDOK	Documents whether or not the carrier has the required bodily injury & property damage insurance coverage.	Yes	https://safer.fmcsa.dot.gov/
CargoRequired	Documents whether or not the carrier is required to have cargo insurance coverage.	Yes	https://safer.fmcsa.dot.gov/
CargoOK	Documents whether or not the carrier has cargo insurance coverage when required to have this type of coverage.	Yes	https://safer.fmcsa.dot.gov/
BondRequired	Documents whether or not a \$10,000 surety bond is required for the broker’s license (authority).	Yes	https://safer.fmcsa.dot.gov/
BondOK	Documents whether or not the surety bond was in place on the broker’s license (authority).	Yes	https://safer.fmcsa.dot.gov/
MinCoverageAmount	Documents (in thousands of dollars) the minimum amount of liability insurance coverage that this	Yes	https://safer.fmcsa.dot.gov/

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	carrier is required to have.		
LiabilityInsurance	Documents the amount (in thousands of dollars) of the liability insurance coverage that this carrier has.	Yes	https://safer.fmcsa.dot.gov/

Table 38 shows the variables in the SAFER Review data set and the ability of an OBSM system and related information to capture these variables. This data set contains the safety ratings of the carrier involved in the crash based on compliance with FMCSA regulations (obtained from FMCSA’s SAFER database).

Table 38. LTCCS SAFER Review data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
RatingDate	Documents the date that the current Federal safety rating was assigned to this carrier.	Yes	https://safer.fmcsa.dot.gov/
Rating	Documents the current Federal safety rating assigned to this carrier.	Yes	https://safer.fmcsa.dot.gov/
ReviewDate	Documents the date that the most recent Safety/Compliance Review was performed on this carrier.	Yes	https://safer.fmcsa.dot.gov/
ReviewType	Documents the type of review performed on this carrier.	Yes	https://safer.fmcsa.dot.gov/

Table 39 shows the variables in the Safe Stat data set and the ability of an OBSM system and related information to capture these variables. This data set contains safety statistics for the driver’s carrier from FMCSA’s Safe Stat database. In December 2010, FMCSA replaced the Safe Stat system with the Compliance, Safety, Accountability (CSA) program (which uses Behavior Analysis and Safety Improvement Categories [BASICS] scores). Whereas SafeStat organized scores in the areas of Accident, Driver, Vehicle and Safety Management, CSA organizes scores into seven categories: Driver Fitness, Unsafe Driving, Fatigued Driving, Controlled Substances/Alcohol, Crash Indicator, Vehicle Maintenance, and Improper Loading/Cargo Securement. Thus, these variables are unavailable due to SafeStat being replaced with CSA.

Table 39. LTCCS Safe Stat data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
STADate	Establishes the date that a particular SafeStat score was assigned to a carrier.	No	
Score	Documents the overall SafeStat Score, where SafeStat score = $2 \times$ Accident Safety Evaluation Area (SEA) + $1.5 \times$ Driver SEA + Vehicle SEA + Safety Management SEA.	No	
AccidentSEA	Documents the SafeStat score for the Accident SEA category for this carrier.	No	
DriverSEA	Documents the SafeStat score for the Driver SEA category for this carrier.	No	
VehicleSEA	Documents the SafeStat score for the Vehicle SEA category for this carrier.	No	
SafetySEA	Documents the SafeStat score for the Safety Management SEA category for this carrier.	No	
STACategory	Provides the letter code for the category indicator value calculated for this carrier.	No	
CategoryDescription	Describes the SafeStat indicator value calculated for this carrier.	No	

Table 40 shows the variables in the Truck Exterior data set and the ability of an OBSM system and related information to capture these variables. This data set contains information on each truck involved the crash.

Table 40. LTCCS Truck Exterior data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
PowerUnitType	Establishes the type of power unit involved in this crash.	Yes	In PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
CabStyle	Establishes the cab style of the power unit involved in the crash.	Yes	Obtained from VIN
DromedaryBox	Establishes the presence of a dromedary box on the vehicle. A dromedary box is essentially a storage box that is typically mounted on the tractor chassis immediately rearward of the rear wall of the tractor cab. Access is typically located on the sides of the vehicle. These boxes are used to store tarps, tie-downs, tools, and the driver's personal gear. On occasion, dromedary boxes are utilized to haul cargo.	Yes	Obtained from VIN
SleeperBerth	Establishes the presence of a sleeper berth as an integral part of the cab structure.	Yes	Obtained from VIN
BlindSpot	Establishes links between the vehicle's mirror system and crash causation.	Maybe	If captured on video or in the PAR
DataRecorder	Establishes the presence of an engine control/data recorder unit.	Yes	Obtained from VIN or carrier
RPM	Establishes the engine revolutions per minute (RPM) as obtained from the truck's data recorder.	No	
TEXSpeed	Establishes the speed (in kph) of the vehicle as indicated by information obtained from the truck's data recorder.	No	
GearPosition	Establishes the gear position of the truck as indicated by information obtained from the data recorder.	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
TrailerCount	Establishes the number of trailers that are included in the vehicle configuration.	Yes	In PAR
TEXEmptyWeight	Establishes the combined total empty weight (kilograms) for all units in the truck configuration. The empty weight for each unit is specified by the unit's manufacturer.	Yes	Obtained from VIN
CMDBCargoWeight	Establishes the total weight (kilograms) of all cargo in all trailers combined. This value represents payload cargo only, not the weight of the trailer, the driver, or the driver's personal effects.	Maybe	From carrier
TOTALGVWR	This is the total combined GVWR (in kilograms) for all units of the truck configuration. The GVWR is specified by the manufacturer and represents the sum of the weights that each axle within a unit is designed to carry.	Maybe	From carrier
TEXConfiguration	Provides a summary of the configuration of the rig. Letter codes are "strung together" (listed from left to right) to represent the order of equipment in the rig. For example, a tractor pulling two trailers connected by an A-dolly would have a configuration of "TSAS."	Yes	In PAR
TEXTotalLength	Establishes the total length (meters) of the entire truck configuration. Due to overlapping vehicle connection points, the total	Yes	In VIN and PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	length of the vehicle configuration will be less than the sum of the unit lengths.		
PlacardRequired	Establishes whether or not the trailer unit was placarded (i.e., had warning symbol on it), indicating the trailer was carrying hazardous cargo.	Yes	In PAR
MirrorCount	Establishes the total number of mirrors on the truck configuration.	Maybe	Obtained from VIN (excludes add-ons)
RightDoorMirror	Establishes whether or not the truck's power unit has an exterior mirror mounted on its right door.	Maybe	Obtained from VIN (not if removed)
LeftDoorMirror	Establishes whether or not the truck's power unit has an exterior mirror mounted on its left door.	Maybe	Obtained from VIN (not if removed)
RightFenderMirror	Establishes whether or not the truck's power unit has an exterior mirror mounted on its right fender.	Yes	Obtained from VIN or video
LeftFenderMirror	Establishes whether or not the truck's power unit has an exterior mirror mounted on its left fender.	Yes	Obtained from VIN or video
OtherLocationMirror	Establishes whether or not the truck's power unit has an exterior mirror mounted on locations other than its doors or fenders.	Maybe	Obtained from VIN or video
ITSCount	Establishes the total number of Intelligent Transportation Systems (ITS) equipment on the truck.	Maybe	Obtained from VIN or carrier
ITSHeadway	Establishes whether or not a headway detection unit is installed in the cab of the vehicle and is functional. These units are intended to	Maybe	Obtained from VIN or carrier

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	assist the driver in avoiding rear-end crashes. While several operational modes are in active use, all of these units measure the gap distance to a vehicle/object located forward of the driver's position. When the gap distance diminishes to a preselected unacceptable level, the unit issues an auditory alert to the driver.		
ITSSideObject	Establishes whether or not a side/object detection unit is installed in the cab of the vehicle and is functional. These units are intended to assist the driver in avoiding side impacts as a result of intruding into adjacent lanes or as a result of other vehicles intruding into the truck lanes. These units are also useful with respect to avoiding obstacles while backing. While several operational modes are in active use, all of these units typically issue alerts when clearances to the sides of the vehicle diminish to unacceptable levels.	Maybe	Obtained from VIN or carrier
ITSRollover	Establishes whether or not a rollover warning unit is installed in the cab of the vehicle and is functional. While several operational modes are in active use, these devices typically measure lateral acceleration and issue an alert to the driver when these forces rise to a level that may	Maybe	Obtained from VIN or carrier

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	create an unstable condition.		
ITSOther	Establishes whether or not other ITS equipment (other than headway detection units, side/object detection units, and rollover warning units) is installed in the cab of the vehicle and is functional.	Maybe	Obtained from VIN or carrier

Table 41 shows the variables in the Truck Inspection data set and the ability of an OBSM system and related information to capture these variables. This data set combines information on FMCSA inspection violations.

Table 41. LTCCS Truck Inspection data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
TINPosition	Indicates which unit in the truck configuration received a specific violation, based on its position in the truck’s configuration.	Yes	In MCMIS
TINViolationCode	Indicates the numerical violation code as it corresponds to a specific violation. These codes are found in the Federal Motor Carrier Safety Regulations, <i>Code of Federal Regulations</i> , Title 49.	Yes	In MCMIS
ViolationType	Indicates if a violation was in effect prior to the crash, or if the violation was a result of the crash.	Yes	In MCMIS
TINOutOfService	Indicates whether or not a specific violation was classified as “out-of-service.”	Yes	In MCMIS
TINDisposition	Establishes the disposition of the truck as indicated by	Yes	In MCMIS

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	violations found during the FMCSA truck inspection.		

Table 42 shows the variables in the Truck Units data set and the ability of an OBSM system and related information to capture these variables. This data set contains detailed information about each truck unit involved in the crash, including power units and trailers, where applicable, as indicated by the position field.

Table 42. LTCCS Truck Units data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
TUNPosition	Identifies the position of a particular unit within the vehicle configuration. Position “1” should identify a straight truck or a power unit in a multiple combination, with each trailer then assigned the next number as it moves away from the power unit.	Yes	In video and/or PAR
TUNUnitType	Describes the unit type for each unit in the vehicle configuration.	Yes	In PAR
TUNBodyType	Establishes the type of trailer unit/cargo body identified within the vehicle configuration. If the vehicle is a straight truck, this designation is also used to describe the body type of the straight truck (e.g., cement mixer).	Yes	In PAR
CargoType	Establishes the type of cargo carried in each unit of the vehicle configuration. A tractor power unit is normally classified with the “Not applicable” designation since these units typically do not carry cargo. For the unusual circumstance	Maybe	In PAR and from carrier

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	where a tractor power unit is carrying cargo, either the “Tractor power unit with container cargo” or “Tractor power unit with other bulk cargo (specify)” designations are used as appropriate.		
TUNVIN	Establishes the VIN for each unit in the vehicle configuration.	Yes	In PAR
ManufactureDate	Establishes the month and year in which each unit in the vehicle configuration was manufactured.	Yes	Obtained from VIN
TUNEmptyWeight	Establishes the empty weight (kilograms) for each unit of the vehicle configuration. This value represents the empty weight of each unit as specified by the unit’s manufacturer.	Yes	Obtained from VIN
TUNCargoWeight	Establishes the weight (kilograms) of the cargo transported in each unit of the vehicle configuration. This value represents the payload associated with each unit of the vehicle combination. Payload is the total weight of the unit and cargo minus the weight of the unit before the cargo is loaded. Payload does not include miscellaneous items in the cab or dromedary box of power units or other items such as chains and tie downs.	Maybe	Carrier information
GVWR	Establishes the GVWR (in kilograms) for each unit of the vehicle configuration. The GVWR is specified by	Yes	Obtained from VIN

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	the manufacturer and represents the sum of the weights that each axle within a unit is designed to carry.		
TUNTotalLength	Establishes the length (in meters) of each unit of the vehicle's configuration. Unit lengths are established by measuring from the furthest forward projection to the furthest rearward projection.	Maybe	In VIN or PAR
CapacityPercent	Establishes the proportion of available cargo space that is used to transport cargo in each unit of the vehicle configuration. The reported percentages are subjective estimates of the total available space that is used.	No	
TankCapacity	Is used with tankers (liquid loads) and establishes the total capacity (liters) of that particular tank.	Maybe	If in PAR
TankLoad	Is used with tankers (liquid load) and establishes the total load (liters) being carried in that particular tank at the time of the crash.	Maybe	Carrier information
Hazard	Establishes the presence of hazardous cargo in each unit of the vehicle configuration. A cargo is hazardous if it is corrosive, explosive, flammable, or radioactive. This includes all petroleum products except motor oil in cans and finished plastics. If the cargo was required by law to be placarded (i.e.,	Yes	In PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	display a warning symbol), it should be classified as hazardous.		
TUNSpillage	Establishes the occurrence of cargo spillage during the crash sequence. To qualify, the cargo spillage must occur as a result of or following the first harmful event. Spillage of fuel from the involved vehicles and the scattering of debris from the crash are not considered cargo spillage. Similarly, cargo spillage that occurs prior to the first harmful event (i.e., pre-crash phase) is not considered applicable to this variable.	Yes	In PAR
AxlesUsed	Establishes the number of axles in use for each unit of the vehicle configuration. This number does not include lift axles that are up and, therefore, not in use at the time of the crash.	No	
AxlesNotUsed	Establishes the number of axles that were lifted and not in use at the time of the crash. The number of lift axles is reported for each unit of the vehicle configuration.	No	
SteerableAxles	Establishes the number of steer axles (including self-aligning steer axles) on each unit within the configuration. For most articulated vehicles on U.S. trafficways, there will typically be one steer axle within the configuration (i.e., the frontsteer axle of	Yes	Obtained from VIN

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	the tractor unit). Within those configurations that utilize a C-dolly, however, there can be self-aligning axles on the C-dolly.		
RearTapeCond	Establishes the condition of the tape on the rear of each trailer/cargo body. For this variable, tape condition factors are limited to visibility issues (e.g., clean/dirty).	No	
SideTapeCond	Establishes the condition of the tape on the sides of each trailer/cargo body. For this variable, tape condition factors are limited to visibility issues (e.g., clean/dirty).	No	
ReflectTapeType	Establishes the use/presence of retroflective tape to improve truck conspicuity. It should be noted that the first unit in the vehicle configuration for this variable is designated as the power unit cargo body. This designation refers to the cargo body of a straight truck. If the power unit is a tractor, the “Not applicable” designation would typically be used.	No	
ReflectTapePattern	Establishes the pattern of tape markings that are present.	No	
ReflectTapeColor	Establishes the color of tape markings that are present.	No	
OverrideTapePeel	Establishes the proportion of tape on the rear override guard that is peeling or damaged.	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
RearTapePeel	Establishes the proportion of the tape on the rear area of each unit (excluding the override guard) that is peeling or damaged.	No	
SideTapePeel	Establishes the proportion of the tape on the sides of the trailer that is peeling or damaged.	No	

Table 43 shows the variables in the Vehicle Events data set and the ability of an OBSM system and related information to capture these variables. This data set contains information about events, such as safety equipment deployment and fires, that occurred during and immediately after the crash.

Table 43. LTCCS Vehicle Events data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
FireOrigin	Identifies the location of fire initiation.	Maybe	If captured on video or in PAR
FireSeverity	Documents the degree of fire involvement.	Maybe	If captured on video or in PAR
RolloverType	Describes the type of rollover event that occurred for this vehicle. Rollover is defined as any vehicle rotation of 90 degrees or more about any true longitudinal or lateral axis. Rollover can occur at any time during the collision and is coded independently of other configuration questions.	Yes	In video and/or PAR
QuarterTurns	Documents the number of quarter turns that the vehicle rolled during the crash sequence. A quarter turn is defined as a rotation of 90 degrees about the longitudinal axis of the vehicle; this does not include rotation about the	Yes	In video and/or PAR

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	vertical axis, commonly called yaw.		
RollInitType	Describes the type of rollover event in terms of how the rollover was initiated. The attributes are used for rollovers initiated about the longitudinal axis.	Yes	In video and/or PAR
RollInitLocation	Establishes the location of the trip point or start of the vehicle's roll that was identified in the variable "Rollover Initiation Type."	Yes	In video and/or PAR
RollObject	Is related to the variable "Rollover Initiation Type," and identifies the source of the force that acted upon the vehicle that resulted in the rollover.	Maybe	If captured on video or in PAR
RollTrip	Establishes the specific point on the vehicle where the tripping force was applied.	No	
RollDirect	Establishes the direction in which the vehicle initially rolled.	Yes	In video and/or PAR
CollisionManner	Is intended to describe the primary impact (in terms of delta V) sustained by this vehicle during the collision sequence. The primary impact may not be the first impact sustained by this vehicle.	No	
FirstHarmfulEvent	Establishes the first property-damaging or injury-producing event that can be determined to have occurred during the crash sequence.	Maybe	If captured on video or in PAR

Table 44 shows the variables in the Vehicle Exterior data set and the ability of an OBSM system and related information to capture these variables. This data set contains information on each passenger vehicle involved in the crash.

Table 44. LTCCS Vehicle Exterior data set and ability to capture via OBSM system and related information.

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
BodyCategory	Describes the vehicle's general body category.	Yes	In PAR
VEXBodyType	Documents the body type of the vehicle, as identified by the manufacturer.	Yes	In PAR
VEXVehicleClass	Documents the class of vehicle, as determined by the researcher. This classification system is based on documentation provided by the Passenger Car Classification Committee A3B11(1) of the Transportation Research Board, Traffic Records and Accident Analysis Committee, A3B11. This classification is based on the size of the vehicle's wheelbase.	Yes	In PAR
VEXWeightSource	Identifies the source from which the curb weight of the vehicle was obtained.	Yes	
VEXCargoWeight	Documents the weight (in kilograms) of any cargo inside the vehicle at the time of the crash and most often represents a researcher's "best guess" estimate of the cargo weight in kilograms. This value is based on interview information, the PAR, and vehicle inspection.	Maybe	In PAR or from carrier
VEXCargoSource	Documents the source from which the estimate of the weight of the cargo inside the vehicle at the time of the crash was obtained.	Yes	
VEXVIN	Documents the VIN of the vehicle, as determined by	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	the researcher from vehicle inspection.		
VEXSpecialUse	Documents specific other uses for the vehicle in addition to personal use.	Maybe	Carrier information
InTransport	Determines whether or not the vehicle was in transport at the time of the crash. To be considered “in transport,” a vehicle must be on the roadway or in motion within the trafficway.	Yes	In video
InspectionType	Documents the type of inspection performed on the vehicle by the researcher. It allows users to identify cases with complete documentation of required damage data (exterior and interior).	No	
VEXInspectionDate	Documents the date that the researcher inspected the vehicle.	No	
Transmission	Documents the type of transmission that is in the vehicle.	No	
DriveWheels	Describes the type of drive wheels that power the vehicle.	No	
LFRestricted	Documents whether or not the vehicle’s left front tire was prevented from rotation by damaged components of this vehicle as a result of the crash.	No	
LRRestricted	Documents whether or not the vehicle’s left rear tire was prevented from rotation by damaged components of this vehicle as a result of the crash.	No	
RRRestricted	Documents whether or not the vehicle’s right rear tire	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	was prevented from rotation by damaged components of this vehicle as a result of the crash.		
RFRestricted	Documents whether or not the vehicle's right front tire was prevented from rotation by damaged components of this vehicle as a result of the crash.	No	
LFDeflated	Documents whether or not the vehicle's left front tire was deflated as a result of the crash.	No	
LRDeflated	Documents whether or not the vehicle's left rear tire was deflated as a result of the crash.	No	
RRDeflated	Documents whether or not the vehicle's right rear tire was deflated as a result of the crash.	No	
RFDeflated	Documents whether or not the vehicle's right front tire was deflated as a result of the crash.	No	
Wheelbase	Reflects the length (in centimeters) of the vehicle's original or undamaged wheelbase to the nearest centimeter, based on manufacturer specifications.	Yes	Obtained from VIN
OverallLength	Documents the overall length (in centimeters) of the vehicle, as specified by the manufacturer.	Yes	Obtained from VIN
MaxWidth	Documents the overall/maximum width (in centimeters) of the vehicle, as specified by the manufacturer.	Yes	Obtained from VIN
VEXCurbWeight	Documents the vehicle's curb weight (in kilograms),	Yes	Obtained from VIN

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
	as identified by manufacturer specifications.		
AverageTrack	Documents the vehicle's average track width in centimeters, calculated by averaging the front and rear track widths as identified by the manufacturer. This value represents the average track width prior to the crash (undamaged).	Yes	Obtained from VIN
FrontOverhang	Documents the front overhang in centimeters of the vehicle as identified by manufacturer specifications. Front overhang is the distance between the front axle and the maximum forward projection of the vehicle. This value represents the vehicle's front overhang prior to the crash (undamaged).	Yes	Obtained from VIN
RearOverhang	Documents the rear overhang in centimeters of the vehicle as identified by manufacturer specifications. Rear overhang is the distance between the rear axle and the maximum rear projection of the vehicle. This value represents the rear overhang prior to the crash (undamaged).	Yes	Obtained from VIN
EndWidth	Represents the undamaged dimension in centimeters of either the contacted end plane or the front undamaged plane if the side plane is contacted.	No	

LTCCS Variable	Description of LTCCS Variable	Ability to Capture	Comments
VehicleDisposition	Represents the researcher's assessment of the disposition of the vehicle and is based primarily on inspection of the vehicle.	No	
Justification	Represents the reason for the determination that the vehicle was or was not towed, based on the researcher's assessment of the disposition of the vehicle.	No	
MultiStage	Documents whether the vehicle is a multi-stage (initially an incomplete) vehicle or an altered (modified) vehicle. The determination is based on a label attached to the vehicle that demonstrates compliance with all Federal Motor Vehicle Safety Standards.	Maybe	If in the PAR

CHAPTER 4. DISCUSSION

Using the structure of the LTCCS codebook, trained researchers determined which variables in the LTCCS codebook could be captured using OBSM systems and other related information sources. Table 45 displays the number and percentage of variables in the 43 LTCCS data sets that could or could not be captured using an OBSM system and related information. In addition, the last column in Table 45 indicates the percentage of variables in the LTCCS that were coded as “unknown.” The LTCCS codebook gave the option of coding a variable as “unknown” for 48.25 percent of the 802 variables. Our analysis found that in the LTCCS, “unknown” was coded in 9.87 percent of all the coded variables with the option to be “unknown”

Table 45. Summary of LTCCS variables captured via OBSM system and related information.

LTCCS Data Set	Total Variables	Yes (%)	Maybe (%)	No (%)	Variables Labeled <i>Unknown</i> in the LTCCS (%)
Airbags	22	10 (45.5)	9 (40.9)	3 (13.6)	23.53
Brakes	11	6 (54.5)	0 (0.0)	5 (45.5)	11.94
Cargo Shift Assessments	28	0 (0.0)	14 (50.0)	14 (50.0)	0.16
CDC Crush	20	1 (5.0)	13 (65.0)	6 (30.0)	2.93
Crash	16	11 (68.8)	3 (18.8)	2 (12.5)	0.82
Crash Assessment	13	10 (76.9)	3 (23.1)	0 (0.0)	0.87
Crash Discussion	1	1 (100.0)	0 (0.0)	0 (0.0)	NA
DMV Violation	8	8 (100.0)	0 (0.0)	0 (0.0)	0.00
Driver Assessment	54	5 (9.3)	9 (16.7)	40 (74.1)	5.66
Driver Decision Aggression	29	23 (79.3)	6 (20.7)	0 (0.0)	4.30
Driver Drugs	4	0 (0.0)	4 (100.0)	0 (0.0)	1.92
Driver Health	27	0 (0.0)	13 (48.1)	14 (51.9)	5.06
Driver Recognition Distraction	24	21 (87.5)	3 (12.5)	0 (0.0)	7.51
Driver Sleep	19	0 (0.0)	8 (42.1)	11 (57.9)	30.91

LTCCS Data Set	Total Variables	Yes (%)	Maybe (%)	No (%)	Variables Labeled Unknown in the LTCCS (%)
Environment	36	28 (77.8)	5 (13.9)	3 (8.3)	0.35
Events	7	6 (85.7)	1 (14.3)	0 (0.0)	0.17
Factor Assessment	65	15 (23.1)	41 (63.1)	9 (13.8)	0.07
General Vehicle	56	49 (87.5)	2 (3.6)	5 (8.9)	15.52
HazMat	3	0 (0.0)	0 (0.0)	3 (100.0)	4.68
HazMat Insp	5	0 (0.0)	0 (0.0)	5 (100.0)	46.87
Injuries	13	5 (38.5)	8 (61.5)	0 (0.0)	40.49
Jackknife Assessments	16	11 (68.8)	5 (31.3)	0 (0.0)	0.04
MCMIS Driver Data	6	6 (100.0)	0 (0.0)	0 (0.0)	32.19
MCMIS Violation Data	4	4 (100.0)	0 (0.0)	0 (0.0)	0.08
Non-Motorists	20	3 (15.0)	17 (85.0)	0 (0.0)	25.00
Occupants	60	14 (23.3)	42 (70.0)	4 (6.7)	20.60
Overview	32	27 (84.4)	5 (15.6)	0 (0.0)	0.46
PAR Violations	2	2 (100.0)	0 (0.0)	0 (0.0)	0.28
Safer Authority Status	3	3 (100.0)	0 (0.0)	0 (0.0)	3.80
Safer Carrier	20	20 (100.0)	0 (0.0)	0 (0.0)	1.88
Safer Crash Summary	4	4 (100.0)	0 (0.0)	0 (0.0)	0.00
Safer Driver Crash Report	29	29 (100.0)	0 (0.0)	0 (0.0)	0.00
Safer Driver Inspection	7	7 (100.0)	0 (0.0)	0 (0.0)	0.00
Safer Driver Violation	4	4 (100.0)	0 (0.0)	0 (0.0)	0.00

LTCCS Data Set	Total Variables	Yes (%)	Maybe (%)	No (%)	Variables Labeled Unknown in the LTCCS (%)
Safer Inspections Summary	13	13 (100.0)	0 (0.0)	0 (0.0)	0.00
Safer Insurance	8	8 (100.0)	0 (0.0)	0 (0.0)	0.00
Safer Review	4	4 (100.0)	0 (0.0)	0 (0.0)	0.00
Safe Stat	8	0 (0.0)	0 (0.0)	8 (100.0)	11.29
Truck Exterior	27	12 (44.4)	12 (44.4)	3 (11.1)	10.34
Truck Inspection	5	5 (100.0)	0 (0.0)	0 (0.0)	1.91
Truck Units	26	10 (38.5)	5 (19.2)	11 (42.3)	4.90
Vehicle Events	11	5 (45.5)	4 (36.4)	2 (18.2)	0.33
Vehicle Exterior	32	13 (40.6)	3 (9.4)	16 (50.0)	3.11
TOTAL	802	403 (50.2)	235 (29.3)	164 (20.4)	9.87

LTCCS DATA ANALYSIS

Although the LTCCS was able to collect a large amount of data for each crash, a number of variables (even complete data sets) were not coded with any data (this means nothing was coded, not even “unknown”). Table 46 shows the percentage of crashes in the LTCCS where data were coded and how many variables in each data set had an option to be coded as unknown. For example, as shown in Table 46, 44.11 percent of the crashes in the Airbag data set were coded with data and 90.91 percent of the variables in this data set had the option to select unknown. Thus, the last column in Table 45 is somewhat misleading. Although only 23.53 percent of the variables in the Airbags data set were coded as unknown, more than half of the variables in this data set had no data coded, leaving only 20.58% of variables in the Airbag dataset with actual data.

Table 46. Percentage of variables collected and those coded as unknown in the LTCCS.

LTCCS Data Set	Crash Cases with Data (%)	Variables that Have Unknown as an Option (%)
Airbags	44.11	90.91
Brakes	97.01	90.91

LTCCS Data Set	Crash Cases with Data (%)	Variables that Have Unknown as an Option (%)
Cargo Shift Assessments	100.00	10.71
CDC Crush	99.53	45.00
Crash	100.00	25.00
Crash Assessment	100.00	46.15
Crash Discussion	NA	NA
DMV Violation	64.58	12.50
Driver Assessment	100.00	38.89
Driver Decision Aggression	100.00	41.38
Driver Drugs	57.01	25.00
Driver Health	100.00	14.81
Driver Recognition Distraction	100.00	41.67
Driver Sleep	100.00	100.00
Environment	100.00	50.00
Events	100.00	42.86
Factor Assessment	100.00	12.31
General Vehicle	100.00	67.86
HazMat	5.23	66.67
HazMat Insp	100.00	80.00
Injuries	88.50	69.23
Jackknife Assessments	100.00	25.00
MCMIS Driver Data	83.74	100.00
MCMIS Violation Data	53.64	50.00
Non-Motorists	4.21	75.00
Occupants	100.00	90.00
Overview	100.00	25.00
PAR Violations	82.52	50.00
Safer Authority Status	50.56	100.00
Safer Carrier	66.07	25.00
Safer Crash Summary	58.60	0.00
Safer Driver Crash Report	17.57	0.00
Safer Driver Inspection	31.12	0.00
Safer Driver Violation	11.87	0.00
Safer Inspections Summary	66.07	0.00
Safer Insurance	50.56	0.00
Safer Review	42.06	0.00
Safe Stat	26.82	12.50
Truck Exterior	100.00	92.59
Truck Inspection	67.48	60.00
Truck Units	100.00	96.15
Vehicle Events	100.00	81.82
Vehicle Exterior	86.07	75.00
TOTAL	75.12	48.25

It appears that the data collection approach using data from OBSM systems and other available data sources will be able to collect as much data as was collected by data analysts in the LTCCS. Almost 25 percent of the variables in the LTCCS were coded with no data, and the data collection approach using OBSM systems and other data is unable to code approximately 20 percent of the variables in the LTCCS. The most notable weakness in using OBSM systems and other data sources is the lack of interviews with drivers and other witnesses. This means that by only using the OBSM systems, no data on sleep, sleep history, or the mental state of the drivers involved in the crash can be gathered. Although the LTCCS was able to capture this data through physical reconstructions and interviews with drivers and witnesses after the crash occurred, sometimes the interviews were performed weeks or months after the crash. Thus, although these data were collected, they may be less accurate and complete due to limited recall on the part of the driver and/or witnesses. Other data sources, such as PARs, DMV files, MCMIS, etc., were used to verify data collected in the interviews.

When comparing data that were gathered in the LTCCS and OBSM systems, it is important to note that there were multiple variables that assessed the same type of information, but from varying information sources. For example, there were four variables that coded the presence of alcohol during the crash. Alcohol presence was a variable coded in the Crash, Driver Assessment, General Vehicle, and Overview data sets in the LTCCS. In the LTCCS, this information came from interviews or the PAR, whereas if this information were collected using the OBSM systems (categorizing the variables as *maybe* able to be captured), it would come from the video provided by the OBSM vendor or the PAR.

OBSM SYSTEM VERSUS OTHER INFORMATION SOURCES

The most beneficial information resources to capture variables from the LTCCS codebook are the OBSM systems and the PAR. Table 47 shows the number of LTCCS variables that can, or may be obtainable using the various sources.

Table 47. Number of LTCCS variables obtainable by source.

Data Source	Yes	Maybe
OBSM	154	135
PAR	111	151
VIN	24	14
Carrier Information	12	21
CDLIS	15	0
MCMIS	18	0
Websites	94	0
Polk Computer System	19	0
VHR	1	1

The video from the OBSM system is the main source of data that can replicate the information collected in the LTCCS via interviews. Although these video data are able to give precise

information on driver behavior and the environment just before and during the crash, they do have some limitations. The video is limited to two camera angles, driver face and forward view, and only a brief amount of time (dependent on the system). These are the primary reasons why 29.3 percent of all the LTCCS variables were coded with a “*maybe*” in the current study. For example, alcohol consumption (yes/no) could only be coded if the driver was on camera drinking a clearly marked alcoholic beverage in the time period just before or during a crash; thus, it is unlikely this could be coded using data from the OBSM system, but possible. Based on the findings in the current report, it appears that the use of OBSM systems and other data sources may yield a similar amount of data, yet more reliably and at a lower cost than data obtained by data analysts in the LTCCS.

REFERENCES

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