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# **The 100-Car Naturalistic Driving Study**

## **Phase II – Results of the 100-Car Field Experiment**

### **Appendix B: Data Reduction Variables**



## APPENDIX B

### Data Reduction Variables

#### 1. Vehicle Number

Comment: Each vehicle will be assigned a vehicle number. Information will originate in the raw data stream.

FORMAT: Integer value.

#### 2. Epoch Number

The Epoch file number is arranged by vehicle identification number, date and time. The first three numbers represent the vehicle identification number, the next two numbers represent the year (Ex. 03 for 2003), the next two numbers represents the month (Ex. 03 for March), the next two numbers represent the day of the month, the next four numbers represent the time in military time. The last six numbers are the epoch ID

002 03 02 28 1209 000000

Comment: Each valid driving performance trigger will be assigned to an epoch. An epoch will consist of 1 minute of video prior and 30 seconds of video after the initial onset of a trigger. If a second trigger occurs within this 1.5-minute segment, the epoch will extend to include a full one minute prior to the onset of the initial trigger and 30 seconds after the onset of the last trigger.

- 3. Event Severity** – A general term referring to all valid triggered occurrences of an incident, near-crash, or crash that begins at the precipitating event and ends when the evasive maneuver has been completed.
- Invalid trigger – Any instance where a trigger appears but no safety-relevant event is present.
    - Non-subject conflict - Any safety-relevant event captured on video (incident, near-crash, or crash) that does not involve the driver.
  - Non-conflict - Any event that increases the level of risk associated with driving, but does not result in a crash, near-crash, or incident, as defined below. Examples include: driver control error without proximal hazards being present; driver judgment error such as unsafe tailgating or excessive speed; or cases in which drivers are visually distracted to an unsafe level.
  - Proximity Event - Any circumstance resulting in extraordinarily close proximity of the subject vehicle to any other vehicle, pedestrian, cyclist,

animal, or fixed object where, due to apparent unawareness on the part of the driver(s), pedestrians, cyclists or animals, there is no avoidance maneuver or response. Extraordinarily close proximity is defined as a clear case where the absence of an avoidance maneuver or response is inappropriate for the driving circumstances (including speed, sight distance, etc.).

- Crash-Relevant - Any circumstance that requires a crash avoidance response on the part of the subject vehicle. Any other vehicle, pedestrian, cyclist, or animal that is less severe than a rapid evasive maneuver (as defined above), but greater in severity than a “normal maneuver” to avoid a crash. A crash avoidance response can include braking, steering, accelerating, or any combination of control inputs. A “normal maneuver” for the subject vehicle is defined as a control input that falls inside of the 99% confidence limit for control input as measured for the same subject.
- Near-crash - Any circumstance that requires a rapid, evasive maneuver by the subject vehicle, or any other vehicle, pedestrian, cyclist, or animal to avoid a crash. A rapid, evasive maneuver is defined as a steering, braking, accelerating, or any combination of control inputs that approaches the limits of the vehicle capabilities. As a guide: subject vehicle braking greater than 0.5 g, or steering input that results in a lateral acceleration greater than 0.4 g to avoid a crash, constitutes a rapid maneuver.
- Crash - Any contact with an object, either moving or fixed, at any speed, in which kinetic energy is measurably transferred or dissipated. Includes other vehicles, roadside barriers, objects on or off the roadway, pedestrians, cyclists or animals.

Comment: Initial coding step. Invalid events result in no further coding. Non-subject and non-conflicts will only result in a brief narrative written, but no other coding. Other coding choices will determine which specific subset of variables that will be coded. Specified at early onset of data reduction software.

#### **4. Trigger Type (C-N-I)**

The triggers were specific data signatures that were specified during the sensitivity analysis performed after 10 percent of the data were collected. The specific data signatures that were used to identify valid events are as follows:

- Lateral acceleration - Lateral motion equal or greater than 0.7 g.
- Longitudinal acceleration - Acceleration or deceleration equal or greater than 0.6 g.
- CI button – Activated by the driver upon pressing a button located on the dashboard when an incident occurred that the driver deemed critical.

- Forward Time To Collision (FTTC) - Acceleration or deceleration equal to or greater than 0.5 g coupled with a forward TTC of 4 seconds or less.
- All longitudinal decelerations between 0.4 g and 0.5 g coupled with a forward TTC value of  $\leq 4$  seconds and that the corresponding forward range value at the minimum TTC is not greater than 100 ft.
- Rear Time To Collision (RTTC) - Any rear TTC trigger value of 2 seconds or less that also has a corresponding rear range distance of  $\leq 50$  ft. AND any rear TTC trigger value where the absolute acceleration of the following vehicle is greater than 0.3 g.
- Side object detection – Detects presence of other vehicles/objects in the adjacent lane.
- Lane change cut-off – Identifies situations in which the subject vehicle cuts in too close either behind or in front of another vehicle by using closing speed and forward TTC.
- Yaw rate – Any value greater than or equal to a plus AND minus 4 deg change in heading (i.e., vehicle must return to the same general direction of travel) within a 3-second window of time.

#### **5. Driver Subject Number (C-N-I-B)**

All primary drivers' subject number will be a 3-digit number followed by the letter "A." Any secondary drivers should be given the same 3-digit number followed by the letters "B," "C," and so on.

#### **6. Onset of Precipitating Factor**

Using video frame numbers, the reductionists will determine the onset of the precipitating event (i.e., onset of lead vehicle brake lights for a lead vehicle conflict).

#### **7. Resolution of the Event**

Using video frame numbers, the reductionists will determine when the evasive maneuver (or lack thereof) has been executed and the level of danger has returned to normal.

### **Event Variables**

#### **1. Event Nature (C-N-I)**

This variable specified the type of crash, near-crash, or incident that occurred. The reductionists chose from the following variables that were modified from GES variables "Manner of Collision" and "Most Harmful Event."

1=Conflict with a lead vehicle

2=Conflict with a following vehicle

3=Conflict with an oncoming traffic

4=Conflict with a vehicle in adjacent lane

5=Conflict with a merging vehicle

6=Conflict with a vehicle turning across subject vehicle path (same

Direction)

- 7=Conflict with a vehicle turning across subject vehicle path (opposite direction)
- 8=Conflict with a vehicle turning into subject vehicle path (same direction)
- 9=Conflict with a vehicle turning into subject vehicle path (opposite direction)
- 10 =Conflict with a vehicle moving across subject vehicle path (through intersection)
- 11=Conflict with a parked vehicle
- 12=Conflict with a pedestrian
- 13=Conflict with a pedal cyclist
- 14=Conflict with an animal
- 15=Conflict with an obstacle/object in roadway
- 16=Single vehicle conflict
- 17=Other
- 18=No known conflict (for RF sensor trigger)
- 99=Unknown conflict

**2. Incident Type (Coded for Crashes and Near-Crashes only)**

- 1 = Rear-end, striking
- 2 = Rear-end, struck
- 3 = Road departure (left or right)
- 4 = Road departure (end)
- 5 = Sideswipe, same direction (left or right)
- 6 = Opposite direction (head-on or sideswipe)
- 7 = Violation of stop sign or signal at intersection
- 8 = Straight crossing path, not involving sign/signal violation
- 9 = Turn across path
- 10 = Turn into path (same direction)
- 11 = Turn into path (opposite direction)
- 12 = Backing, fixed object
- 13 = Backing into traffic
- 14 = Pedestrian
- 15 = Pedalcyclist
- 16 = Animal
- 17 = Other (specify)
- 99 = Unknown

**3. Pre-Event Maneuver (GES Variable Vehicle 1 Maneuver Prior to Event)**

This represents the last action that the subject vehicle driver engaged in just prior to the point that the driver realized impending danger. Note that the variables in italics are those GES variables that were expanded.

- 1a = Going straight, constant speed*
- 1b = Going straight ahead, accelerating*
- 1c = Going straight, but with unintentional "drifting" within lane or across lanes*
- 2 = Decelerating in traffic lane
- 3 = Accelerating in traffic lane

- 4 = Starting in traffic lane
- 5 = Stopped in traffic lane
- 6 = Passing or overtaking another vehicle
- 7 = Disabled or parked in travel lane
- 8 = Leaving a parked position
- 9 = Entering a parked position
- 10 = Turning right
- 11 = Turning left
- 12 = Making U-turn
- 13 = Backing up (other than for parking purposes)
- 14 = Negotiating a curve
- 15 = Changing lanes
- 16 = Merging
- 17 = Successful corrective action to previous action
- 18a = Maneuvering to avoid an animal*
- 18b = Maneuvering to avoid a pedestrian/pedalcyclist*
- 18c = Maneuvering to avoid an object*
- 18d = Maneuvering to avoid a vehicle*
- 97 = Other
- 99 = Unknown

Source/comment: GES Variable V21, Movement Prior to Critical Event. Also, very similar to VA PAR Variable 19/20.

FORMAT: Integer value as listed above.

#### **4. Judgment of Vehicle 1 Maneuver Prior to Event**

This variable provided additional information about the pre-event maneuver as to whether this maneuver was either safe or legal.

- 1 = Safe and legal
- 2 = Unsafe but legal
- 3 = Safe but illegal
- 4 = Unsafe and illegal
- 99 = Unknown

#### **5. Precipitating Factor (GES Variable V26, Critical Event)**

The driver behavior or state of the environment that begins the event and the subsequent sequence of actions that result in a crash, near-crash, or incident, independent of who caused the event (driver at fault). The precipitating factor occurs outside the vehicle and does not include driver distraction, fatigue, or disciplining child while driving.

**A. This Vehicle Loss of Control Due to:**

- 001 = Blow-out or flat tire
- 002 = Stalled engine
- 003 = Disabling vehicle failure (e.g., wheel fell off)
- 004 = Minor vehicle failure
- 005 = Poor road conditions (puddle, pothole, ice, etc.)
- 006 = Excessive speed
- 007 = Other or unknown reason
- 008 = Other cause of control loss
- 009 = Unknown cause of control loss

**B. This Vehicle Traveling:**

- 018a = Ahead, stopped on roadway more than 2 seconds*
- 018b = Ahead, decelerated and stopped on roadway 2 seconds or less*
- 021 = Ahead, traveling in same direction and decelerating*
- 022 = Ahead, traveling in same direction with slower constant speed*
- 010 = Over the lane line on the left side of travel lane
- 011 = Over the lane line on right side of travel lane
- 012 = Over left edge of roadway
- 013 = Over right edge of roadway
- 014 = End departure
- 015 = Turning left at intersection
- 016 = Turning right at intersection
- 017 = Crossing over (passing through) intersection
- 019 = Unknown travel direction
- 020a = From adjacent lane (same direction), over left lane line behind lead vehicle, rear-end crash threat*
- 020b = From adjacent lane (same direction), over right lane line behind lead vehicle, rear-end crash threat*

**C. Other Vehicle in Lane:**

- 050a = Ahead, stopped on roadway more than 2 seconds*
- 050b = Ahead, decelerated and stopped on roadway 2 seconds or less*
- 051 = Ahead, traveling in same direction with slower constant speed*
- 052 = Ahead, traveling in same direction and decelerating*
- 053 = Ahead, traveling in same direction and accelerating*
- 054 = Traveling in opposite direction
- 055 = In crossover
- 056 = Backing
- 059 = Unknown travel direction of the other motor vehicle

**D. Another Vehicle Encroaching into This Vehicle's Lane:**

- 060a = From adjacent lane (same direction), over left lane line in front of this vehicle, rear-end crash threat*
- 060b = From adjacent lane (same direction), over left lane line behind this vehicle, rear-end crash threat*
- 060c = From adjacent lane (same direction), over left lane line, sideswipe threat*
- 060d = From adjacent lane (same direction), over right lane line, sideswipe threat*
- 060e = From adjacent lane (same direction), other*
- 061a = From adjacent lane (same direction), over right lane line in front of this vehicle, rear-end crash threat*
- 061b = From adjacent lane (same direction), over right lane line behind this vehicle, rear-end crash threat*
- 061c = From adjacent lane (same direction), other*
- 062 = From opposite direction over left lane line.
- 063 = From opposite direction over right lane line
- 064 = From parallel/diagonal parking lane
- 065 = Entering intersection—turning in same direction
- 066 = Entering intersection—straight across path
- 067 = Entering intersection – turning into opposite direction
- 068 = Entering intersection—intended path unknown
- 070 = From driveway, alley access, etc – turning into same direction
- 071 = From driveway, alley access, etc – straight across path
- 072 = From driveway, alley access, etc – turning into opposite direction
- 073 = From driveway, alley access, etc – intended path unknown
- 074 = From entrance to limited access highway
- 078 = Encroaching details unknown

**E. Pedestrian, Pedalcyclist, or other Non-Motorist:**

- 080 = Pedestrian in roadway
- 081 = Pedestrian approaching roadway
- 082 = Pedestrian in unknown location
- 083 = Pedalcyclist/other non-motorist in roadway
- 084 = Pedalcyclist/other non-motorist approaching roadway
- 085 = Pedalcyclist/or other non-motorist unknown location
- 086 = Pedestrian/pedalcyclist/other non-motorist—unknown location

**F. Object or Animal:**

- 087 = Animal in roadway
- 088 = Animal approaching roadway
- 089 = Animal unknown location
- 090 = Object in roadway
- 091 = Object approaching roadway

092 = Object unknown location  
099 = Unknown critical event

**6. Evasive Maneuver (GES Variable V27 Corrective Action Attempted)**

The subject vehicle driver's reaction to the precipitating factor.

0 = No driver present  
1 = No avoidance maneuver  
2 = Braking (no lockup)  
3 = Braking (lockup)  
4 = Braking (lockup unknown)  
5 = Releasing brakes  
6 = Steered to left  
7 = Steered to right  
8 = Braked and steered to left  
9 = Braked and steered to right  
10 = Accelerated  
11 = Accelerated and steered to left  
12 = Accelerated and steered to right  
98 = Other actions  
99 = Unknown if driver attempted any corrective action

**7. Vehicle Control After Corrective Action (GES Variable V28—Coded only for Near-crashes and crashes):**

0 = No driver present  
1 = Vehicle control maintained after corrective action  
2 = Vehicle rotated (yawed) clockwise  
3 = Vehicle rotated (yawed) counter-clockwise  
4 = Vehicle slid/skid longitudinally – no rotation  
5 = Vehicle slid/skid laterally – no rotation  
9 = Vehicle rotated (yawed) unknown direction  
20 = Combination of 2-9  
94 = More than two vehicles involved  
98 = Other or unknown type of vehicle control was lost after corrective action  
99 = Unknown if vehicle control was lost after corrective action.

**Contributing Factors**

**1. Driver Behavior: Driver 1 Actions/Factors Relating to the Event (VA PAR Variable 17/18)**

This variable provides a descriptive label to the driver's actions that may or may not have contributed to the event.

0 = None  
1 = Exceeded speed limit

- 2= Inattentive or distracted
- 3 = Exceeded safe speed but not speed limit
- 4 = Driving slowly: below speed limit
- 5 = Driving slowly in relation to other traffic: not below speed limit
- 6 = Illegal passing (i.e., across double line)
- 7 = Passing on right
- 8 = Other improper or unsafe passing
- 9 = Cutting in, too close in front of other vehicle
- 10 = Cutting in, too close behind other vehicle
- 11 = Making turn from wrong lane (e.g., across lanes)
- 12 = Did not see other vehicle during lane change or merge
- 13 = Driving in other vehicle's blind zone
- 14 = Aggressive driving, specific, directed menacing actions
- 15 = Aggressive driving, other, i.e., reckless driving without directed menacing actions
- 16 = Wrong side of road, not overtaking
- 17 = Following too close
- 18 = Failed to signal, or improper signal
- 19 = Improper turn - wide right turn
- 20 = Improper turn - cut corner on left turn
- 21 = Other improper turning
- 22 = Improper backing, did not see
- 23 = Improper backing, other
- 24 = Improper start from parked position
- 25 = Disregarded officer or watchman
- 26 = Signal violation, apparently did not see signal
- 27 = Signal violation, intentionally ran red light
- 28 = Signal violation, tried to beat signal change
- 29 = Stop sign violation, apparently did not see stop sign
- 30 = Stop sign violation, intentionally ran stop sign at speed
- 31 = Stop sign violation, "rolling stop"
- 32 = Other sign (e.g., Yield) violation, apparently did not see sign
- 33 = Other sign (e.g., Yield) violation, intentionally disregarded
- 34 = Other sign violation
- 35 = Non-signed crossing violation (e.g., driveway entering roadway)
- 36 = Right-of-way error in relation to other vehicle or person, apparent recognition failure (e.g., did not see other vehicle)
- 37 = Right-of-way error in relation to other vehicle or person, apparent decision failure (i.e., did see other vehicle prior to action but misjudged gap)
- 38 = Right-of-way error in relation to other vehicle or person, other or unknown cause
- 39 = Sudden or improper stopping on roadway
- 40 = Parking in improper or dangerous location, e.g., shoulder of Interstate
- 41 = Failure to signal with other violations or unsafe actions
- 42 = Failure to signal, without other violations or unsafe actions
- 43 = Speeding or other unsafe actions in work zone

- 44 = Failure to dim headlights
- 45 = Driving without lights or insufficient lights
- 46 = Avoiding pedestrian
- 47 = Avoiding other vehicle
- 48 = Avoiding animal
- 49 = Apparent unfamiliarity with roadway
- 50 = Apparent unfamiliarity with vehicle, e.g., displays and controls
- 51 = Apparent general inexperience driving
- 52 = Use of cruise control contributed to late braking
- 53 = Other, specify

**2. Driver 1 Physical/Mental Impairment (GES Variable D3: Driver Physical/Mental Condition)**

- 0 = None apparent
- 1 = Drowsy, sleepy, asleep, fatigued
- 2 = Ill, blackout
- 3a = *Angry*
- 3b = *Other emotional state*
- 4a = Drugs-medication
- 4b = Drugs-Alcohol
- 5 = Other drugs (marijuana, cocaine, etc.)
- 6 = Restricted to wheelchair
- 7 = Impaired due to previous injury
- 8 = Deaf
- 50 = Hit and run vehicle
- 97 = Physical/mental impairment – no details
- 98 = Other physical/mental impairment
- 99 = Unknown physical/mental condition

Source: GES D3, Driver Physical/Mental Condition. Element 3 expanded to separate anger from other emotions. Element 50 not applicable.  
 Coded in General State Variables: Driver's General State, Causal/Contributing Factors, & Precipitating Event.  
 FORMAT: 16-bit encoded value(s) as listed above.

**3. Driver 1 Distracted By (GES Variable D7: Driver Distracted By)**

This variable was recorded if the reductionists observed the drivers engaging in any of the following secondary tasks 5 to 10 seconds prior to the onset of the precipitating factor. For a complete definition of these tasks, see Appendix D.

- 00 = Not Distracted
- 15 = *Cognitive distraction*
  - 97 = Lost in thought
  - 01 = Looked but did not see

15a = Reading  
15b = Talking/singing without obvious passenger  
15c = Dancing to the radio  
15d = Reading

03 = Passenger in vehicle

*3a = Passenger in adjacent seat*  
*3b = Passenger in rear seat*  
*3c = Child in adjacent seat*  
*3d = Child in rear seat*

04 = Object/Animal/Insect in Vehicle

*4a = Moving object in vehicle (i.e. object fell off seat when driver stopped hard at a traffic light)*  
*4b = Insect in vehicle*  
*4c = Pet in vehicle*  
*4d = Object dropped by driver*  
*4e = Reaching for object in vehicle (not cell phone)*

5 = Cell phone operations

*05a = Talking/listening*  
*06a = Dialing hand-held cell phone*  
*06b = Dialing hand-held cell phone using quick keys*  
*06c = Dialing hands-free cell phone using voice activated software*  
*06d = Locating/reaching/answering cell phone*

17 = PDA operations

*15a = Locating/reaching PDA*  
*15b = Operating PDA*  
*15c = Viewing PDA*

16 = In-vehicle system operations

*7 = Adjusting climate control*  
*8a = Adjusting the radio*  
*8b = Inserting/retrieving cassette*  
*8c = Inserting/retrieving CD*  
*9 = Adjusting other devices integral to vehicle (unknown which device)*  
*9a = Adjusting other known in-vehicle devices (text box to specify)*

12 = External Distraction

*12a = Looking at previous crash or highway incident*  
*12b = Pedestrian located outside the vehicle*  
*12c = Animal located outside the vehicle*  
*12d = Object located outside the vehicle*  
*12e = Construction zone*

13 = Dining

*13a = Eating with a utensil*

*13b = Eating without a utensil*

*13c = Drinking from a covered container (i.e. straw)*

*13d = Drinking from an uncovered container*

14 = Smoking

*14a = Reaching for cigar/cigarette*

*14b = Lighting cigar/cigarette*

*14c = Smoking cigar/cigarette*

*14d = Extinguishing cigar/cigarette*

18. Personal Hygiene

*18a = Combing/brushing/fixing hair*

*18b = Applying make-up*

*18c = Shaving*

*18d = Brushing/flossing teeth*

*18e = Biting nails/cuticles*

*18f = Removing/adjusting jewelry*

*18g = Removing/inserting contact lenses*

*18h = Other*

19. Inattention to the Forward Roadway

*19a = Left window*

*19b = Left rear-view mirror*

*19c = Center rear-view mirror*

*19d = Right rear-view mirror*

*19e = Right passenger window*

### **3a. Time Distraction Began**

Reductionists entered the video frame number corresponding to the time at which the driver became distracted or began to engage in the distracting task.

### **3b. Time Distraction Ended**

Reductionists entered the video frame number corresponding to the time at which the driver disengaged from the distracting task or the driver's attention returned to the forward roadway.

### **3c. Outcome (of Incident) Impacted**

Reductionists also marked whether they believed that the secondary task that was present at the onset of the precipitating factor impacted the severity or the outcome of the event. Note that all distraction analyses conducted in this report only used those secondary tasks that were marked "yes" or "not able to determine."

- 1 = Yes
- 2 = No
- 3 = Not able to determine
- 99 = Unknown

#### **4. Willful Behavior**

Reductionists marked this variable when they believed that the driver was aware or cognizant of their poor behavior. There were 3 options, written in sequential order of increasingly willful or aggressive behavior.

- 1 = Aggressive driving
- 2 = Purposeful violation of traffic laws
- 3 = Use of vehicle for improper purposes (Intimidation/weapon)
- 99 = Unknown

Source/comment: This variable came from the Light/Heavy Vehicle Interaction Study Taxonomy.

#### **5. Driver Proficiency**

Reductionists marked this variable when it was believed that the driver was generally unaware of their poor driving behavior. There are 4 options, written in order of decreasing levels of proficiency (the last is the most drastic measure of poor driving proficiency).

- 1 = Violation of traffic laws
- 2 = Driving techniques (incompetent to safely perform driving maneuver)
- 3 = Vehicle kinematics (incompetent handling the vehicle)
- 4 = Driver capabilities (incompetent on what maneuvers are safe and appropriate)

Source/comment: This variable came from the Light/Heavy Vehicle Interaction Study Taxonomy.

#### **6. Driver 1 Drowsiness Rating (Coded for Crashes and Near-Crashes only)**

An observer rating of drowsiness will be assigned for the 30 seconds prior to the event based on review of driver videos. For drowsiness levels above a criterion level of and ORD of 60 or above, a manual calculation of PERCLOS will be measured by the analyst. This variable will be coded for all crashes and near-crashes (Wierwille and Ellsworth, 1994).

#### **7. Driver 1 Vision Obscured by (GES Variable D4: Vision Obscured by)**

Reductionists will ascertain to the best of their ability whether the driver's vision was obscured by any of the following:

- 0 = No obstruction
- 1 = Rain, snow, fog, smoke, sand, dust

- 2a = *Reflected glare*
- 2b = *Sunlight*
- 2c = *Headlights*
- 3 = Curve or hill
- 4 = Building, billboard, or other design features (includes signs, embankment)
- 5 = Trees, crops, vegetation
- 6 = Moving vehicle (including load)
- 7 = Parked vehicle
- 8 = Splash or spray of passing vehicle [any other vehicle]
- 9 = Inadequate defrost or defog system
- 10 = Inadequate lighting system
- 11 = Obstruction interior to vehicle
- 12 = Mirrors
- 13 = Head restraints
- 14 = Broken or improperly cleaned windshield
- 15 = Fog
- 50 = Hit & run vehicle
- 95 = No driver present
- 96 = Not reported
- 97 = Vision obscured – no details
- 98 = Other obstruction
- 99 = Unknown whether vision was obstructed

**8. Vehicle Contributing Factors (GES Variable V12, Vehicle contributing factors)**

Reductionists will determine if any of the following contributed to the severity or the presence of an event.

- 0 = None
- 1 = Tires
- 2 = Brake system
- 3 = Steering system
- 4 = Suspension
- 5 = Power train
- 6 = Exhaust system
- 7 = Headlights
- 8 = Signal lights
- 9 = Other lights
- 10 = Wipers
- 11 = Wheels
- 12 = Mirrors
- 13 = Driver seating and controls
- 14 = Body, doors
- 15 = Trailer hitch
- 50 = Hit and run vehicle

- 97 = Vehicle contributing factors, no details
- 98 = Other vehicle contributing factors
- 99 = Unknown if vehicle had contributing factors

## **Environmental Factors: Driving Environment**

### **1. Weather (GES Variable A20I, Atmospheric condition and VA PAR Variable 4)**

Reductionists will determine the type of weather using the video and record as part of the data reduction process.

- 1 = Clear
- 2 = Cloudy
- 3 = Fog
- 4 = Mist
- 5 = Raining
- 6 = Snowing
- 7 = Sleet
- 8 = Smoke dust
- 9 = Other
- 99 = Unknown

### **2. Light (GES Variable A19I, Light Condition and VA PAR Variable 7)**

Reductionists will determine the type of ambient light conditions are present using the video and record as part of the data reduction process.

- 1 = Dawn
- 2 = Daylight
- 3 = Dusk
- 4 = Darkness, lighted
- 5 = Darkness, not lighted
- 99 = Unknown

### **3. Windshield Wiper Activation**

Analysts will determine the windshield wiper activation through video reduction.

- 0 = Off
- 1 = On
- 99 = Unknown

### **4. Surface Condition (VA PAR Variable 5)**

Reductionists will determine the type of surface condition at the onset of the precipitating factor and record as part of the data reduction process.

- 1 = Dry
- 2 = Wet

- 3 = Snowy
- 4 = Icy
- 5 = Muddy
- 6 = Oily
- 7 = Other
- 99 = Unknown

### **5. Traffic Density (Level of Service)**

Reductionists will determine the level of traffic density at the time of the precipitating factor and record as part of the data reduction process.

- 1 = LOS A: free flow
- 2 = LOS B: Flow with some restrictions
- 3 = LOS C: Stable flow, maneuverability and speed are more restricted
- 4 = LOS D: Unstable flow – temporary restrictions substantially slow driver
- 5 = LOS E: Flow is unstable, vehicles are unable to pass, temporary stoppages, etc.
- 6 = LOS F: Forced traffic flow condition with low speeds and traffic volumes that are below capacity. Queues forming in particular locations.
- 99 = Unknown

### **Driving Environment: Infrastructure**

#### **1. Kind of Locality (VA PAR Variable 8)**

Reductionists will determine the kind of locality at the onset of the precipitating factor and record as part of the data reduction process.

- 1 = School
- 2 = Church
- 3 = Playground
- 4 = Open Country
- 5 = Business/industrial
- 6 = Residential
- 7 = Interstate
- 8 = Other
- 9 = *Construction Zone (Added)*
- 99 = Unknown

#### **2. Relation to Junction (GES Variable A9)**

Reductionists will determine the whether the precipitating factor occurred near a roadway junction and record as part of the data reduction process.

#### **Non-Interchange Area**

- 00 = Non-Junction
- 01 = Intersection

- 02 = Intersection-related
- 03 = Driveway, alley access, etc.
- 04 = Entrance/exit ramp
- 05 = Rail grade crossing
- 06 = On a bridge
- 07 = Crossover-related
- 08 = Other, non-interchange area
- 09 = Unknown, non-interchange
- 20 = *Parking lot [Added]*

FORMAT: Integer value as listed above.

**Interchange Area**

- 10 = Non-Junction
- 11 = Intersection
- 12 = Intersection-related
- 13 = Driveway, alley access, etc.
- 14 = Entrance/exit ramp
- 16 = On a bridge
- 17 = Crossover-related
- 18 = Other location in interchange area
- 19 = Unknown, interchange area
- 99 = Unknown if interchange

**3. Trafficway Flow (GES Variable A11)**

Reductionists will determine the whether the roadway was divided at the time of the precipitating factor and record as part of the data reduction process.

- 1 = Not divided
- 2 = Divided (median strip or barrier)
- 3 = One-way traffic
- 99 = Unknown

**4. Number of Travel Lanes (GES Variable A12)**

Reductionists will determine the number of travel lanes at the time of the precipitating factor and record as part of the data reduction process.

- 1 = 1
- 2 = 2
- 3a = *3 lanes in direction of travel (divided or one-way trafficway)*
- 3b = *Undivided highway, 3 lanes total, 2 in direction of travel*
- 3c = *Undivided highway, 3 lanes total, 1 in direction of travel*
- 4 = 4
- 5 = 5
- 6 = 6
- 7 = 7+

99 = Unknown

**5. Traffic Control (VA PAR Variable 1)**

Reductionists will determine whether there was a traffic control device present and record as part of the data reduction process.

- 1 = No traffic control
- 2 = Officer or watchman
- 3 = Traffic signal
- 4 = Stop sign
- 5 = Slow or warning sign
- 6 = Traffic lanes marked
- 7 = No passing signs
- 8 = Yield sign
- 9 = One way road or street
- 10 = Railroad crossing with markings or signs
- 11 = Railroad crossing with signals
- 12 = Railroad crossing with gate and signals
- 13 = Other
- 99 = Unknown

Source: VA PAR Variable 1.

Coded in General State Variables: Road/Traffic Variables.

FORMAT: Integer value as listed above.

**6. Alignment (VA PAR Variable 3)**

Reductionists will determine whether there what the road alignment was at the onset of the precipitating factor and record as part of the data reduction process.

- 1 = Straight level
- 2 = Curve level
- 3 = Grade straight
- 4 = Grade curve
- 5 = Hillcrest straight
- 6 = Hillcrest curve
- 7 = Dip straight
- 8 = Up curve [need definition]
- 9 = Other
- 99 = Unknown

## **Driver State Variables**

### **1. Driver 1 Hands on Wheel (C-N-I-B)**

Reductionists will the number of hands the driver had on the steering wheel at the time of the precipitating factor and record as part of the data reduction process.

- 0 = None
- 1 = Left hand only
- 2 = Both hands
- 3 = Right hand only
- 99 = Unknown

### **2. Occupant Safety Belt Usage (C)**

Reductionists will determine whether the driver had a safety belt fastened at the time of the precipitating factor and record as part of the data reduction process.

- 1 = Lap/shoulder belt
- 2 = Lap belt only
- 3 = Shoulder belt only
- 5 = None used
- 99 = Unknown if used.

### **3. Driver 1 Alcohol Use (GES Variable V92)**

Reductionists will determine whether drivers were using alcohol or under the influence of alcohol at the time of the precipitating factor and record as part of the data reduction process.

- 1a = Use observed in vehicle without overt effects on driving
- 1b = Use observed in vehicle with overt effects on driving
- 1c = Use not observed but reported by police
- 1d = Use not observed or reported, but suspected based on driver behavior.
- 2 = None known
- 99 = Unknown

### **4. Fault Assignment**

- 1 = Driver 1 (subject vehicle)
- 2 = Driver 2
- 3 = Driver 3
- 4 = Driver 4
- 5 = Driver 5
- 6 = Driver 6
- 7 = Driver 7
- 8 = Driver 8
- 9 = Driver 9
- 10 = Driver 10
- 11 = Other (textbox)

99 = Unknown

### **5. Average PERCLOS (Percentage Eyes Closed) (C, N)**

For crashes and near-crashes where the driver's observer rating of drowsiness is above a criterion level an ORD of 60, the average PERCLOS value for the 30-second pre-event period will be obtained through video reduction.

### **6. Driver 1 Eye Glance Reconstruction (C-N)**

Eye glances for the previous 30 seconds will be classified using the following categories and described as a timed, narrative sequence of the following numbers:

- 1 = Center forward
- 2 = Left forward
- 3 = Right forward
- 4 = Left mirror
- 5 = Right mirror
- 6 = Left window
- 7 = Right window
- 8 = Instrument panel
- 9 = Passenger
- 10 = Object
- 11 = Cell Phone
- 12 = Other

Comment: The analysis will include a recording of time the driver's eyes were not "on the road," i.e., straight ahead, forward right, or forward left. When possible, eye glances will be characterized in greater detail than the general directions and areas listed above, e.g., when known, the specific object of regard will be noted in the narrative. For the instrument panel, for example, specific components such as the radio/CD will be noted in the narrative. When applicable and possible, the eye glance reconstruction will also include an assessment of driver reaction time to a stimulus, e.g., braking reaction time following a potential crash-precipitating event.

## **Driver/Vehicle 2**

### **1. Number of other Vehicle/Person (s)**

Reductionists will identify the number of vehicles in the immediate environment and then record the following variables.

### **2. Location of other Vehicle/Persons**

Reductionists will identify the location of vehicles in the immediate environment with respect to the subject vehicle and then record the following variables.

A = In front of subject vehicle

B = In front and to the immediate right of the subject vehicle

C = On the right side of the subject vehicle, closer to front seat of the vehicle.

D = On the right side of the subject vehicle, closer to rear seat of the vehicle.

E = Behind and to the immediate right of the subject vehicle.

F = Behind the subject vehicle

G = Behind and to the immediate left of the subject vehicle.

H = On the left side of the subject vehicle, closer to the rear seat of the vehicle.

I = On the left side of the subject vehicle, closer to the front seat of the vehicle.

J = In front and to the immediate left of the subject vehicle.

### **3. Vehicle/Person 2 Type (Modified version of GES Variable V5, Body Type)**

Data reductionists will record what type of vehicles that are in the subject vehicle's immediate surroundings.

1 = Automobile

14 = Sport utility vehicles

20 = Van-based truck (minivan or standard van)

30 = Pickup truck

50 = School bus

58a = Transit bus

58b = Greyhound bus

58c = Conversion bus

64a = *Single-unit straight truck: Multistop/step van*

64b = *Single-unit straight truck: Box*

64c = *Single-unit straight truck: Dump*

64d = *Single-unit straight truck: Garbage/recycling*

64e = *Single-unit straight truck: Concrete mixer*

64f = *Single-unit straight truck: Beverage*

64g = *Single-unit straight truck: Flatbed*

64h = *Single-unit straight truck: Tow truck*

64i = *Single-unit straight truck: Other*

64j = *Single-unit straight truck: Unknown*

64k = *Straight Truck + Trailer*

66 = *Tractor only*

66a = *Tractor-trailer: Enclosed box*

66b = *Tractor-trailer: Flatbed*

66c = *Tractor-trailer: Tank*

66d = *Tractor-trailer: Car carrier*

66e = *Tractor-trailer: Livestock*

66f = *Tractor-trailer: Lowboy trailer*

66g = *Tractor-trailer: Dump trailer*

66h = *Tractor-trailer: Multiple trailers/enclosed box*

66i = *Tractor-trailer: Multiple trailers/grain*

66e = *Tractor-trailer: Other*

93 = *Other Large Construction Equipment*

8 = Motorcycle or moped

9a = Ambulance

9b = Fire truck

9c = Police

- 10 = Other vehicle type
- 11 = Pedestrian
- 12 = Cyclist
- 13 = Animal
- 99 = Unknown vehicle type

**4. Vehicle 2 Maneuver (GES Variable V21, Movement Prior to Critical Event)**

Reductionists will record what the other vehicle's actions were just prior to the onset of the precipitating factor.

- 1 = Going straight ahead
- 2 = Making right turn
- 3 = Making left turn
- 4 = Making U-turn
- 5 = Slowing or stopping
- 6 = Starting in traffic lane
- 7 = Starting from parked position
- 8 = Stopped in traffic lane]
- 9 = Ran off road right
- 10 = Ran off road left
- 11 = Parked
- 12 = Backing
- 13 = Passing
- 14 = Changing lanes
- 15 = Other
- 16 = Accelerating in traffic lane*
- 17 = Entering a parked position*
- 18 = Negotiating a curve*
- 19 = Merging*
- 99 = Unknown

**5. Driver/Vehicle 2 Corrective Action Attempted (GES V27, Corrective Action Attempted)**

Reductionists will record the corrective action attempted for each vehicle immediately surrounding the subject vehicle.

- 0 = No driver present
- 1 = No avoidance maneuver
- 2 = Braking (no lockup)
- 3 = Braking (lockup)
- 4 = Braking (lockup unknown)
- 5 = Releasing brakes
- 6 = Steered to left
- 7 = Steered to right
- 8 = Braked and steered to left
- 9 = Braked and steered to right

- 10 = Accelerated
- 11 = Accelerated and steered to left
- 12 = Accelerated and steered to right
- 98 = Other actions
- 99 = Unknown if driver attempted any corrective action

Coded: From PAR and/or video.

Source: GES V27, Corrective Action Attempted.

Coded in General State Variables: Driver/Vehicle 2.

FORMAT: Integer value as listed above.

### **6. Driver/Vehicle 2 Physical/Mental Impairment (GES D3, Driver Physical/Mental Condition)**

Reductionists will mark only for those crashes that a police accident report form is collected from the subject.

- 0 = None apparent
- 1 = Drowsy, sleepy, asleep, fatigued
- 2 = Ill, blackout
- 3a = *Angry*
- 3b = *Other emotional state*
- 4 = Drugs-medication
- 5 = Other drugs (marijuana, cocaine, etc.)
- 6 = Restricted to wheelchair
- 7 = Impaired due to previous injury
- 8 = Deaf
- 50 = Hit-and-run vehicle
- 97 = Physical/mental impairment – no details
- 98 = Other physical/mental impairment
- 99 = Unknown physical/mental condition

### **7. Driver 2 Actions/Factors Relating to Crash/Incident (VA PAR Variable 17/18)**

Reductionists will code this for crashes and near-crashes only for each vehicle immediately surrounding the subject vehicle.

- 0 = None
- 1 = Exceeded speed limit
- 2 = Inattentive or distracted (coded in previous variable)
- 3 = Exceeded safe speed but not speed limit
- 4 = Driving slowly: below speed limit
- 5 = Driving slowly in relation to other traffic: not below speed limit
- 6 = Illegal passing (i.e., across double line)
- 7 = Passing on right
- 8 = Other improper or unsafe passing
- 9 = Cutting in, too close in front of other vehicle

- 10 = Cutting in, too close behind other vehicle
- 11 = Making turn from wrong lane (e.g., across lanes)
- 12 = Did not see other vehicle during lane change or merge
- 13 = Driving in other vehicle's blind zone
- 14 = Aggressive driving, specific, directed menacing actions
- 15 = Aggressive driving, other, i.e., reckless driving without directed menacing actions
- 16 = Wrong side of road, not overtaking
- 17 = Following too close
- 18 = Failed to signal, or improper signal
- 19 = Improper turn: wide right turn
- 20 = Improper turn: cut corner on left turn
- 21 = Other improper turning
- 22 = Improper backing, did not see
- 23 = Improper backing, other
- 24 = Improper start from parked position
- 25 = Disregarded officer or watchman
- 26 = Signal violation, apparently did not see signal
- 27 = Signal violation, intentionally ran red light
- 28 = Signal violation, tried to beat signal change
- 29 = Stop sign violation, apparently did not see stop sign
- 30 = Stop sign violation, intentionally ran stop sign at speed
- 31 = Stop sign violation, "rolling stop"
- 32 = Other sign (e.g., Yield) violation, apparently did not see sign
- 33 = Other sign (e.g., Yield) violation, intentionally disregarded
- 34 = Other sign violation
- 35 = Non-signed crossing violation (e.g., driveway entering roadway)
- 36 = Right-of-way error in relation to other vehicle or person, apparent recognition failure (e.g., did not see other vehicle)
- 37 = Right-of-way error in relation to other vehicle or person, apparent decision failure (i.e., did see other vehicle prior to action but misjudged gap)
- 38 = Right-of-way error in relation to other vehicle or person, other or unknown cause
- 39 = Sudden or improper stopping on roadway
- 40 = Parking in improper or dangerous location, e.g., shoulder of Interstate
- 41 = Failure to signal with other violations or unsafe actions
- 42 = Failure to signal, without other violations or unsafe actions
- 43 = Speeding or other unsafe actions in work zone
- 44 = Failure to dim headlights
- 45 = Driving without lights or insufficient lights
- 46 = Avoiding pedestrian
- 47 = Avoiding other vehicle
- 48 = Avoiding animal
- 49 = Apparent unfamiliarity with roadway

- 50 = Apparent unfamiliarity with vehicle, e.g., displays and controls
- 51 = Apparent general inexperience driving
- 52 = Use of cruise control contributed to late braking
- 53 = Other, specify





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