CRASH DATA RESEARCH CENTER
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Buffalo, NY 14225

CALSPAN ON-SITE HEAVY TRUCK REAR IMPACT GUARD CRASH INVESTIGATION
SCI CASE NO.: CA09060

VEHICLE: FREIGHTLINER TRACTOR W/ 2005 STOUGHTON TRAILER
LOCATION: NORTH CAROLINA

CRASH DATE: SEPTEMBER, 2009

Contract No. DTNH22-07-C-00043

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
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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 are 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

This on-site investigation focused on the rear impact guard that was installed on a 2005 Stoughton 16.1 m (53 ft) van-body trailer. The back of the trailer was struck by a 2009 Ford F-150 pickup truck that was traveling above the 105 km/h (65 mph) interstate speed limit. The pickup truck impacted and deformed the rear impact guard and underrode the trailer resulting in frontal crush that extended to the A-pillars of the Ford. The driver and front right passenger of the Ford were removed from the vehicle after a prolonged extrication due to the extent of the intrusion. The driver was transported by helicopter to a regional hospital where he was admitted in critical condition. The front right passenger was transported to a local hospital where she was pronounced deceased.

The crash was identified through an on-line news article by the National Highway Traffic Safety Administration (NHTSA) and was forwarded to the Calspan Special Crash Investigations (SCI) team for follow-up on Wednesday, September 16, 2009. Cooperation was established with the investigating police officer on the evening of the notification and the on-site investigation was conducted on September 17-18, 2009. The on-site investigation involved the inspection and documentation of the involved vehicles with specific focus on the underride guard of the trailer and the frontal crush to the Ford F-150. The crash site was documented and the Ford's Event Data Recorder (EDR) was imaged during the investigation.

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BACKGROUND

This on-site investigation focused on the rear impact guard that was installed on a 2005 Stoughton 16.1 m (53 ft) van-body trailer. The back of the trailer was struck by a 2009 Ford F-150 pickup truck that was traveling above the 105 km/h (65 mph) interstate speed limit. The pickup truck impacted and deformed the rear impact guard and underrode the trailer resulting in frontal crush that extended to the A-pillars of the Ford (**Figure 1**). The driver and front right passenger of the Ford were removed from the vehicle after a prolonged extrication due to the extent of the intrusion. The driver was transported by helicopter to a regional hospital where he was admitted in critical condition. The front right passenger was transported to a local hospital where she was pronounced deceased.

Figure 1: Left side view of the Ford at rest under the back of the struck trailer (Image courtesy of Internet news article).

The crash was identified through an on-line news article by the National Highway Traffic Safety Administration (NHTSA) and was forwarded to the Calspan Special Crash Investigations (SCI) team for follow-up on Wednesday, September 16, 2009. Cooperation was established with the investigating police officer on the evening of the notification and the on-site investigation was conducted on September 17-18, 2009. The on-site investigation involved the inspection and documentation of the involved vehicles with specific focus on the underride guard of the trailer and the frontal crush to the Ford F-150. The crash site was documented and the Ford's Event Data Recorder (EDR) was imaged during the investigation.

SUMMARY

VEHICLE DATA

Freightliner Tractor/Stoughton Trailer

The struck vehicle in this investigation was a 2005 Stoughton, dual-axle, van-body trailer pulled by a 2001 Freightliner tractor. The trailer was manufactured in March 2004 and was identified by the Vehicle Identification Number (VIN): 1DW1A53285S (production sequence deleted); Model Number: AVM-535T-S-C-AR. At the time of the crash, the tractor trailer was hauling paper products from South Carolina to Pennsylvania and was operating at a driver reported speed of 64 km/h (40 mph) due to an unknown air pressure problem. The gross weight of the tractor trailer combination was approximately 33,113 kg (73,000 lb).

The Stoughton trailer (**Figure 2**) was 16.1 m (53 ft) in length, 259 cm (102 in) in overall width and 4.1 m (13.5 ft) in overall height. The rear overhang measured 333 cm (131 in). The height of the trailer floor measured 114 cm (45 in) above the ground. The van trailer was manufactured with ladder-type steel frame floor construction. The floor framing was overlaid with oak floor boards. The sides, top and front planes of the trailer were aluminum panels. The trailer was configured with dual-axles, an air ride suspension and an adjustable slider frame. The width between the longitudinal slider frame rails measured 122 cm (48 in).

The rear impact guard was a three-piece bolt-on assembly that attached to the reinforced attachment junction of the slider frame and the back plane of the trailer (**Figure 3**). The rear impact guard was constructed from two vertical I-beam supports attached to a horizontal box-beam bumper. The vertical supports of the guard were constructed of 23 x 13 cm (9 x 5 in) tapered I-beam section that measured 41 cm (16 in) in length. The vertical supports were located on 122 cm (48 in) centers. The 10 x 10 cm (4 x 4 in) steel box-beam bumper measured 239 cm (94 in) in total width and was attached to the lower ends of the tapered I-beams. The guard was attached to the trailer frame by four 16 mm (5/8 in) Grade 5 bolts. Two bolts were oriented vertically through the rear frame and two bolts were oriented horizontally through the back plane.

The bumper separated from the vertical supports due to the force of the crash. It was located with the Ford F-150 and inspected at that location. Refer to the *Exterior Damage* section of this report for further information regarding the post-crash condition of the rear impact guard. The pre-impact height of the bumper was reconstructed from the measurements taken during the vehicle inspections. The bumper height was 53 cm (21 in). This height is referenced to the bumper's top surface. **Figure 4** is an end-view of the trailer depicting the pre-crash arrangement of the rear impact guard.

Figure 2: Left view of the aft portion of the Stoughton trailer.

Figure 3: Left view of the trailer depicting the slider frame and the attachment of the rear impact guard.

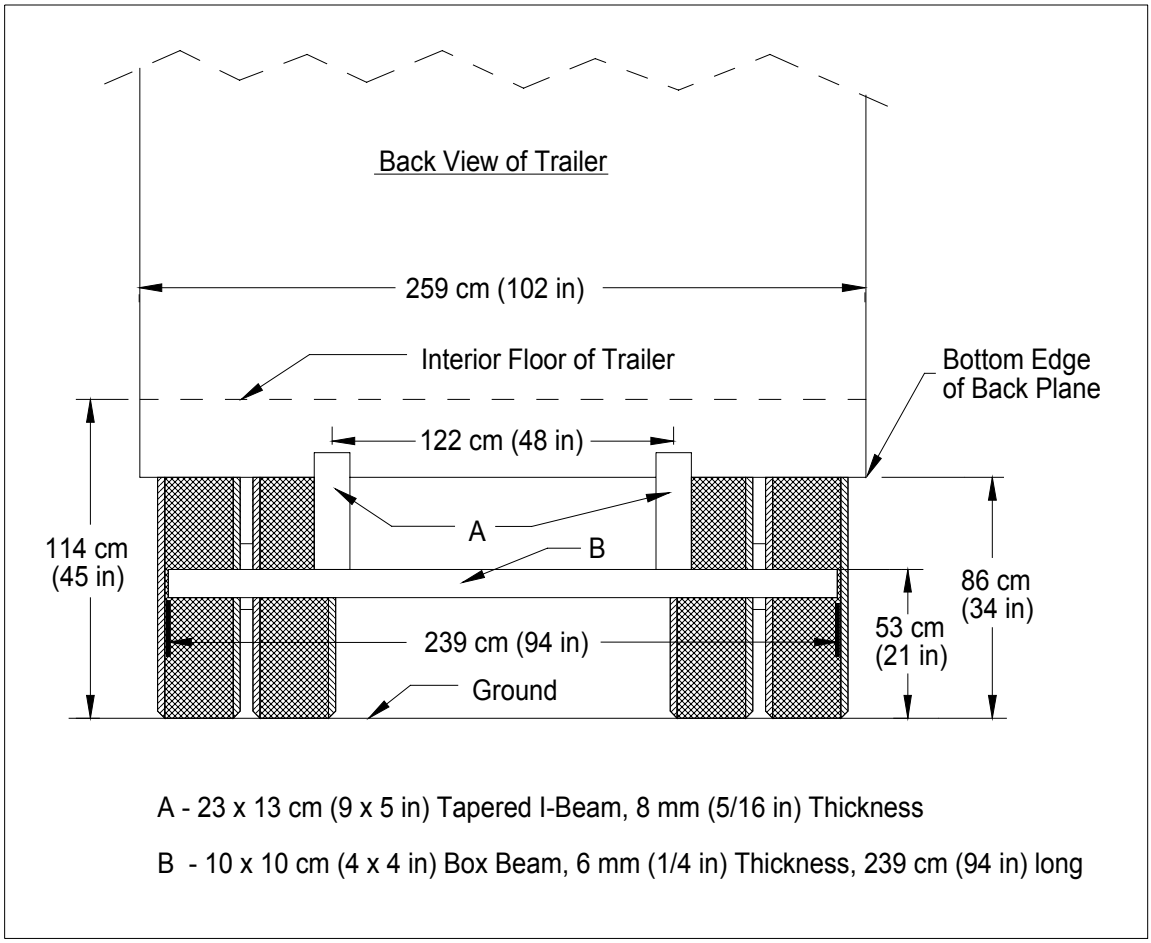


Figure 4: Schematic of the pre-crash arrangement of the rear impact guard.

2009 Ford F-150 Pickup Truck

The 2009 Ford F-150 pickup truck was manufactured in March 2009 and identified by the Vehicle Identification Number (VIN): 1FTPW14V39F (production sequence deleted). The 4x4, super crew cab pickup was configured with a 367 cm (144.5 in) wheelbase and had a Gross Vehicle Weight Rating (GVWR) of 3265 kg (7200 lb). The power train consisted of a 5.4-liter, V8 engine linked to a 5-speed automatic transmission. The service brakes consisted of a front disc/rear drum system with anti-lock (ABS). The manual restraint system consisted of 3-point lap and shoulder safety belts in the five seat positions. The front safety belts were equipped with retractor pretensioners. The frontal air bags consisted of Certified Advanced 208-Compliant (CAC) air bags for the driver and front right passenger. The vehicle was equipped with front seat-mounted side impact air bags and roll-sensing Inflatable Curtain (IC) air bags. The Ford was equipped with General Ameritrac P255/70R17 tires. The vehicle manufacturer's cold tire pressure was 240 kPa (35 PSI) for the front and rear tires. The specific tire data measured at the time of the SCI vehicle inspection was as follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	Tire Flat	9 mm (11/32 in)	No	Debeaded
LR	Tire Flat	7 mm (7/32 in)	No	None
RF	Tire Flat	9 mm (11/32 in)	No	Sidewall cut
RR	262 kPa (38 PSI)	7 mm (7/32 in)	No	None

CRASH SITE

This two-vehicle crash occurred during the daylight hours of September 2009. At the time of the crash, the weather was not a factor. The crash occurred in the outboard westbound lane of a two-lane, divided east/west interstate highway in a rural setting. The road way was straight with a negative two percent grade (-2%) in the area of the crash. The traffic lanes measured 3.7 m (12.1 ft) in width and were separated by broken center lines. The outboard edges of the travel lanes were delineated by solid fog lines. The north shoulder consisted of a 3.5 m (11.5 ft) wide breakdown lane. The speed limit was 105 km/h (65 mph). The impact was evidenced by a series of gouge marks on the inboard westbound lane. The gouge marks measured 3.6 m (11.8 ft) in length. The post-crash trajectory of the vehicles was evidenced by a fluid trail from the point of impact leading to the final rest position of the vehicles on the north breakdown lane. **Figure 5** is a trajectory view of the vehicles at the point of impact.

Figure 5: Westbound trajectory view and point of impact at the crash site.

CRASH SEQUENCE

Pre-Crash

The tractor trailer was westbound driven by a 57-year-old male. A 49-year-old female was a passenger in the sleeper berth of the tractor. The tractor trailer was operating at a reduced speed due to a driver reported air pressure problem. The driver reported to the investigating officer that his speed was approximately 64 km/h (40 mph). The vehicle was in the outboard lane of the interstate and the vehicle's emergency flashers were "On". The 2009 Ford F-150 was westbound driven by a 39-year-old unrestrained male and occupied by a 24-year-old unrestrained female front right passenger. Witnesses to the crash reported that the speed of the Ford was above the posted 105 km/h (65 mph) speed limit. The EDR data imaged at the time of the vehicle inspection indicated the speed of the Ford was 133 km/h (82.7 mph) one second prior to the impact. The EDR data also indicated that the driver steered left and applied the brakes during the last second prior to the impact in an attempt to avoid the crash. A schematic of the crash is included at the end of this report as **Figure 19**.

Crash

The front plane of the Ford stuck the rear impact guard mounted to the back plane of the Stoughton trailer. The impact was biased to the left aspect of the trailer's back plane. The centerline of the Ford was offset approximately 36 cm (14 in) to the left of the trailer's centerline. The force of the impact completely deformed the left vertical support of the guard and separated the horizontal bumper beam from the vertical supports. The engine compartment of the Ford completely underrode the back plane of the trailer and the Ford became wedged under the rear overhang. The direct contact between the vehicles extended to the A-pillars of the Ford. The CAC frontal air bags of the Ford deployed as a result of the impact. **Figures 6 and 7** are on-scene police images of the vehicles at final rest.

Figure 6: Left view of the Ford at final rest. Image supplied by the police investigator.

Figure 7: Right rear oblique view of the Ford at final rest. Image supplied by the police investigator.

The severity of the impact (delta-V) was calculated utilizing the Barrier Algorithm of the WinSMASH program and are for anecdotal purposes only. A crash analysis of a truck tractor was beyond the scope of the WinSMASH program. The total delta-V of the Ford was 70 km/h (43.5 mph). The longitudinal and lateral delta-V components were -70 km/h (-43.5 mph) and 0, respectively. The maximum longitudinal delta-V recorded by the Ford's EDR was -75.59 km/h (-46.98 mph) and was reached 234 milliseconds after crash detection.

Post-Crash

The vehicles came to a controlled stop on the north roadside 128.8 m (422.6 ft) west of the area of the impact. The driver and passenger of the Freightliner were not injured. The police, fire, and ambulance personnel from multiple departments were summoned to the scene. The occupants of the Ford required extrication due to the extent of the intrusion. The driver was removed from the vehicle 54 minutes after the reported dispatch time. He was air lifted to a regional trauma center and admitted in critical with extensive multi-system trauma. The front right passenger was extricated 98 minutes after the reported dispatch time. She was pronounced deceased upon arrival at a local hospital

VEHICLE EXTERIOR DAMAGE

2005 Stoughton Trailer

The rear impact guard and the back of the trailer sustained moderate damage as a result of the impact (**Figure 8**). The direct contact damage, measured along the lower edge of the back plane, began 60 cm (23.5 in) right of center and extended 189 cm (74.5 in) to the left rear corner. The left vertical support of the rear impact guard was located within the region of the direct contact and had deformed forward and upward. The webbing of the I-beam was buckled. **Figure 9** is a right side view of the deformed support. The height of the left support measured 71 cm (28 in) above the ground. The height of the right vertical support measured 55 cm (21.5 in).

Figure 8: Back view of the trailer and deformed rear impact guard.

Figure 9: Right side view of the deformed rear impact guard vertical support.

Figure 10 is a view depicting the deformation of the left rear corner of the trailer and slider frame. The end of the left slider frame rail was deformed vertically 6 cm (2.5 in) as a result of the underride. The left rear corner of the trailer's interior floor was vertically buckled over an area that measured 198 cm x 116 cm (78 in x 45.5 in), width by depth. The left rear door of the trailer was jammed closed. **Figure 11** is a view looking rearward toward the deformed back plane.

Figure 10: Left view depicting the deformed left slider frame rail and trailer.

Figure 11: View looking rearward of the deformed back plane and rear impact guard supports.

The rear impact guard beam (**Figure 12**) had separated from the vertical supports during the underride of the Ford and was located in the bed of the pickup. The guard beam was deformed in a shallow V pattern. The deflection at the mid-point of the beam measured 13 cm (5 in). In its pre-crash condition, the beam was fastened to the vertical supports by three 16 mm (5/8 in) Grade 5 bolts through an intermediate plate that was welded to the beam. **Figure 13** is a view of the left side of the guard beam and the intermediate connection plate. The left side of the beam separated through one of the bolted connections and by shearing of the flange of the vertical I-beam support. **Figure 14** is a view of the right side of the guard beam. The right side of the beam separated from the vertical support by a tearing of the metal that surrounded the welded intermediate connection plate. The connection plate remained bolted to the right vertical support.

Figure 12: View of the separated rear impact guard beam.

Figure 13: View of the left end of the guard beam and the welded intermediate connection plate.

Figure 14: View of the right side of the guard beam and the torn metal surrounding the welded connection of the intermediate plate.

2009 Ford F-150 Pickup Truck

The 2009 Ford F-150 sustained severe impact damage due to the underride of the trailer's rear overhang. The vehicle structure above the level of the frame compressed rearward through the engine compartment and into the cowl resulting in extensive occupant compartment intrusion. **Figures 15 and 16** are left and right views of the engine compartment deformation.

The vertical face of the front bumper had rotated about its connection to the forward ends of the frame rails and was in a horizontal orientation at inspection. The front of the Ford struck the back plane of the trailer and crushed rearward. The body mounts located at the lower edge of the radiator support separated from the frame rails and deformed rearward. The longitudinal displacement of the left and right body mounts measured 41 cm (16 in) and 34 cm (13.5 in),

respectively. The hood folded into an inverted V-pattern and crushed into the A-pillars and lower aspect of the windshield. Crush profiles were documented at the bumper level and at the level of the hood face. The maximum crush at the bumper level was located 49 cm (19.3 in) right of center and measured 17 cm (6.7 in). The maximum crush at the level of the hood face was located on the vehicle's centerline and measured 157 cm (61.8 in). The crush profiles at the bumper level and at the level of the hood were averaged and utilized as an input to the WinSMASH program to estimate the crash delta-V. The average crush profile was as follows: C1 = 67 cm (23.4 in), C2 = 75 cm (29.5 in), C3 = 85 cm (33.5 in), C4 = 87 cm (34.3 in), C5 = 83 cm (32.7 in), C6 = 84 cm (33.1 in). There was no change in the wheelbase dimensions. The front doors of the Ford were jammed shut by the force of the impact and removed during the extrication of the occupants. Inspection of the vehicle revealed cab-to-bed contact on both side planes. The Collision Deformation Classification of the Ford was 12-FDAW6.

Figure 15: Left view of the frontal deformation. The left body mount is highlighted in the image.

Figure 16: Right view of the frontal deformation.

INTERIOR DAMAGE

2009 Ford F-150 Pickup Truck

The forward occupant compartment in the Ford sustained severe instrument panel intrusion as a result of the underride. **Figure 17** is a view of the driver's position. The driver seat was adjusted to a full-rear track position. The driver seat back angle measured 5 degrees aft of vertical and the adjustable head restraint was in the full-down position. The steering column was displaced rearward in close proximity to the driver seat and had rotated to a near vertical position. The left shear capsule displacement was 3 cm (1 in); the right shear capsule was displaced 1 cm (0.5 in). The deployed air bag module in the center of the steering wheel was used as a reference in order to document the displacement of the steering wheel/column. Comparison measurements to an exemplar Ford F-

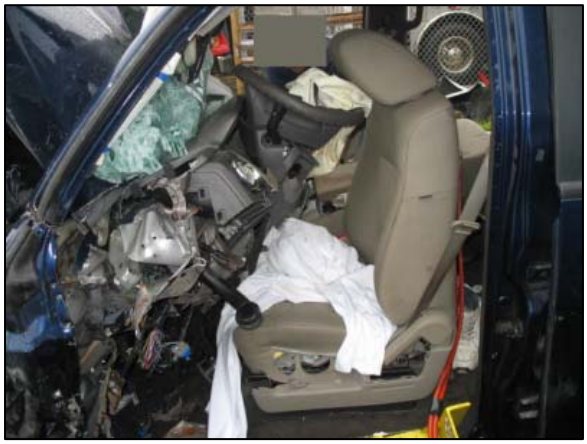


Figure 17: Left lateral view at the driver's position.

150 indicated the center of the steering wheel was displaced 15 cm (6 in) vertically and 22 cm (8.5 in) rearward. The horizontal distance from the seat back to the center of the steering wheel rim measured 25 cm (10 in). The steering wheel was rotated approximately 90 degrees counterclockwise. The rim was deformed 8 cm (3 in) in the 5 to 9 o'clock sectors. The longitudinal intrusion at the left corner of the instrument panel measured 29 cm (11.5 in).

Figure 18 is a right lateral view across the front row. The front right seat was in the full-rear track position. The seat back had been reclined by the first responders during the extrication of the front passenger. The head restraint was adjusted 8 cm (3 in) above full-down. The instrument panel intruded to the leading edge of the seat cushion. The intrusion at right corner of the instrument panel measured 20 cm (8 in). The center instrument panel intrusion also measured 20 cm (8 in).

Figure 18: Right lateral view of the occupant compartment.

MANUAL RESTRAINT SYSTEMS

2009 Ford F-150 Pickup Truck

The manual restraint systems in the Ford consisted of three-point lap and shoulder safety belts in the five seat positions. The driver's belt consisted of continuous loop webbing, a sliding latch plate, an Emergency Locking Retractor (ELR) and an adjustable D-ring. The retractor was equipped with a pretensioner. The driver's belt was stowed on the retractor at initial inspection and the retractor was operational. Inspection of the webbing and latch plate were unremarkable for crash related evidence. Post-crash blood evidence was noted on the lower aspect of the webbing at the outboard anchor. The retractor pretensioner did not actuate in the crash event. Based on the observations of the SCI inspection, the driver was not restrained at the time of the crash. The police report and imaged EDR data supported the unrestrained status of the driver.

The front right passenger restraint consisted of continuous loop webbing, a sliding latch plate, an adjustable D-ring and a switchable ELR/Automatic Locking Retractor (ELR/ALR) with pretensioner. The webbing was stowed on the retractor at initial inspection. The retractor was operational; the pretensioner did not actuate during the crash. Examination of the belt webbing and latch plate were unremarkable for crash related evidence. Based on the observations of the SCI inspection, the front right passenger was not restrained at the time of the crash. The police report and EDR data supported the conclusion that this restraint was not in use.

AIR BAG SYSTEMS

2009 Ford F-150 Pickup Truck

The frontal air bag system in the Ford F-150 consisted of dual-stage CAC air bags for the driver and front right passenger. The vehicle manufacturer has certified that the frontal air bags in the Ford F-150 were compliant with the advanced air bag requirements of the Federal Motor Vehicle Safety Standard No. 208. The frontal air bags deployed as a result of the underride impact. The driver air bag module was located in the center hub of the steering wheel rim. The I-configuration module cover flaps were symmetric and measured 5 cm x 16 cm (2 in x 6.2 in).

There was no noted contact to the cover flaps. The deployed driver air bag measured 66 cm (26 in) in its deflated state. It was tethered by two straps and vented by two ports in the 1 and 11 o'clock sectors. Large areas of post-crash body fluid were noted on the face of air bag.

The front right passenger air bag was a top-mount design located in right aspect of the instrument panel. The module cover flap consisted of a single rectangular vinyl flap. The face of the passenger air bag measured 41 cm (16 in) in width and 56 cm (22 in) in height. The bag was not tethered. The rearward excursion of the bag from the module measured 54 cm (20 in). The bag was vented from the side panels by two 5 cm (2 in) diameter ports. An 8 cm x 10 cm (3 in x 4 in) area of post-crash body fluid was noted on the right lower aspect of the air bag.

The front seat-mounted side impact air bags and roll-sensing IC air bags did not deploy as a result of the crash.

EVENT DATA RECORDER SYSTEM

2009 Ford F-150 Pickup Truck

The Ford F-150 was equipped with an Air bag Control Module (ACM) that had EDR data recording capabilities. The ACM was located under the center console adjacent to the front buckle stalks. The ACM was removed by the investigating police on the day of the SCI vehicle inspection. The EDR data was imaged through a direct-to-module connection utilizing the Bosch Crash Data Retrieval hardware, software version 3.2 and external electrical power. The imaged electronic file was reanalyzed with software version 3.3 and printed. A text summary of some key data points are listed below. A copy of the image data file is attached to the end of this technical report as Attachment A.

The imaged data indicated the EDR had recorded a Deployment Event that was related to this underride crash. The crash occurred on Ignition Cycle 1,171 and the data was imaged on Ignition Cycle 1,172. The imaged data was locked and a complete file had been recorded. There were no Diagnostic Trouble Codes present at the time of the crash and the air bag indicator light in the instrument cluster was "Off".

The first and second stages of the frontal air bag deployment occurred at 6.5 milliseconds and 16.5 milliseconds after crash detection, respectively. The safety belts for the driver and front right passenger were not buckled. The maximum longitudinal delta V was -75.59 km/h (-46.98 mph). The maximum delta-V was recorded 234 milliseconds after crash detection.

The EDR recorded a five second history of pre-crash data elements related to the operation of the vehicle. Five seconds prior to the crash (T-5), the speed of the vehicle was 130 km/h (80.8 mph). The speed one second prior to the crash (T-1) was 133 km/h (82.7 mph). The service brakes were "On" at crash detection (T-0) and the ABS feature was engaged. The steering wheel angle increased from 4.3 degrees to 80.8 degrees during the last second (T-1) immediately prior to the crash. These recorded parameters were consistent with driver avoidance actions that occurred too late in the pre-crash sequence to be effective in avoiding the impact.

OCCUPANT DEMOGRAPHICS

2001 Freightliner Tractor

	Driver	Passenger (Sleeper berth)
Age/Sex:	57-year-old / Male	49-year-old / Female
Height:	Unknown	Unknown
Weight:	Unknown	Unknown
Injury:	None	None

2009 Ford F-150 Pickup Truck

	Driver	Front Right Passenger
Age/Sex:	39-year-old / Male	24-year-old / Female
Height:	Unknown	Unknown
Weight:	Unknown	Unknown
Seat Track Position:	Full-rear track	Full-rear track
Safety Belt Usage:	Unrestrained	Unrestrained
Usage Source:	SCI vehicle inspection	SCI vehicle inspection
Egress from Vehicle:	Extricated by first responders	Extricated by first responders
Type of Medical Treatment:	Hospitalized in critical condition	None – Fatally injured

DRIVER INJURIES

2009 Ford F-150 Pickup Truck

Injury	*Injury Severity (AIS 90/Update 98)*	*Injury Source*
Blunt force trauma	Not codeable	Steering assembly

Source: Police report

DRIVER KINEMATICS

2009 Ford F-150 Pickup Truck

The 39-year-old male driver was seated in a full-rear track position and was unrestrained. The driver steered the vehicle 80 degrees counterclockwise and applied the brakes immediately prior to the impact in an attempt to avoid the crash.

At impact, the frontal air bags deployed. The driver responded to the 12 o'clock direction of the impact by initiating a forward trajectory. The driver contacted and loaded the steering wheel rim with his abdomen evidenced by the rim deformation. He loaded the deployed air bag with his chest and head. Coincident with his forward movement, the instrument panel was intruding rearward. The steering column rotated vertically as it intruded and the driver likely came into greater contact with column and the left instrument panel. A series of scuff marks were noted to the base of the column. The driver came to rest within the driver seat and required a prolonged extrication due to the extent of the intrusion. He was removed 54 minutes post-crash, transported via helicopter to regional trauma center and admitted in critical condition.

FRONT RIGHT PASSENGER INJURIES

2009 Ford F-150 Pickup Truck

Injury	*Injury Severity (AIS 90/Update 98)*	*Injury Source*
Fatal blunt force trauma	Not codeable	Intruding instrument panel

Source: Police report

FRONT RIGHT PASSENGER KINEMATICS

2009 Ford F-150 Pickup Truck

The 24-year-old female was unrestrained and seated in a full-rear track position. At impact, the frontal air bags deployed. The passenger responded to the 12 o'clock direction of the impact by initiating a forward trajectory. She contacted and loaded the deployed air bag with her chest and head and began to ride down the force of the impact. Coincident to her loading, the instrument panel intruded due to the force of the underride crash. The passenger likely loaded through the air bag and came into contact with the intruding instrument panel resulting in her blunt force injuries. The passenger became entrapped in the front right position and required a prolonged extrication. She was removed from the vehicle 98 minutes post-crash. She was transported to a local hospital and pronounced deceased upon arrival.

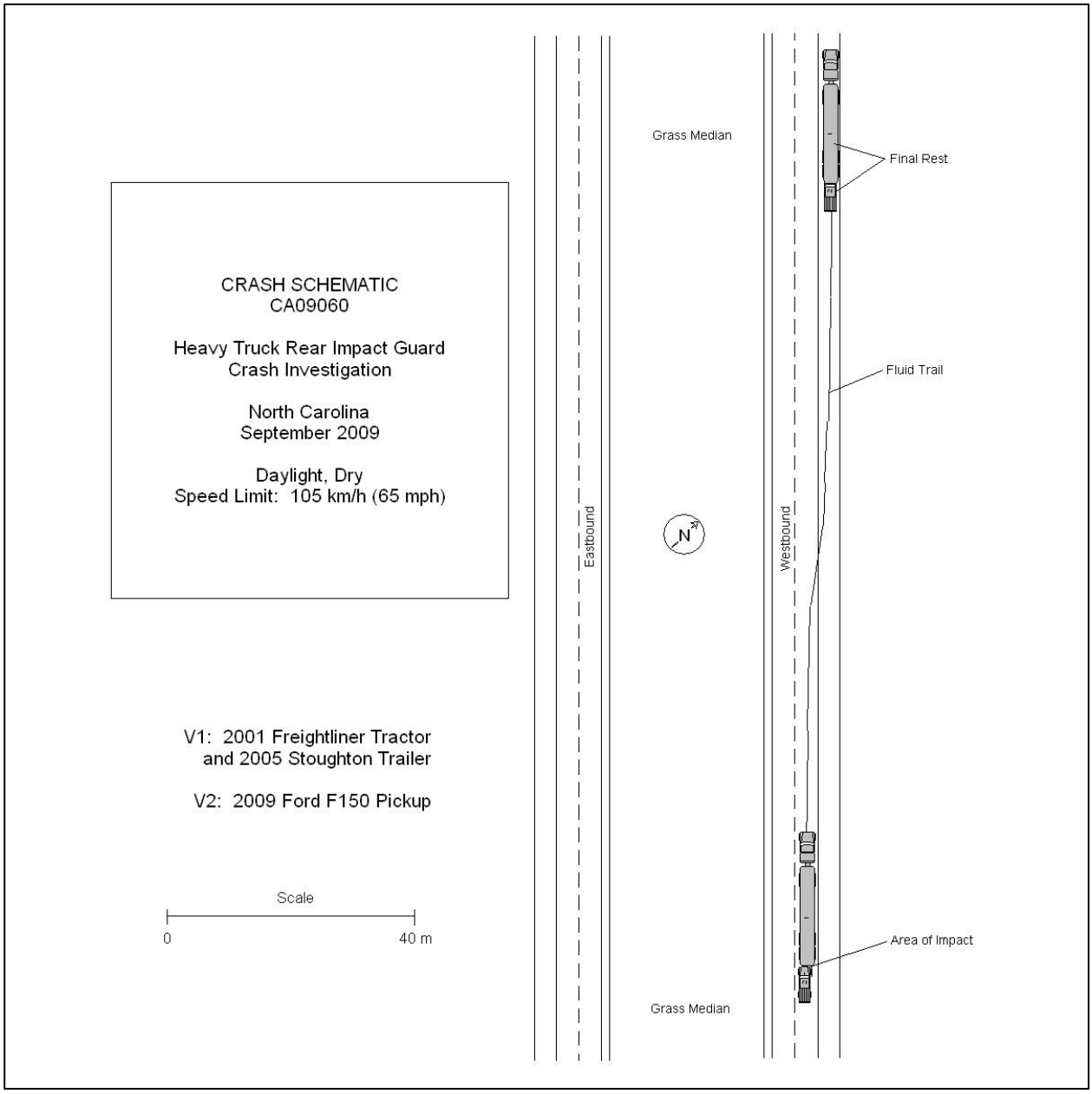


Figure 19: Crash Schematic.

ATTACHMENT A

2009 Ford F-150 EDR Data

CDR File Information

User Entered VIN	1FTPW14V39F******
User	
Case Number	
EDR Data Imaging Date	Friday, September 18 2009
Crash Date	Tuesday, September 15 2009
Filename	CA09060 CDR.CDR
Saved on	Friday, September 18 2009 at 09:51:44 AM
Collected with CDR version	Crash Data Retrieval Tool 3.2
Reported with CDR version	Crash Data Retrieval Tool 3.3
EDR Device Type	airbag control module
ACM Adapter Detected During Download	Yes
Event(s) recovered	locked frontal event Fuel cutoff level 1

IMPORTANT NOTICE: Robert Bosch LLC recommends that the latest production release of Crash Data Retrieval software be utilized when viewing, printing or exporting any retrieved data from within the CDR program. This ensures that the retrieved data has been translated using the most recent information including but not limited to that which was provided by the manufacturers of the vehicles supported in this product.

Module Information

The retrieval of this data has been authorized by the vehicle's owner, or other legal authority such as a subpoena or search warrant, as indicated by the CDR tool user on Friday, September 18 2009 at 09:51:44 AM .

Restraints Control Module Recorded Crash Events:
Deployment Events cannot be overwritten or cleared from the Restraints Control Module (RCM). Once the RCM has deployed any airbag device, the RCM must be replaced. The data from events which did not qualify as deployable events can be overwritten by subsequent events.
The RCM can store up to two deployment events.

Airbag Module Data Limitations:

• Restraints Control Module Recorded Vehicle Forward Velocity Change reflects the change in forward velocity that the sensing system experienced from the point of algorithm wake up. It is not the speed the vehicle was traveling before the event. Note that the vehicle speed is recorded separately five seconds prior to algorithm wake up. 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.
• Event Recording Complete will indicate if data from the recorded event has been fully written to the RCM memory or if it has been interrupted and not fully written.
• If power to the Airbag Module is lost during a crash event, all or part of the crash record may not be recorded.

Airbag Module Data Sources:
• Event recorded data are collected either INTERNALLY or EXTERNALLY to the RCM.

- INTERNAL DATA is measured, calculated, and stored internally, sensors external to the RCM include the following:
> The Driver and Passenger Belt Switch Circuits are wired directly to the RCM.
> The Driver's Seat Track Position Switch Circuit is wired directly to the RCM.
> The Side Impact Sensors (if equipped) are located on the side of vehicle and are wired directly to the RCM.
> The Occupant Classification Sensor is located in the front passenger seat and transmits data directly to the RCM on high-speed CAN bus.
> Front Impact Sensors (right and left) are located at the front of vehicle and are wire directly to the RCM.

- EXTERNAL DATA recorded by the RCM are data collected from the vehicle communication network from various sources such as Powertrain Control Module, Brake Module, etc.

System Status at Time of Retrieval

VIN as programmed into RCM at factory	1FTPW14V39F******
Current VIN from PCM	1FTPW14V39F******
Ignition cycle, download (first record)	1,172
Ignition cycle, download (second record)	N/A
Restraints Control Module Part Number	9L34-14B321-DL
Restraints Control Module Serial Number	7122393400000000
Restraints Control Module Software Part Number (Version)	9L34-14C028-AN
Left/Center Frontal Restraints Sensor Serial Number	0C04F847
Left Side Restraint Sensor 1 Serial Number	FEA321A1
Left Side Restraint Sensor 2 Serial Number	0C08FE3F
Right Frontal Restraints Sensor Serial Number	0C04F52C
Right Side Restraint Sensor 1 Serial Number	A0A321A1
Right Side Restraints Sensor 2 Serial Number	0C07EAE1

System Status at Event (First Record)

Recording Status	Locked Record
Complete file recorded (yes,no)	Yes
Multi-event, number of events (1,2)	1
Time from event 1 to 2 (msec)	N/A
Lifetime Operating Timer at event time zero (seconds)	1,672,215
Key-on Timer at event time zero (seconds)	1,305
Vehicle voltage at time zero (Volts)	13.446
Energy Reserve Mode entered during event (Y/N)	Yes
Time Driver Front Satellite Sensor Lost Relative to Time Zero (msec)	43.0
Time Passenger Front Satellite Sensor Lost Relative to Time Zero (msec)	28.5
Time Driver First Row Satellite Sensor Lost Relative to Time Zero (msec)	62.5
Time Passenger Second Row Satellite Sensor Lost Relative to Time Zero (msec)	62.5

Faults Present at Start of Event (First Record)

No Faults Recorded

Deployment Data (First Record)

Frontal airbag deployment, time to first stage deployment, driver (msec)	6.5
Frontal airbag deployment, time to 2nd stage, driver (msec)	16.5
Frontal airbag deployment, time to first stage deployment, front passenger (msec)	6.5
Frontal airbag deployment, time to 2nd stage, front passenger (msec)	16.5
Maximum delta-V, longitudinal (MPH [km/h])	-46.98 [-75.59]
Time, maximum delta-V longitudinal (msec)	234
Maximum delta-V, lateral (MPH [km/h])	-2.49 [-4.01]
Time, maximum delta-V lateral (msec)	138
Left or center, front satellite Sensor safing	Yes
Right, front satellite sensor discriminating deployment	Yes
Right, front satellite sensor safing	Yes
RCM, front sensor discriminating deployment	Yes
RCM, front sensor safing	Yes

Pre-Crash Data -1 sec (First Record)

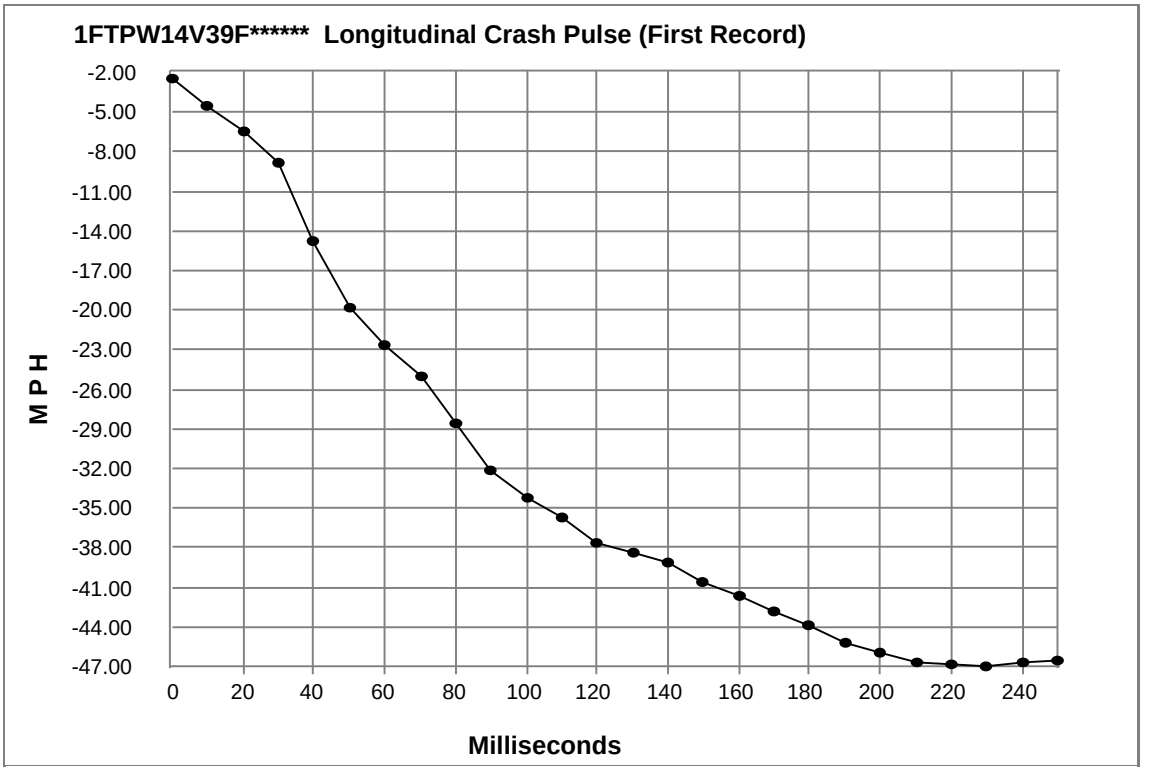
Ignition cycle, crash	1,171
Frontal air bag warning lamp, on/off	OFF
Occupant size classification, front passenger (Child size Yes/No [Hex value])	No [$08]
Frontal air bag suppression switch status, front passenger	N/A
Safety belt status, driver	Driver Not Buckled
Seat track position switch, foremost, status, driver	Not Forward
Safety belt status, front passenger	Passenger Not Buckled
Brake Telltale	Off
ABS Telltale	Off
Stability Control Telltale	Off
Speed Control Telltale	Off
Powertrain Wrench Telltale	Off
Powertrain Malfunction Indicator Lamp (MIL)Telltale	Off
HEV Hazard Telltale	Off

Pre-Crash Data -5 to 0 sec [2 samples/sec] (First Record)

Times (sec)	Speed vehicle indicated MPH [km/h]	Accelerator pedal, % full	Service brake, on/off	Engine rpm	ABS activity (engaged, non-engaged)	Stability control (engaged, non-engaged)	Traction Control via Brakes (engaged, non-engaged)	Traction Control via Engine (engaged, non-engaged)
- 5.0	80.8 [130.0]	31	OFF	2,000	non-engaged	non-engaged	non-engaged	non-engaged
- 4.5	80.8 [130.0]	32	OFF	2,000	non-engaged	non-engaged	non-engaged	non-engaged
- 4.0	81.4 [131.0]	32	OFF	2,000	non-engaged	non-engaged	non-engaged	non-engaged
- 3.5	81.4 [131.0]	32	OFF	2,000	non-engaged	non-engaged	non-engaged	non-engaged
- 3.0	82.0 [132.0]	32	OFF	2,000	non-engaged	non-engaged	non-engaged	non-engaged
- 2.5	82.0 [132.0]	32	OFF	2,100	non-engaged	non-engaged	non-engaged	non-engaged
- 2.0	82.0 [132.0]	32	OFF	2,100	non-engaged	non-engaged	non-engaged	non-engaged
- 1.5	82.7 [133.0]	32	OFF	2,100	non-engaged	non-engaged	non-engaged	non-engaged
- 1.0	82.7 [133.0]	32	OFF	2,100	non-engaged	non-engaged	non-engaged	non-engaged
- 0.5	83.3 [134.0]	7	OFF	2,100	non-engaged	non-engaged	non-engaged	non-engaged
0.0	76.4 [123.0]	0	ON	1,900	engaged	non-engaged	non-engaged	non-engaged

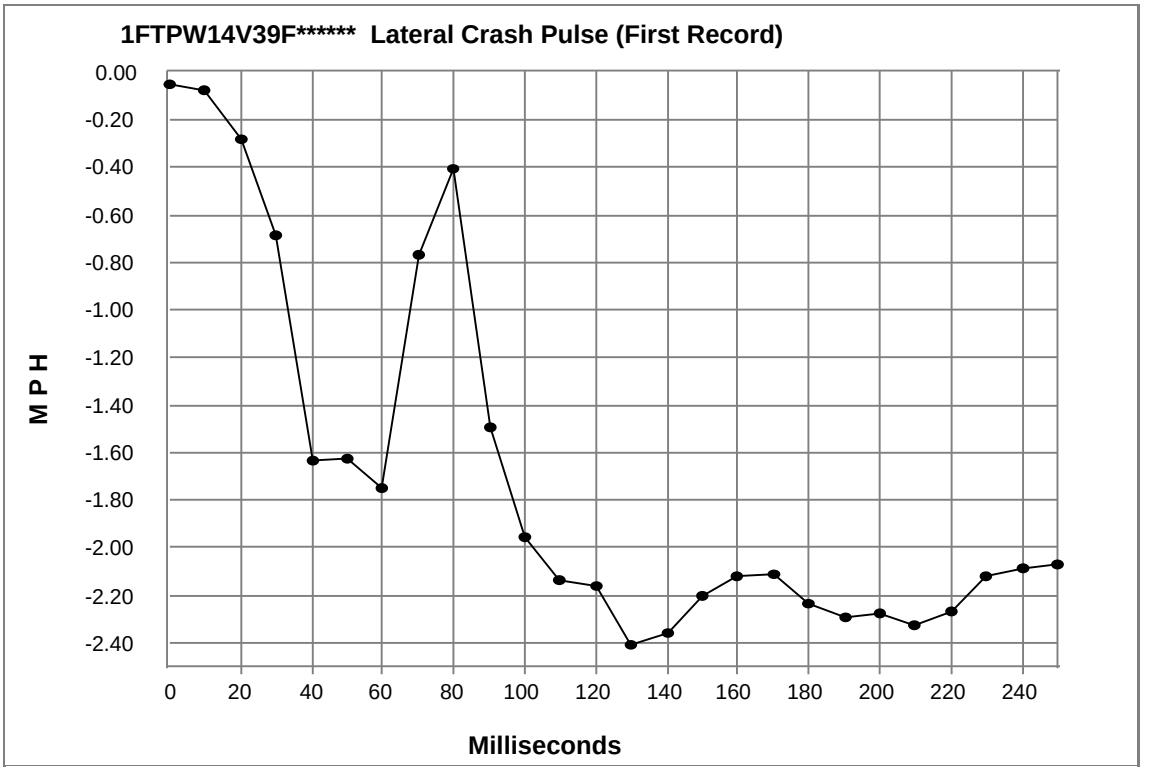
Pre-Crash Data -5 to 0 sec [10 samples/sec] (First Record)

Times (sec)	Steering Wheel Angle (degrees)	Stability Control Lateral Acceleration (g)	Stability Control Longitudinal Acceleration (g)	Stability Control Yaw Rate (deg/sec)	Stability Control Roll Rate (deg/sec)
- 5.0	-0.2	0.001	-0.006	0.25	-0.25
- 4.9	-0.2	-0.018	0.013	0.12	0.75
- 4.8	-0.2	-0.001	-0.004	0.12	-0.12
- 4.7	-0.2	-0.042	0.016	0.12	0.0
- 4.6	-0.2	-0.004	-0.001	-0.12	-1.0
- 4.5	-0.2	-0.047	0.008	-0.25	-0.37
- 4.4	-0.2	-0.007	-0.014	0.25	-1.62
- 4.3	-0.2	-0.055	0.036	0.0	-0.12
- 4.2	4.3	0.009	-0.043	0.25	0.37
- 4.1	4.3	-0.075	0.008	0.37	0.87
- 4.0	4.3	0.048	-0.029	0.0	-1.37
- 3.9	4.3	-0.034	0.031	0.37	-1.62
- 3.8	4.3	0.006	-0.034	0.5	-0.25
- 3.7	4.3	-0.056	0.033	0.5	0.62
- 3.6	4.3	0.016	-0.043	0.37	0.25
- 3.5	4.3	-0.033	-0.009	0.12	0.75
- 3.4	4.3	0.042	0.0	0.0	-0.87
- 3.3	4.3	-0.053	0.0	0.37	0.0
- 3.2	4.3	0.023	-0.016	0.12	-0.87
- 3.1	4.3	-0.059	-0.016	0.37	-0.5
- 3.0	4.3	0.007	0.016	0.25	0.62
- 2.9	4.3	-0.039	-0.014	0.5	0.75
- 2.8	4.3	0.02	0.026	0.37	-0.25
- 2.7	4.3	-0.006	-0.016	0.5	-0.62
- 2.6	4.3	0.035	0.026	0.37	-0.5
- 2.5	4.3	-0.007	-0.043	0.0	0.0
- 2.4	4.3	0.012	0.026	0.62	0.25
- 2.3	4.3	0.002	-0.024	0.87	0.75
- 2.2	4.3	0.026	0.033	0.75	0.0
- 2.1	4.3	0.026	-0.043	0.37	0.0
- 2.0	4.3	0.022	0.033	1.5	0.25
- 1.9	4.3	0.046	-0.043	0.37	-0.25
- 1.8	4.3	0.032	0.021	0.87	-0.25
- 1.7	4.3	0.035	-0.036	0.37	-0.25
- 1.6	4.3	0.025	0.011	0.62	-0.5
- 1.5	4.3	0.034	-0.001	0.37	-0.25
- 1.4	4.3	0.024	-0.006	0.5	0.37
- 1.3	4.3	0.04	0.021	0.5	-0.5
- 1.2	4.3	0.037	-0.029	0.62	-0.75
- 1.1	4.3	0.025	0.021	0.62	0.0
- 1.0	4.3	0.024	-0.034	0.62	0.0
- 0.9	4.3	0.029	0.033	1.37	-0.37
- 0.8	4.3	0.048	-0.031	0.37	-1.0
- 0.7	8.8	0.045	0.016	1.0	0.0
- 0.6	8.8	0.062	-0.043	0.75	0.5
- 0.5	13.3	0.074	-0.019	1.62	1.87
- 0.4	31.3	0.209	-0.434	3.25	3.75
- 0.3	53.8	0.362	-0.605	7.0	8.25
- 0.2	76.3	0.497	-0.685	11.75	10.25
- 0.1	80.8	0.528	-0.685	16.87	2.0
0.0	80.8	0.42	-0.737	17.0	-4.12



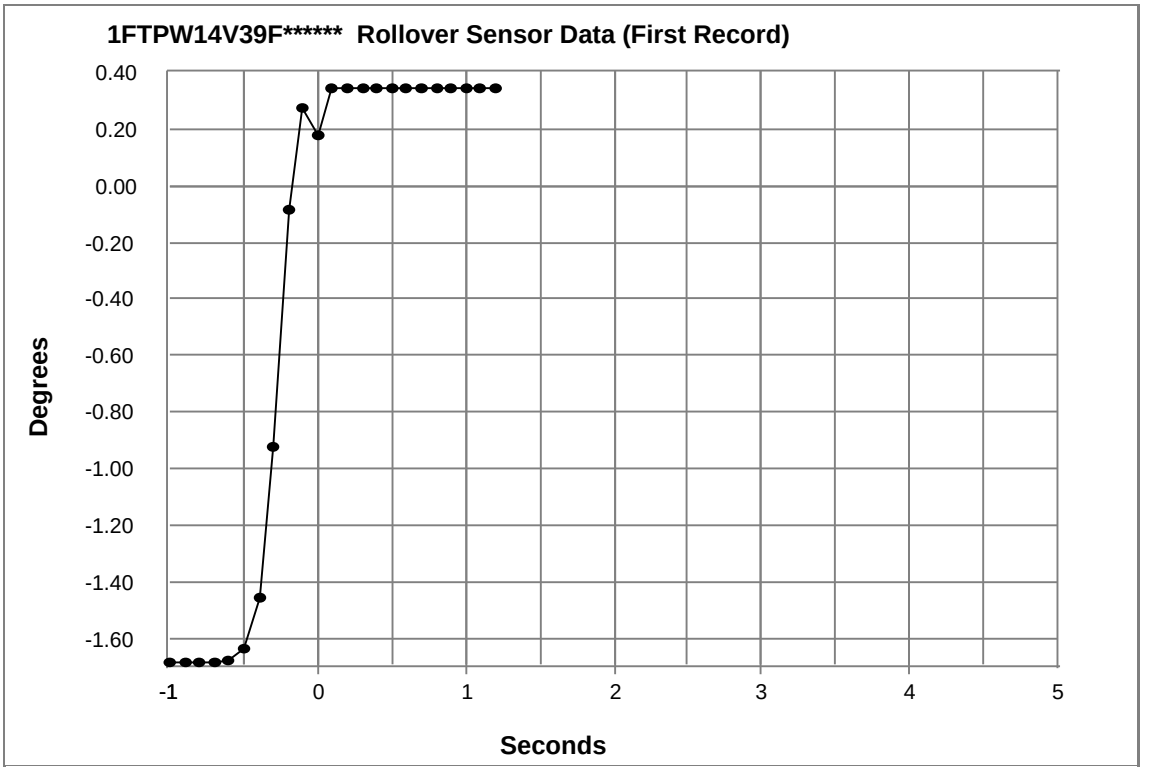
Longitudinal Crash Pulse (First Record)

Time (msec)	Delta-V, longitudinal (MPH)	Delta-V, longitudinal (km/h)
0	-2.49	-4.01
10	-4.58	-7.37
20	-6.47	-10.42
30	-8.89	-14.31
40	-14.81	-23.84
50	-19.88	-31.99
60	-22.64	-36.42
70	-25.03	-40.27
80	-28.52	-45.89
90	-32.13	-51.69
100	-34.16	-54.97
110	-35.75	-57.53
120	-37.68	-60.63
130	-38.32	-61.66
140	-39.06	-62.86
150	-40.55	-65.25
160	-41.62	-66.97
170	-42.79	-68.85
180	-43.87	-70.59
190	-45.16	-72.66
200	-45.94	-73.92
210	-46.64	-75.05
220	-46.90	-75.46
230	-46.94	-75.53
240	-46.77	-75.25
250	-46.52	-74.86



Lateral Crash Pulse (First Record)

Time (msec)	Delta-V, lateral (MPH)	Delta-V, lateral (km/h)
0	-0.05	-0.08
10	-0.08	-0.12
20	-0.28	-0.45
30	-0.68	-1.10
40	-1.63	-2.62
50	-1.62	-2.61
60	-1.75	-2.81
70	-0.77	-1.24
80	-0.40	-0.65
90	-1.49	-2.40
100	-1.96	-3.15
110	-2.13	-3.43
120	-2.16	-3.48
130	-2.41	-3.88
140	-2.36	-3.80
150	-2.20	-3.54
160	-2.12	-3.42
170	-2.11	-3.40
180	-2.23	-3.60
190	-2.29	-3.69
200	-2.28	-3.67
210	-2.32	-3.74
220	-2.27	-3.65
230	-2.12	-3.41
240	-2.09	-3.36
250	-2.07	-3.33



Rollover Sensor Data (First Record)

Time (sec)	Vehicle roll angle (degrees)
-1.0	-1.68
-0.9	-1.68
-0.8	-1.68
-0.7	-1.68
-0.6	-1.68
-0.5	-1.64
-0.4	-1.45
-0.3	-0.93
-0.2	-0.08
-0.1	0.27
0.0	0.18
0.1	0.34
0.2	0.34
0.3	0.34
0.4	0.34
0.5	0.34
0.6	0.34
0.7	0.34
0.8	0.34
0.9	0.34
1.0	0.34

Time (sec)	Vehicle roll angle (degrees)
1.1	0.34
1.2	0.34
1.3	N/A
1.4	N/A
1.5	N/A
1.6	N/A
1.7	N/A
1.8	N/A
1.9	N/A
2.0	N/A
2.1	N/A
2.2	N/A
2.3	N/A
2.4	N/A
2.5	N/A
2.6	N/A
2.7	N/A
2.8	N/A
2.9	N/A
3.0	N/A
3.1	N/A

Time (sec)	Vehicle roll angle (degrees)
3.2	N/A
3.3	N/A
3.4	N/A
3.5	N/A
3.6	N/A
3.7	N/A
3.8	N/A
3.9	N/A
4.0	N/A
4.1	N/A
4.2	N/A
4.3	N/A
4.4	N/A
4.5	N/A
4.6	N/A
4.7	N/A
4.8	N/A
4.9	N/A
5.0	N/A