On-scene Advanced Occupant Protection Systems
Dynamic Science, Inc. / Case Number: DS00-018
2000 Ford Taurus SE 4-door
Texas
June, 2000

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

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16. Abstract

The collision occurred in Texas in June, 2000 at 1548 hours. This was a two vehicle, broadside type collision at a four leg intersection of a rural state divided highway. The weather was clear and the roadway was dry and free of any defects. The case vehicle was a 2000 Ford Taurus SE 4-door that was driven by a restrained 51-year-old male. The case vehicle was on loan from a Ford dealer where the driver was having his personal vehicle repaired. There were two additional occupants in the case vehicle. The front right seat was occupied by an unrestrained 38-year-old female. The 2nd left seat was occupied by an improperly restrained 4-year-old female. The driver indicated that the 4-year-old would place the shoulder portion of the safety belt behind her so that the belt would not be positioned in front of her face. The driver was asked why the 4-year-old was not in a child safety seat and he indicated that it was his understanding that Texas law did not require children in child safety seats over a certain weight. The vehicle inspection did not reveal any evidence of seat belt usage in the 2nd left seat position.

The other vehicle was a 1997 Buick LeSabre 4-door that was driven by a restrained 64-year-old female. The front right seat was occupied by a restrained 91-year-old female.

The case vehicle was northbound in the third lane from the left edge of the roadway. The Buick was traveling eastbound in the second lane from the center median edge. The driver of the case vehicle indicated that he saw the Buick stop and then proceeded to cross the highway. The driver of the case vehicle braked, but the front of the case vehicle (11FDEW1) broadsided the right side of the Buick (02RYEW3). On impact, both frontal airbags, the driver's pretensioners and the driver's seat mounted side airbag deployed in the case vehicle deployed. After impact 1, the case vehicle rotated clockwise and the Buick rotated counterclockwise. Impact 2 was a side slap between the left side of the case vehicle (09LYEW2) and the right side of the Buick (04RZEW3). After the impact 2, the case vehicle continued rotating clockwise and with its left rear tire struck the concrete curb (impact 3) of the of the east-west roadway center median. The case vehicle rotated clockwise approximately 180 degrees from its original travel direction and came to final rest heading south, perpendicular to the front of the east-west roadway center median.

After the impact 2, the Buick rotated counterclockwise and continued moving forward in an easterly direction. The Buick ran up and over the concrete curb of the east-west roadway center median, causing damage to the front left tire (impact 4) of the Buick. The Buick continued on the center median and knocked over a stop sign with its left side (impact 5). The Buick continued moving forward, off the center median and came to final rest heading east on the westbound travel lanes, parallel to the center median.

Both vehicles were towed from the scene. Both vehicles were declared a total loss by their respective insurance companies.

The driver of the case vehicle sustained injuries consisting of contusions to the left shoulder and right hip as a result of loading the lap and shoulder belt. After being treated at the scene he was transported by ground ambulance to a hospital were he was treated and released. He missed three weeks of work as a result of his injuries and received treatment for one month from a chiropractor. The front right occupant sustained injuries consisting of a contusion to her forehead as a result of knocking off the rear view mirror and large contusions to both of her knees as a result of striking the center and right instrument panel areas. After being treated at the scene, the front right occupant was transported by ground ambulance to a hospital were she was treated and released. She received approximately two months of treatment from a chiropractor. The rear occupant was transported to a hospital with the driver and front right occupant. She was checked out and released with no injuries.

17. Key Words	18. Distribution Statement
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Dynamic Science, Inc.
Accident Investigation
Case Number: DS00-018

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BACKGROUND:

Description:	This Advanced Occupant Protection Systems and Event Data Recorder case was reported to the NHTSA by DSI on September 25, 2000 and the case was assigned to DSI on September 26, 2000. An on-site investigation was conducted and all field work was completed on September 27, 2000.
Investigation Type:	On-scene
Crash Location:	Texas
Crash Date:	June, 2000
Notification Date:	September 26, 2000
Field Work Completed:	September 27, 2000

SUMMARY:

The collision occurred in Texas in June, 2000 at 1548 hours. This was a two vehicle, broadside type collision at a four leg intersection of a rural state divided highway. The northbound roadway is a one way, concrete state highway. Three lanes are designated for through traffic and one lane is designated as a left turn lane. There were no traffic controls present for northbound traffic and the posted speed limit is 105 km/h (65 mph). The east-west roadway is a two way, divided concrete roadway. The eastbound roadway consist of two lanes and a left turn lane to head north. The westbound roadway consist of three travel lanes. East and westbound traffic is controlled by standard stop signs at the intersection with the state highway. The stop signs are clearly visible. The speed limit for the east-west roadway is 89 km/h (55 mph). The weather was clear and the roadway was dry and free of any defects.

Figure 1. Case vehicle path to impact (north).

The case vehicle was a 2000 Ford Taurus SE 4-door that was driven by a restrained[1] 51-year-old male (168 cm/66 in., 84 kg/185 lbs). The case vehicle was on loan from a Ford dealer where the driver was having his personal vehicle repaired. There were two additional occupants in the case

[1] The EDR report and the measured pretensioner barrel both indicate that the driver's seat belt buckle was engaged.

vehicle. The front right seat was occupied by an unrestrained[2] 38-year-old female (157 cm/62 in., 73 kg/160 lbs). The 2nd left seat was occupied by an improperly restrained 4-year-old female (97 cm/38 in., 18 kg/39 lbs). The driver indicated that the 4-year-old would place the shoulder portion of the safety belt behind her so that the belt would not be positioned in front of her face. The driver was asked why the 4-year-old was not in a child safety seat and he indicated that it was his understanding that Texas law did not require children in child safety seats over a certain weight[3]. The vehicle inspection did not reveal any evidence of seat belt usage in the 2nd left seat position.

Figure 2. Buick's path to impact (east).

The other vehicle was a 1997 Buick LeSabre 4-door that was driven by a restrained 64-year-old female. The front right seat was occupied by a restrained 91-year-old female 157 cm/62 in., 70 kg/154 lbs).

The case vehicle was northbound in the third lane from the left edge of the roadway. The Buick was traveling eastbound in the second lane from the center median edge. The driver of the case vehicle indicated that he saw the Buick stop and then proceeded to cross the highway. The driver of the case vehicle braked, but the front of the case vehicle (11FDEW1) broadsided the right side of the Buick (02RYEW3). On impact, both frontal airbags, the driver's pretensioners and the driver's seat mounted side airbag in the case vehicle deployed. The case vehicle sustained a calculated total delta v of 25.0 km/h (15.5 mph), a longitudinal delta v of -23.5 km/h (-14.6 mph) and a latitudinal delta v of 8.6 km/h (5.3 mph) as computed by WinSmash[4]. The Buick sustained a total delta v of 25.0 km/h (15.5 mph), a longitudinal delta v of -12.5 km/h (-7.8 mph) and a latitudinal delta v of -21.7 km/h (-13.5 mph). The results fit the collision model, and appear reasonable for both vehicles.

The downloaded Electronic Data Recorder (EDR) report for the case vehicle indicates a cumulative longitudinal delta v of -31.5 km/h (-19.6 mph), and a lateral cumulative delta v of 11.9 km/h (7.4 mph) at the 78 ms mark. The EDR report also indicates that the driver's air bag, the driver's side air bag, and the front right passenger's air bag all deployed at the 21 ms mark. The data indicates that the driver's seat belt was engaged and that the pretensioner on the driver's side fired at the 14 ms mark. The EDR report is included as an attachment to this report.

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[2] The EDR report indicates that front right passenger seat buckle was "not engaged".

[3] Texas law requires a child less than four years old, or less than 91.4 cm (36 in.) tall, must be secured in a child safety seat.

[4] Calculated using the damage only algorithm of Winsmash 2.1.2 and stiffness values for the case vehicle calculated using NCAP crash data.

The Buick was equipped with a driver's air bag and a front right passenger's airbag mid-mounted in the instrument panel that did not deploy. The Sensing and Diagnostic Module (SDM) data was downloaded from the Buick using the Vetronix Crash Data Retrieval system. The SDM recorded a Near Deployment Event and the data indicates a recorded maximum velocity change of -0.88 km/h (-1.4 mph) at the 62.5 ms mark. The Near Deployment Event was recorded at 7301 ignition cycles and the investigation (downloading of the data) occurred at 7318 ignition cycles. The SDM data also indicates that the driver's safety belt was buckled. The SDM report is included as an attachment to this report.

After impact 1, the case vehicle rotated clockwise and the Buick rotated counterclockwise. Impact 2 was a side slap between the left side of the case vehicle (09LYEW2) and the right side of the Buick (04RZEW3). The case vehicle sustained a calculated total delta v of 18.0 km/h (11.2 mph), a longitudinal delta v of 0 km/h (0 mph) and a latitudinal delta v of 18.0 km/h (11.2 mph) as computed by WinSmash[5]. The Buick sustained a total delta v of 18.0 km/h (11.2 mph), a longitudinal delta v of 0 km/h (0 mph) and a latitudinal delta v of -18.0 km/h (-11.2 mph). The results fit the collision model and appear reasonable for both vehicles.

Figure 3. Left side damage to the case vehicle.

After the impact 2, the case vehicle continued rotating clockwise and with its left rear tire struck the concrete curb (impact 3) of the of the east-west roadway center median. The case vehicle rotated clockwise approximately 180 degrees from its original travel direction and came to final rest heading south, perpendicular to the front of the east-west roadway center median.

After the impact 2, the Buick rotated counterclockwise and continued moving forward in an easterly direction. The Buick ran up and over the concrete curb of the east-west roadway center median, causing damage to the front left tire (impact 4) of the Buick. The Buick continued on the center median and knocked over a stop sign with its left side (impact 5). The Buick continued moving forward, off the center median and came to final rest heading east on the westbound travel lanes, parallel to the center median.

Both vehicles were towed from the scene. Both vehicles were declared a total loss by their respective insurance companies.

The police were notified of crash at 1551 hours and arrived at the scene at 1552 hours. A "life

[5] Calculated using the damage algorithm of WinSmash 2.1.2 and size and stiffness values in the NASS Coding Manual.

flight" helicopter was notified at 1558 hours and arrived at the scene at 1616 hours. EMS were notified at 1608 and arrived at the scene at 1620 hours and treated the injured. The life flight helicopter left the scene and arrived at the hospital at 1731 hours.

The driver of the case vehicle sustained injuries consisting of contusions to the left shoulder and right hip as a result of loading the lap and shoulder belt. After being treated at the scene he was transported by ground ambulance to a hospital were he was treated and released. He missed three weeks of work as a result of his injuries and received treatment for one month from a chiropractor. The front right occupant sustained injuries consisting of a contusion to her forehead as a result of knocking off the rear view mirror and large contusions to both of her knees as a result of striking the center and right instrument panel areas. After being treated at the scene, the front right occupant was transported by ground ambulance to a hospital were she was treated and released. She received approximately two months of treatment from a chiropractor. The rear occupant was transported to a hospital with the driver and front right occupant. She was checked out and released with no injuries.

The driver of the Buick sustained "C" type injuries but the police report does not indicate transport to a hospital for treatment. The front right occupant was entrapped in the Buick and required extrication by fire rescue personnel. She was life flighted to a hospital where she expired at 1831 hours. An evasive autopsy conducted two days after the crash reported the following injuries for the front right occupant of the Buick:

- Lacerations of the aorta (with hemothoraces), the pericardial sac (with hemoperitoneum), and the urinary bladder as a result of contact with the intruding right door.

- Fractures of the anterior right ribs 2-9, the lateral left ribs 3-8 and thyroid cartilage. The right side rib fractures were as a result of contact with the intruding right door and the left side rib and thyroid fractures was as a result of possible interaction with the driver of the Buick.

- Fractures of the posterior rami of right pelvis and anterior and posterior rami of left pelvis as a result of contact with the intruding right door.

- She had multiple and numerous contusions of the head, upper and lower extremities. The right side contusions were as a result of contact with the intruding right door. She sustained a contusion to her left eye orbit as a result of possible contact with the driver. She had numerous and multiple contusion to both of her legs, knees and feet. These were as a result of contact with the deformed instrument panel area.

The coroner listed the cause of death as multiple blunt force trauma.

Scene Diagrams

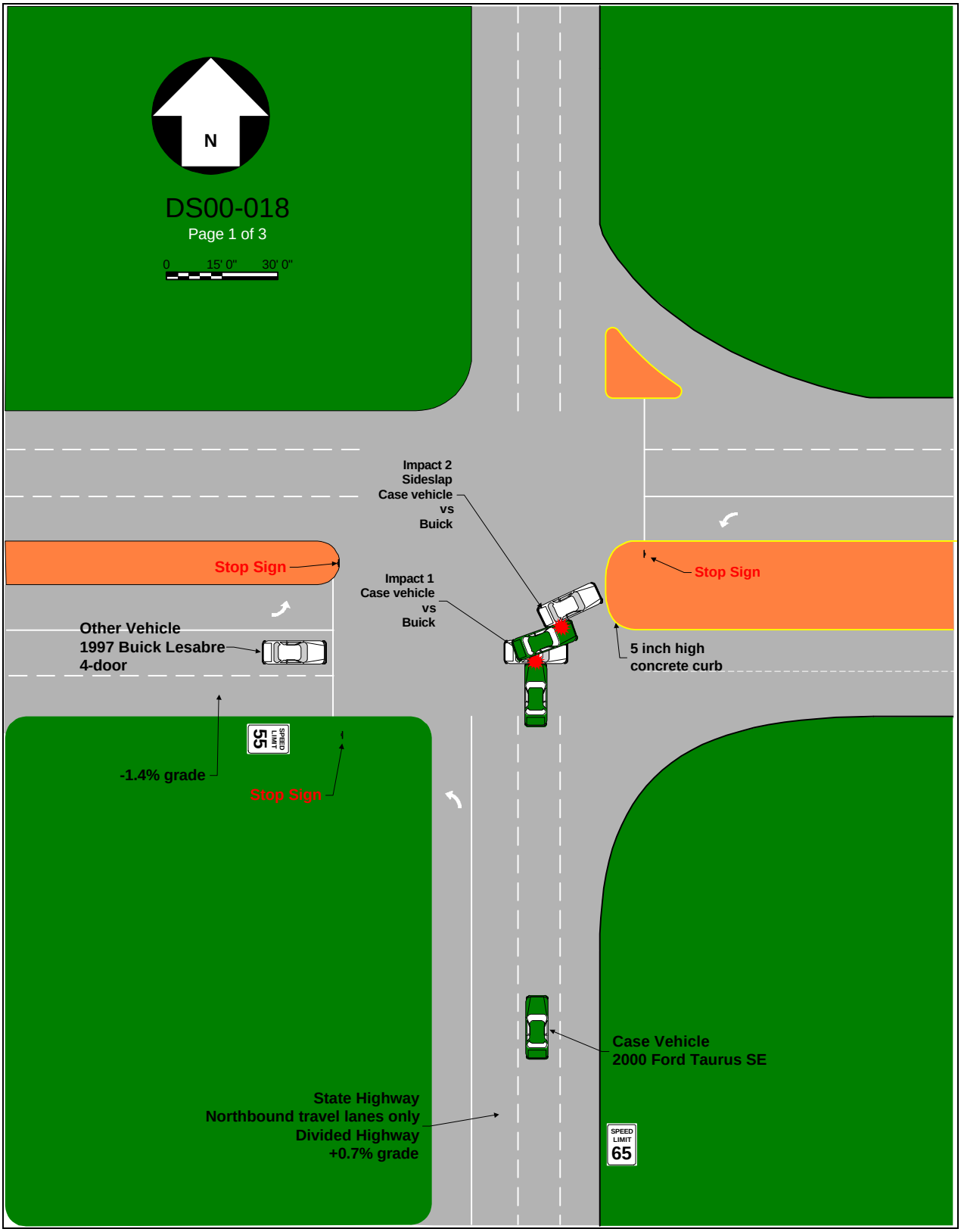


Figure 4. Impacts 1 and 2

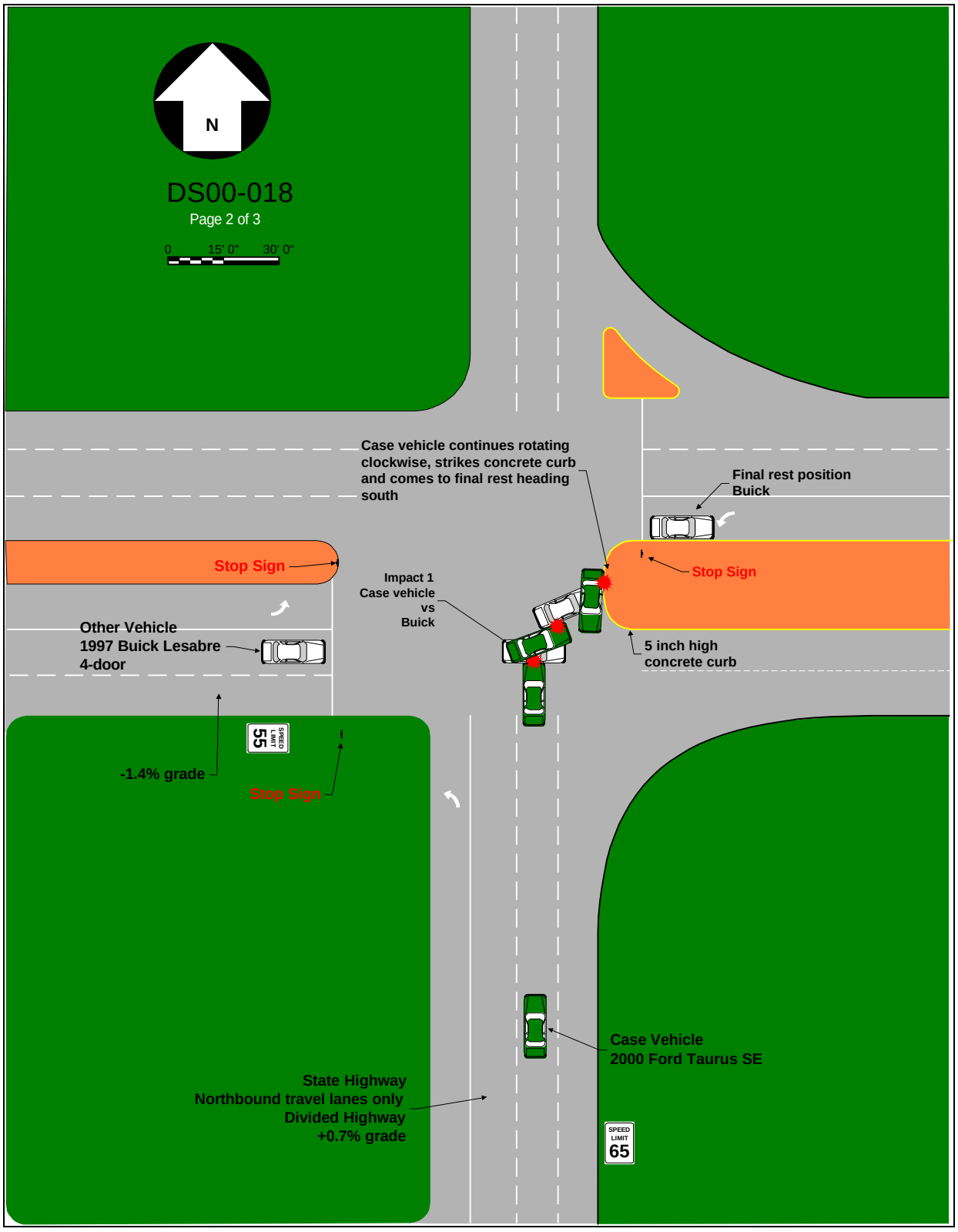


Figure 5. Impact 3.

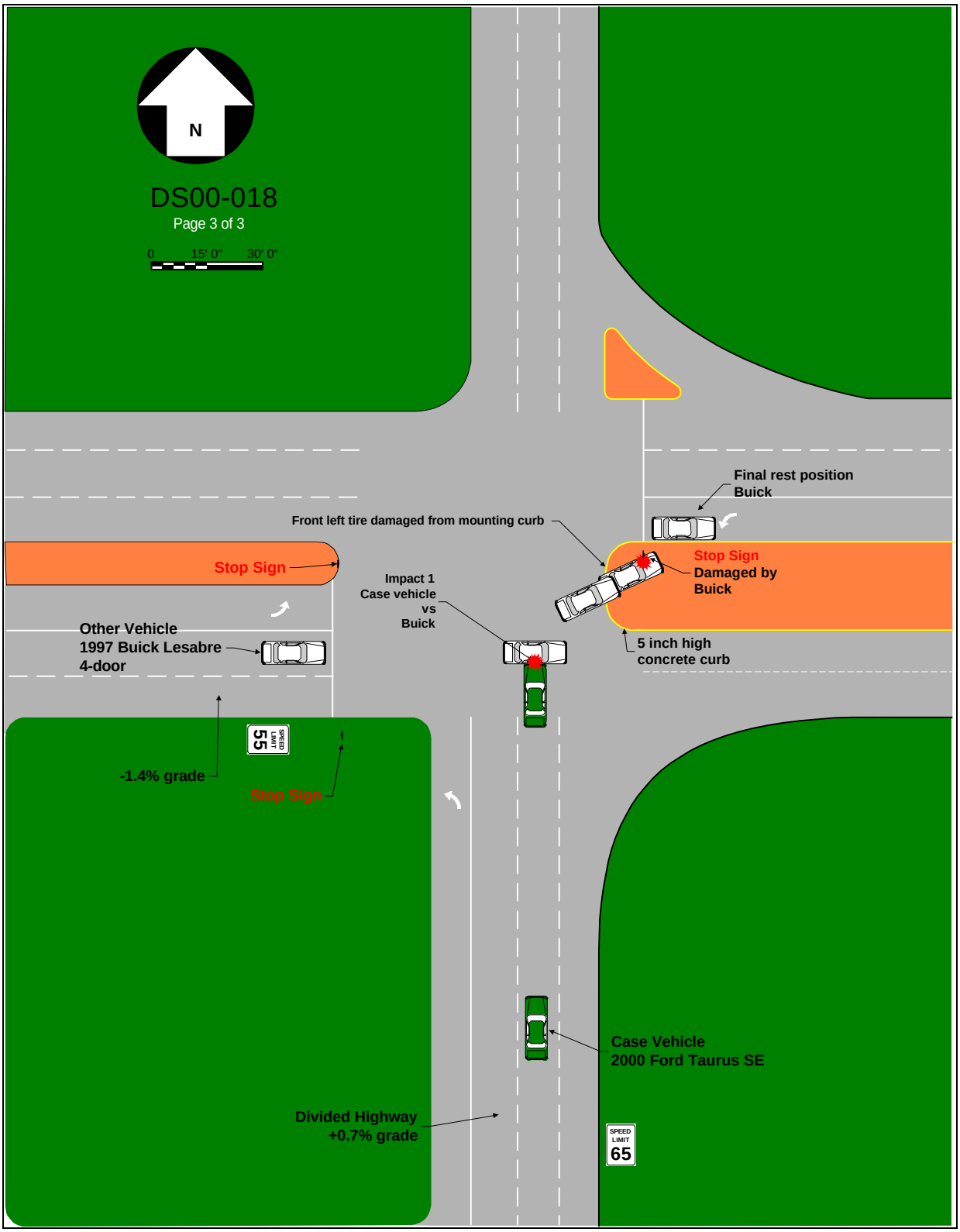


Figure 6. Impacts 4 and 5.

DETAILED INFORMATION

Vehicles

Case vehicle

Description:	2000 Ford Taurus SE 4-door Ford dealer loaner
VIN:	1FAFP55S3YGXXXXXX
Odometer:	1,849 km (1,149 miles)
Engine:	3.0 L V6
Reported Defects:	None
Cargo:	None
Damage Description:	Moderate frontal damage to the front bumper, hood, grille area and both front fenders from the 1st impact. The left driver's door sustained minor damage from the side slap, 2nd impact. The vehicle was towed from scene.

CDC	
(Impact 1 v. Right side Buick):	11FDEW1
(Impact 2 v. Side slap right side Buick):	09LYEW2
(Impact 3 v. concrete curb):	09LBWN1

Delta V (Impact 1 v. Right side Buick):	Total	25.0 km/h (15.5 mph)
	Longitudinal	-23.5 km/h (-14.6 mph)
	Latitudinal	8.6 km/h (5.3 mph)
	Energy	18,426 joules (13,590 ft-lbs)

Figure 7. Front damage to case vehicle.

AOPS Discussion

This vehicle was equipped with an advanced occupant protection system. The system consists of a Restraint Control Module (RCM) dual stage front air bags, seat belt pretensioners, seat track sensors, and seat belt latch usage detectors. The system is controlled by the RCM. The primary function of the RCM is to control the deployment of the occupant protection systems. The system records longitudinal and lateral acceleration. Data related to the driver and passenger air bag deployment include: 78 milliseconds of crash pulse, deployment strategy of the dual-stage air bag system, seat belt latch use, pretensioner operation, and driver seat track location.

At impact the case vehicle sustained a total delta v of 25.0 km/h (15.5 mph), a longitudinal delta v of -23.5 km/h (-14.6 mph), and a latitudinal delta v of 8.6 km/h (5.3 mph) as computed by WinSmash. The downloaded Electronic Data Recorder (EDR) data indicates a cumulative longitudinal delta v of -31.5 km/h (-19.6 mph) at the 78 ms mark. The EDR report is included as an attachment to this report.

The EDR report further indicates that:

1. This was a first stage deployment only.
2. The driver's seat was not in the forward position.
3. The driver's seat belt buckle was engaged, and the passenger's (front right) seat buckle was not engaged.
4. The time from algorithm wake-up to pretensioner was 14 milliseconds.
5. The time from algorithm wake-up to first stage - unbelted was 17 milliseconds.
6. The time from algorithm wake-up to first stage - belted was 21 milliseconds.
7. Time from side safing decision to left (driver) side airbag deployment was 21 milliseconds.

Figure 8. Case vehicle driver's air bag.

The case vehicle was equipped with a driver's and a front right passenger's airbags that are mounted in the steering wheel and the top of the right instrument panel respectively. The driver's airbag was circular and measured 42 cm (16.5 in.) in diameter. It was equipped with two tethers and two vent ports. The dual module covers opened in an "H" configuration. There were no occupant contacts noted to the airbag, only grease, module cover contacts and unknown yellow smudges. Neither the airbag nor the module covers were damaged. The front right occupant's frontal airbag was rectangular and measured 42 cm (16.5 in) by 57 cm (22.4 in). It was equipped with two vent ports and did not have any tethers. On the face of the airbag there were black transfer from the single flap module cover. There was also a 20 cm (7.9 in) long make up contact to the mid-left side of the air bag from interacting with

the unrestrained front right occupant. Neither the air bag nor the single flap module cover sustained any damage.

The case vehicle was also equipped with a driver's and front right seat-mounted side air bags. The EDR report indicates that the driver's side air bag deployed at the same time the driver's front airbag deployed–21 ms from time algorithm wakeup to first stage belted deployment attempt. The driver's side air bag appears to have a single tether and no vent ports. The bag is vaguely rectangular in shape and measures 72 cm (28.3 in) high by 35 cm (13.8 in) wide at its base. There was no indication of occupant contact nor any damage to the driver's seat mounted side airbag.

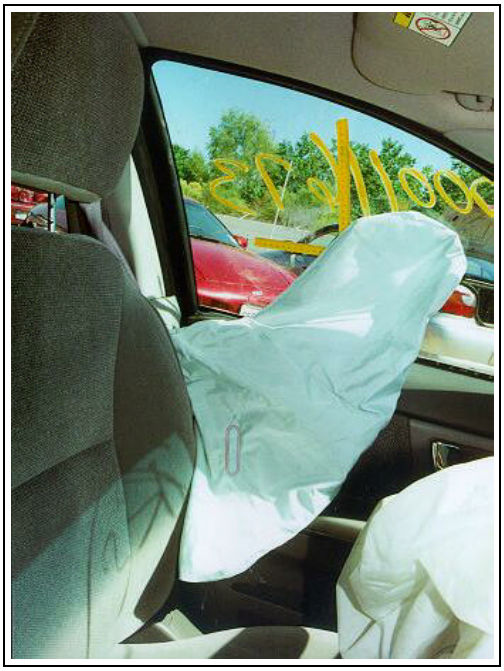


Figure 9. Case vehicle seat mounted side air bag.

Both front outboard seat positions of the case vehicle were equipped with seat belt pretensioners. The front right pretensioner barrel was checked and measured 6.7 cm (2.6 in.)–indicating that it had fired. The front left pretensioner barrel was checked and measured 11.1 cm (4.4 in)–indicating that it had not fired.

There was steering column stroke. The right and left sheer capsules were measured as 0 and 0.8 cm (0.3 in.) respectively. The steering column breakaway coupling was intact.

Other vehicle (Buick Le Sabre)

Description:	1997 Buick Le Sabre 4-door
VIN:	1G4HP52KXVHXXXXXX
Odometer:	90,705 km (56,363 miles)
Engine:	3.8 L 6 cylinders
Reported Defects:	None
Cargo:	None
Damage Description:	Severe right side damage from 1st impact. Front right door and B pillar intruded into front right passenger compartment area, and the roof buckled. Front right fender, hood and windshield damage. Moderate right side damage from 2nd impact. Moderate damage to front left door. Front left tire/rim damage.

CDC

(Impact 1 v. Buick):	02RYEW3
(Impact 2 v. side slap case vehicle):	03RZEW3
(Impact 4 v. concrete curb):	12FLWN3
(Impact 5 v. stop sign pole):	12LYEN2

Delta V (Impact 1 v. case vehicle):	Total	25.2 km/h (15.5 mph)
	Longitudinal	-12.5 km/h (-7.8 mph)
	Latitudinal	-21.7 km/h (-13.5 mph)
	Energy	71,769 joules (52,934 ft-lbs)

Figure 10. Exterior damage to Buick-1st impact.

Occupants

Case vehicle (Ford Taurus)	Occupant 1	Occupant 2
Age/Sex:	51/Male	38/Female
Seated Position:	Front left	Front right
Seat Type:	Fabric covered bucket. Seat track was adjusted to rear-most position. Seatback upright.	Fabric covered bucket. Seat track was adjusted to rear-most position. Seatback reclined to slight rearward position.
Height:	168 cm (66 in.)	157 cm (62 in.)
Weight:	84 kg (185 lbs)	73 kg (160 lbs)
Occupation:	Unknown	Unknown
Pre-existing Medical Condition:	None indicated	None indicated
Alcohol/Drug Involvement:	None	N/A
Driving Experience:	Presumed to be greater than 30 years	N/A
Body Posture:	Normal, upright	Normal, upright.
Hand Position:	Left hand at 10 o'clock position, right hand at 2 o'clock position	Unknown
Foot Position:	Right foot on brake pedal, left foot on floor	Unknown
Restraint Usage:	Lap and shoulder belt available, used	Lap and shoulder belt available, **not** used
Air bag:	Steering wheel mounted airbag, deployed. Seat back mounted side airbag deployed	Top instrument panel mounted, deployed

Case vehicle (cont...)	Occupant 3
Age/Sex:	4/Female
Seated Position:	2nd seat left
Seat Type:	Fabric covered split bench with folding back. Not adjustable seat track or seat back recline.
Height:	97 cm (38 in.)
Weight:	18 kg (39 lbs)
Occupation:	None
Pre-existing Medical Condition:	None indicated
Alcohol/Drug Involvement:	N/A
Driving Experience:	None
Body Posture:	Seated upright, normal position
Hand Position:	Unknown
Foot Position:	Unknown
Restraint Usage:	Lap and shoulder belt used incorrectly with shoulder portion of belt behind her back
Air bag:	None available

Other vehicle (Buick Riviera)

Age/Sex:	64/Female	91/Female
Seated Position:	Front left	Front right
Seat Type:	Cloth covered bucket seat adjusted to rear most seat track position. Seatback reclined to completely rearward position at time of inspection, but may have been moved there by EMS for treatment	Cloth covered split bench. Due to severe intrusion of front right door unable to determine seat track position. Seatback and seat cushion deformed by intrusion and pushed laterally to the left
Height:	Unknown	157 cm (62 in.)
Weight:	Unknown	70 kg (154 lbs)
Occupation:	Retired	Retired
Pre-existing Medical Condition:	Unknown	Unknown
Alcohol/Drug Involvement:	None	N/A
Driving Experience:	Assumed > 20 year	N/A
Body Posture:	Presumed normal, upright	Presumed normal, upright
Hand Position:	Unknown	Unknown
Foot Position:	Assumed right foot on gas pedal and left on floor	Assumed on floor
Restraint Usage:	Lap and shoulder belt used	Lap and shoulder belt used
Air bag:	Steering wheel mounted airbag available **did not deploy**	Mid-instrument panel mounted front right passenger airbag available **did not** deploy

Injuries and Injury Mechanisms

Case vehicle (Ford Taurus)

	INJURY	OIC CODE	ICD-9	SOURCE
Driver:	Left shoulder contusion	790402.1, 2	923.00	Seat belt
	Right hip contusion	890402.1, 1	924.01	Seat belt
Front right:	Contusion to forehead	290402.1, 7	920	Rear view mirror
	Large contusions to both knees	890402.1, 1 890402.1, 2	924.11 924.11	Right instrument panel
2nd seat left:	Not injured. Checked out at hospital ER			

Other vehicle (Buick Riviera)

	INJURY	OIC CODE	ICD-9	SOURCE
Driver:	Injured, details unknown			
Front right:	3.2 cm (1.25 in.) curvilinear laceration at apex of arch of aorta with hemothoraces	420210.5, 4	901.1	Front right door
	Fractures anterior right ribs 2-9 and lateral left ribs 3-8	450240.4, 3	807.08	Front right door and possibly the driver
	Fractures medial anterior and posterior rami of right pelvis and anterior and posterior rami of left pelvis with extensive extravasation of blood into pelvic cavity	852602.2, 1 852602.2, 2	808.2 808.2	Front right door

3.2 cm (1.25 in.) curvilinear laceration anterior pericardial sac	441602.2, 4	868.04	Front right door
1.9 cm (0.75 in.) curvilinear laceration anterior wall of urinary bladder	540620.2, 8	861.00	Front right door
Fracture of greater horn of left thyroid cartilage	340299.2, 5	807.5	Possibly driver
6.4 by 2.0 by 0.6cm (2.5 by 0.75 by .25 in.) heart hematoma	441002.1, 4	861.01	Front right door
Superficial laceration of right parietal head region	190602.1, 1	873.0	Front right door
8.3 by 4.5 cm (3.25 by 1.75 in.) periorbital contusion around left eye extending to left bridge of nose and lower left frontal region of head	297402.1, 2	921.2	Possibly driver
Vertical, 1.9 cm (0.75 in.) laceration and 3.8 by 2.5 cm (1.5 by 1 in.), contusion on upper pinna of right ear	290602.1, 1 290402.1, 1	872.0 920	Front right door
Contusion on lower left cheek	290402.1, 2	920	Possibly driver
Contusion, 2.5 by 1.9 cm (1.0 by 0.75 in.), on right buccal (cheek)	290402.1, 1	920	Front right door
Superficial contusion on anterior upper right neck	390402.1, 1	920	Front right door
Superficial contusion of upper left abdomen	590402.1, 2	922.2	Seat belt
Contusion, 15.2 by 14 cm (6.0 by 5.5 in.), on upper lateral and posterior right shoulder	790402.1, 1	923.00	Front right door
Ecchymosis, 3.8 by 2.9 cm (1.5 by 1.125 in.), on distal lateral upper right arm	790402.1, 1	923.03	Front right door

Several ecchymoses around right elbow	790402.1, 1	923.11	Front right door
Contusion, 7.6 by 5.4 cm (3.0 by 2.125 in.), on distal anterior right forearm and anterior right wrist	790402.1, 1	923.10 923.21	Front right door
Contusion, 12.7 by 14 cm (5.0 by 5.5 in.), on distal posterior medial upper right leg	890402.1, 1	924.10	Front right door
Multiple contusions, 1.3 by 3.8 cm (0.5 by 1.5 in.), scattered around right knee	890402.1, 1	924.11	Instrument panel
Several contusions, 1.3 cm by 3.8 cm (0.5 by 1.5 in.), on proximal anterolateral upper right leg	890402.1, 1	924.10	Front right door
Contusion, 5.1 by 1.9 cm (2.0 by 0.75 in.), on midshaft of anterolateral upper right leg	890402.1, 1	924.10	Front right door
Contusion, 6.4 by 3.8 cm (2.5 by 1.5 in.), on proximal anteromedial lower right leg	890402.1, 1	924.10	Front right door
Contusion, 15.2 by 14 cm (6.0 by 5.5 in.), on anterior and medial proximal lower right leg	890402.1, 1	924.10	Front right door
Contusion, 9 by 6.4 cm (3.5 by 2.5 in.), on midshaft of posterior medial lower right leg	890402.1, 1	924.10	Front right door
Contusion, 5.1 by 3.8 cm (2.0 by 1.5 in.), on medial right ankle	890402.1, 1	924.21	Front right door
Contusion, 5.1 by 3.2 cm (2.0 by 1.125 in.), on distal dorsal lateral right foot	890402.1, 1	924.20	Sill

Contusion, 25.4 by 14.0 cm (10.0 by 5.5 in.), on distal anterior upper left arm and proximal posterior medial and anterior left forearm	790402.1, 1	923.03 923.10	Possibly driver
Contusion, 8.9 by 6.4 cm (3.5 by 2.5 in.), covering distal posterior lateral left forearm, lateral left wrist, and proximal posterior lateral left hand	790402.1, 1	923.10 923.21 923.20	Instrument panel
Scattered contusions on back of left hand and proximal left fingers	79042.1, 2	923.20 923.3	Instrument panel
Contusion, 11.4 by 8.9 cm (4.5 by 3.5 in.), on lateral upper left hip	890402.1, 2	924.01	Seat belt/buckle
Contusion, 3.8 by 3.8 cm (1.5 by 1.5 in.), on lower left knee	890402.1, 2	924.11	Instrument panel
Contusion, 45.7 by 20.3 cm (18.0 by 8.0 in.), on distal medial upper left leg and posterior lower left leg	890402.1, 2	924.10	Instrument panel
Contusion, 3.2 by 2.5 cm (1.25 by 1 in.), on proximal anterior lateral lower left leg	890402.1, 2	924.10	Instrument panel
Laceration, 12.7 cm (5.0 in.), on distal posterior and medial lower left leg with subcutaneous soft tissue and fat exposed	890602.1, 2	891.0	Instrument panel
Contusion, 5.1 by 1.9 cm (2.0 by 0.75 in.), on distal anterior lower left leg at juncture with left foot	890402.1, 2	924.10	Toe pan
Contusion, 3.8 by 3.2 cm (1.5 by 1.25 in.), on medial left ankle	890402.1, 2	924.21	Toe pan

Contusion, 6.4 by 3.8 cm (2.5 by 1.5 in.), on proximal dorsal lateral left foot	890402.1, 2	924.20	Toe pan
Contusion on proximal medial left great toe	890402.1, 2	924.3	Toe pan

Occupant Kinematics

The driver of the case vehicle was seated in a normal, upright fashion. He was wearing the available lap and shoulder belt. The upper anchorage adjustment was in the full up position. The fabric-covered bucket seat was adjusted to between middle and rear most track position. The seat back angle was upright. He was wearing glasses. His right foot was on the accelerator and his left foot on the floor. Both of his hands were on the steering wheel at the 10 and 3 o'clock positions. The driver saw the Buick drive across his path and braked the case vehicle. The case vehicle was unable to stop and broadsided the right side of the Buick. The driver of the case vehicle responded to the 340 degree direction of principal force by moving forward and laterally to the left. The driver's seat belt pretensioner fired and the driver sustained injuries consisting of contusions to his left shoulder and right hip as a result of loading the lap and shoulder belt. He contacted the airbag even thought there were no obvious occupant contacts on the airbag. There was evidence of loading on the steering column; there was 0.8 cm (0.3 in) displacement of the left shear capsules. He reported seeing a lot of smoke in the vehicle and thinking that the car was on fire. His glasses were not knocked off. There was no evidence of contact with the driver's seat mounted side airbag. When the case vehicle side slapped the right side of the Buick with its left side, the driver responded by moving laterally to the left. As the case vehicle continued rotating clockwise to final rest, the driver moved laterally to the right and rearward and was held in the seat by the lap and shoulder belt. He was transported to a hospital after being treated at the scene by the local fire department personnel. Hew was treated and released from the hospital. He missed three weeks of work as a result of his injuries and received treatment for one month from a chiropractor.

Figure 11. Case vehicle front right passenger's air bag.

The front right occupant of the case vehicle was seated in a normal, upright fashion. She was not wearing the available lap and shoulder belt. The fabric-covered bucket seat was adjusted to the rear most track position. The seat back angle was reclined slightly rearward. There was pre-impact braking and as a result of being unrestrained, the front right occupant was out of position. As the case vehicle broadsided the Buick, the front right passenger responded to the 340 degree direction of principal force by moving forward and laterally to the left. There was evidence of contact to the mid-left face of the airbag in the form of makeup/lipstick transfer. She also struck the instrument panel with both of her knees sustaining large contusions. When the case vehicle side slapped the right side of the Buick with its left side, the front right occupant responded by moving laterally to the left and struck the rear view mirror and sun visor with her forehead sustaining a contusion to her forehead. She also struck the center instrument panel with her left knee and bent/cracked the center console with her left lower body. As the case vehicle continued rotating clockwise to final rest, the front right occupant moved laterally to the right and rearward into the front right seat. After being treated at the scene, the front right occupant was transported by ground ambulance to a hospital were she was treated and released. She received approximately two months of treatment from a chiropractor.

The 4-year-old 2nd left seat occupant was sitting upright in a normal position in the cloth covered bench seat. She

was improperly restrained by the lap and shoulder belt. The driver indicated that the 4-year-old would place the shoulder portion of the safety belt behind her so that the belt would not be positioned in front of her face. The driver was asked why the 4-year-old was not in a child safety seat and he indicated that it was his understanding that Texas law did not require children in child safety seats over a certain weight. The vehicle inspection did not reveal any evidence of seat belt usage in the 2nd left seat position. As the case vehicle broadsided the Buick, the 4-year-old responded to the 340 degree direction of principal force by moving forward and laterally to the left and loaded the lap belt. She did not suffer any ill effects of improperly wearing the shoulder portion of the safety belt behind her. She was transported to a hospital with the driver and front right occupant. She was checked out and released with no injuries.

Attachment 1. EDR Report (Ford Taurus)

2000 Taurus/Sable EDR Report - Summary Page

Investigation Data

File Name:	DS00-018.hex	**File Save Date:**	03-Oct-2000
File Read-out Date:	N/A	**Report Date:**	20-Oct-2000
Report Version:	1.4		

EDR Control Module Data

Data Validity Check:	Valid	**EDR Model Version:**	141
Time From Side Safing Decision to Left (Driver) Side Bag Deployment:			21
Time From Side Safing Decision to Right (Passenger) Side Bag Deployment:			Not Deployed
Passenger Airbag Switch Position During Event:			N/A
Diagnostic Codes Active When Event Occurred:			0

Algorithm Times Actual initiation depends on restraint system status (below).	**ms**
Time From Algorithm Wakeup to Pretensioner:	14
Time From Algorithm Wakeup to First Stage - Unbelted:	17
Time From Algorithm Wakeup to First Stage - Belted:	21
Time From Algorithm Wakeup to Second Stage:	0

Restraint System Status

Driver Seat Belt Buckle:	Engaged
Passenger Seat Belt Buckle:	Not Engaged
Driver Seat Track In Forward Position:	No
Passenger Seat Weight Switch Position:	N/A

Deployment Initiation Attempt Times	**Driver**	**Passenger**
Time From Algorithm Wakeup to Pretensioner Deployment Attempt:	14	Unbelted
Time From Algorithm Wakeup to First Stage Deployment Attempt:	21	21
Time From Algorithm Wakeup to Second Stage Deployment Attempt:	Disposal	Disposal

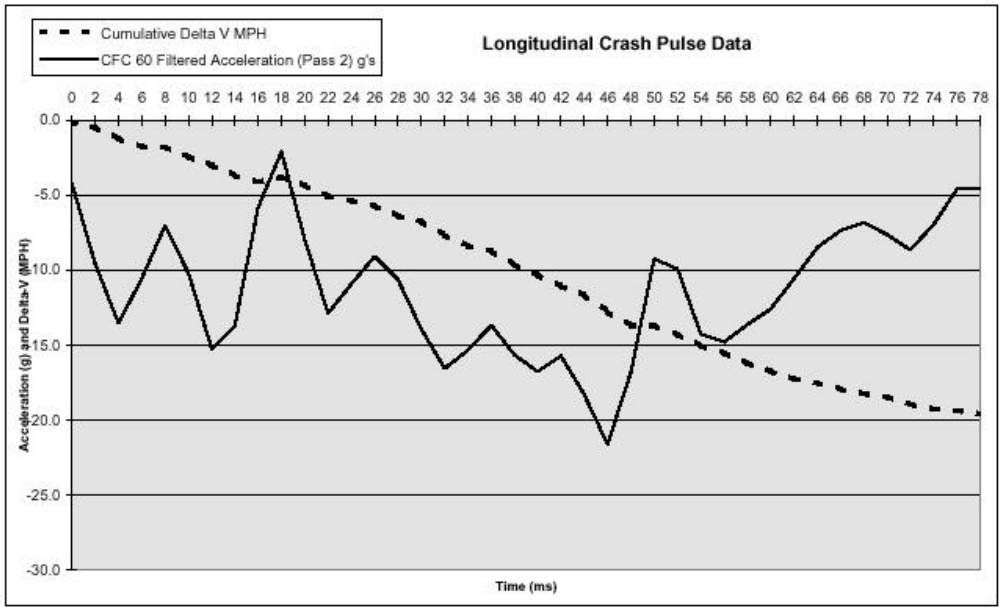
Notes

1. Read-out date is set by the PC interface tool.
2. Features and data parameters which are not available on the module are marked "N/A".
3. CFC 60 is a Butterworth 4-pole phaseless digital filter. (See SAE J211 Part 1 Appendix C dated March 1995.)
4. Total and maximum Delta-V results are not available from truncated/incomplete crash pulses.
5. Algorithm wakeup (0 ms) is not the first moment of vehicle contact or impact.
6. The Excel "Analysis ToolPak" Add-in must be enabled for this spreadsheet to operate properly.

2000 Taurus/Sable EDR Report - Charts

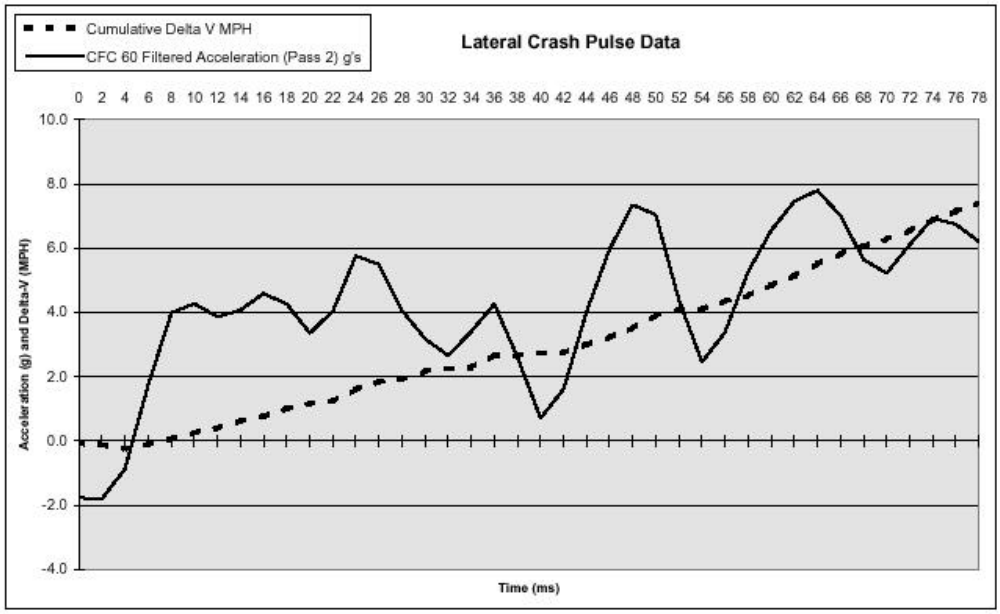
Longitudinal Cumulative Delta-V

Time (ms)	0	10	20	30	40	50	60	70	78
Delta-V (MPH)	-0.2	-2.4	-4.3	-6.7	-10.3	-13.7	-16.7	-18.5	-19.6



Lateral Cumulative Delta-V

Time (ms)	0	10	20	30	40	50	60	70	78
Delta-V (MPH)	-0.1	0.3	1.2	2.2	2.7	3.9	4.9	6.3	7.4



File Name: DS00-018.hex

2000 Taurus/Sable EDR Report - Memory Dump

Hexidecimal Module Memory Dump

Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
0800	0F	4A	40	76	14	FB	FF	FF	FF	FF	0E	24	0F	2D	3A	4C
0810	C8	FF	00	FF	52	60	52	60	60	52	E3	20	3C	78	D6	A0
0820	08	03	28	37	5F	0F	0F	0A	F5	0A	B7	84	A1	5E	D5	AA
0830	03	0C	1B	1E	00	FF	3C	3C	80	06	28	64	64	00	0C	01
0840	5A	96	50	FF	FF	FF	EF	DF	D5	E7	FF	72	4E	13	25	B1
0850	EC	14	09	0F	01	FF	FF	88	FF	FF	CD	44	00	FF	FF	0D
0860	0C	22	05	37	E5	7B	22	0C	22	05	37	E5	94	21	FF	FF
0870	05	3A	29	9B	6C	00	8F	FF	59	46	31	41	02	04	FF	16
0880	02	F8	80	06	FF	79	12	F8	80	25	F8	80	2B	F8	80	FF
0890	35	F8	80	38	FF	80	FF	FF	00	FF	FF	00	FF	FF	00	FF
08A0	44	00	04	00	20	08	20	01	00	00	FF	FF	FF	FF	FF	FF
08B0	02	FF	81	38	00	8D	01	FF	FF	FF	FF	FF	33	01	D4	78
08C0	FF	34	01	D4	79	51	01	D4	79	51	02	88	52	72	FF	FE
08D0	01	0E	0C	80	02	58	16	87	1F	BE	01	0A	00	8C	01	04
08E0	00	F0	01	36	00	A0	01	54	00	3F	02	30	02	C7	02	8A
08F0	05	14	07	08	01	2C	03	CA	04	CE	06	40	73	33	00	A0
0900	3F	FF	00	03	00	4B	01	CC	00	03	0F	FF	00	14	00	78
0910	00	A0	00	6E	0A	16	FF	01	00	00	00	7F	0F	0C	0F	02
0920	03	5A	32	46	05	50	02	02	FA	1E	08	0C	0A	1C	02	23
0930	09	06	28	32	16	20	16	1F	5F	FF	FF	02	FF	FF	FF	11
0940	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0950	11	00	15	00	0E	00	00	06	00	00	0C	0A	0D	0F	10	30
0960	08	09	0C	0E	0E	11	03	10	00	00	00	15	15	20	0E	11
0970	00	00	BA	90	A1	81	B0	A5	8B	91	93	B6	9F	78	5F	AF
0980	B2	56	B7	BD	62	A9	A8	CC	AE	D0	CA	B3	93	9A	9E	A8
0990	AA	B1	AF	B0	B3	AF	B0	AD	AF	AC	A8	A8	AA	AC	AD	9A
09A0	93	7E	89	A0	83	87	83	8D	B0	87	81	93	90	83	92	76
09B0	80	92	78	81	80	86	6E	76	A1	86	7F	8A	83	89	89	95
09C0	8E	94	96	8B	92	9D	97	7D	80	7B	87	89	8A	87	8B	88
09D0	8C	88	84	92	8C	84	8D	85	82	93	80	85	81	8D	8B	8E
09E0	93	89	82	8C	89	90	8E	92	8F	8C	8B	8D	90	8E	8D	00
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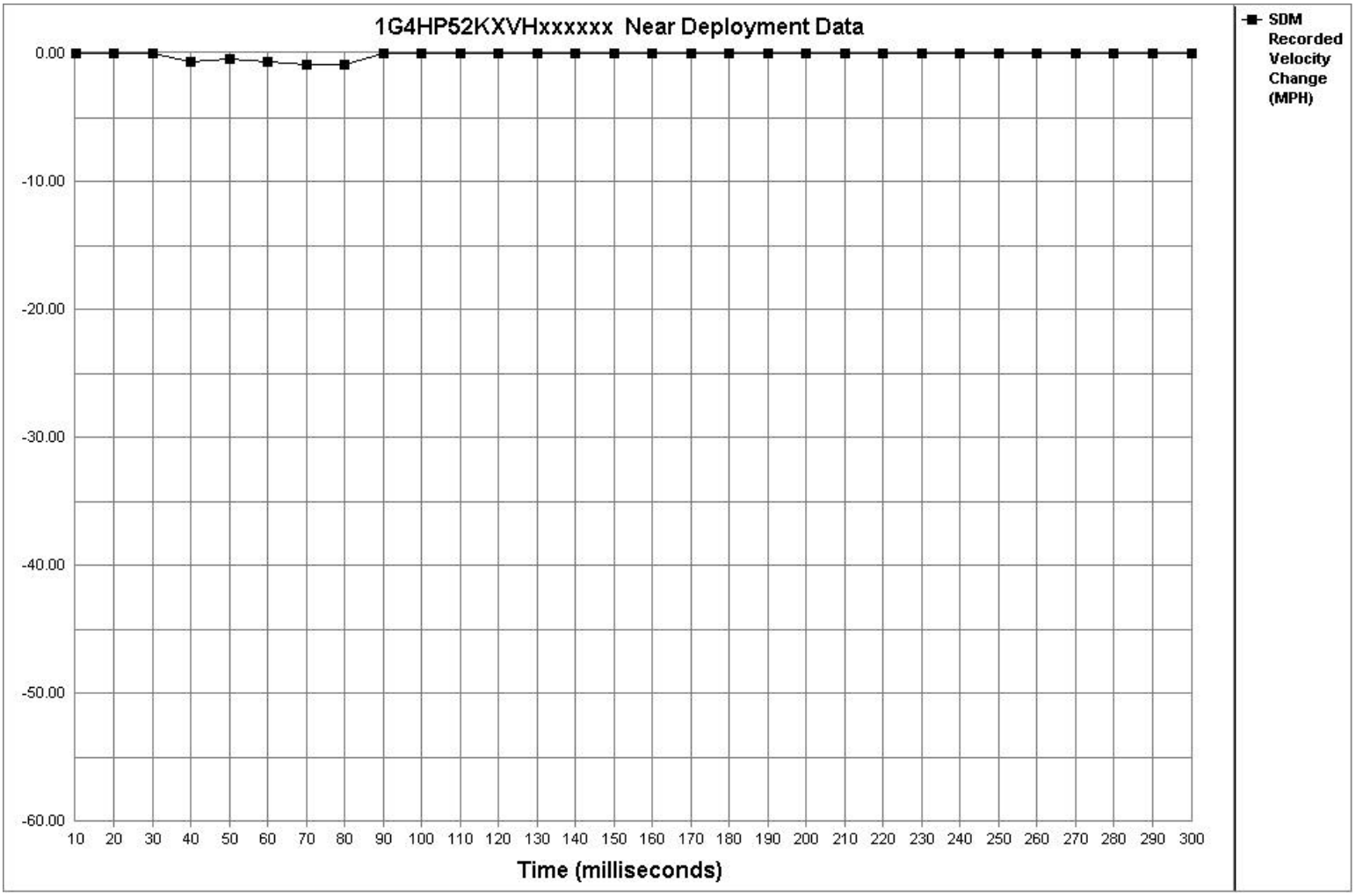
File name: DS00-018.hex

Attachment 2. SDM Report (Buick)



1G4HP52KXVHxxxxxx System Status At Near Deployment	
SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Passenger Front Air Bag Suppression Switch Circuit Status	Air Bag Not Suppressed
Ignition Cycles At Near Deployment	7301
Ignition Cycles At Investigation	7318
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	62.5
Maximum SDM Recorded Velocity Change (MPH)	-0.88
A Deployment was Commanded Prior to this Event	No

Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	0.00	0.00	0.00	-0.66	-0.44	-0.66	-0.88	-0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SDM Recorded Crash Events:
There are two types of SDM recorded crash events. The first is the Near Deployment Event. A Near Deployment Event is an event severe enough to "wake up" the sensing algorithm but not severe enough to deploy the air bag(s). The SDM can store up to one Near Deployment Event. This event can be overwritten by an event that has a greater SDM recorded forward velocity change. This event will be cleared by the SDM after the ignition has been cycled 250 times.
The second type of SDM recorded crash event is the Deployment Event. The SDM can store up to two different Deployment Events, if they occur within five seconds of one another. The first deployment event will be stored in the Deployment file (this would have been the event that deployed the air bag) and the second Deployment Event will be stored in the Near Deployment file. Deployment events can not be overwritten or cleared from the SDM. Once the SDM has deployed the air bag, the SDM must be replaced.
The data in the near deployment file will be locked after a deployment, if the near deployment occurred within 5 seconds before the deployment or a deployment level event occurs within 5 seconds after the deployment.

SDM Data Limitations:
-SDM Recorded Vehicle Forward Velocity Change is one of the measures used to make air bag deployment decisions. SDM Recorded Vehicle Forward Velocity Change reflects the change in forward velocity that the sensing system experienced during the recorded portion of the event. This data should be examined in conjunction with other available physical evidence from the vehicle and scene when assessing occupant or vehicle forward velocity change. The SDM records the first 300 milliseconds of Vehicle Forward Velocity Change after Algorithm Enable. The maximum value that can be recorded for Vehicle Forward Velocity Change is 56 MPH.
-Driver's Belt Switch Circuit Status indicates the status of the driver's seat belt switch circuit.
-The Time between Near Deployment and Deployment Events is displayed in seconds. If the time between the two events is greater than five seconds, "N/A" is displayed in place of the time.
-If power to the SDM is lost during a crash event, all or part of the crash record may not be recorded. . An indication of a loss of power would be if the ignition cycles at Deployment or Near Deployment is recorded as zero. Data recorded after that may not be reliable, such as Time Between Near Deployment and Deployment Events, Driver Belt Switch Circuit Status, and Passenger Sir Suppression Switch Circuit Status.

SDM Data Source:
All SDM recorded data is measured, calculated, and stored internally, except for the following:
-The Driver's Belt Switch Circuit is wired directly to the SDM.
-The Passenger Front Air Bag Suppression Switch Circuit is wired directly to the SDM.