Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (1998-075-803E)

1998 Buick Century

Colorado

October, 1998

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16. Abstract

This remote investigation focused on the redesigned air bag system deployment of a 1998 Buick Century 4-door sedan. This minor injury crash occurred in October, 1998 in the afternoon. The weather was clear and the bituminous roadways were dry. The crash occurred in a four-legged intersection. The northbound leg of the intersection is a two-way divided roadway and is comprised of seven travel lanes; one northbound right-turn lane, two northbound thru lanes, one northbound left-turn lane, and three southbound lanes. Northbound traffic is separated from southbound traffic by a raised concrete median strip. The speed limit for this road is 72 kmph (45 mph). It is controlled by overhead traffic signals. The road has a >2% uphill northbound grade at the area of impacts. The westbound leg of the intersection is a two-way undivided roadway and is comprised of three travel lanes; one westbound thru lane, one westbound left-turn lane, and one eastbound lane. The speed limit for this road is 48 kmph (30 mph). It is controlled by overhead traffic signals. The road is level at the area of impacts. Vehicle 1, a 1992 Chrysler Lebaron 2-door coupe driven by a 44 year old female, was traveling south in the southbound left-turn lane approaching the intersection at an unknown speed. The driver was preparing to make a left turn at the intersection. The traffic signal was in the green phase at this time. It is unknown if the driver was restrained. There were no other occupants in Vehicle 1. Vehicle 2, a 1998 Buick Century 4-door sedan (case vehicle) driven by a 69 year old male (173 cm/68 in, 73 kg/161 lbs), was traveling north in northbound lane 2 approaching the intersection at a driver estimated speed of 56-64 kmph (35-40) mph. The driver was preparing to travel straight through the intersection. The traffic signal was in the green phase at this time. The driver was restrained by the available manual lap/shoulder restraint. The front right seat was occupied by a 71 year old female (163 cm/64 in, 71 kg/156 lbs) who was restrained by the available manual lap/shoulder restraint. Vehicle 3, a 1985 Toyota Pickup compact pickup truck driven by a 33 year old male, was stopped at the intersection in the right westbound travel lane facing west. The driver was preparing to travel straight through the intersection. The traffic signal was in the red phase at this time. It is unknown if the driver was restrained. There were no other occupants in Vehicle 3. The driver of Vehicle 1 failed to yield the right-of-way for opposing traffic and started the left turn. Vehicle 1 crossed the path of Vehicle 2 and was struck. The front plane of Vehicle 2 (11FYEW1) struck the front plane of Vehicle 1 (02FREE4) in the intersection (event 1). The two vehicles then sideslapped (event 2) with the left plane of Vehicle 2 (09LZEN1) striking the right plane of Vehicle 1 (03RBEW1). The initial impacts caused Vehicle 2 to travel northeast across the intersection and strike Vehicle 3 (event 3). The front plane of Vehicle 2 (12FYEW99) struck the front plane of Vehicle 3 (10FLEW2). A Delta V was calculated for event 1 for the case vehicle, utilizing WinSMASH, as 13 kmph (8 mph). As a result of the first event front impact, the supplemental restraint system (driver's and passenger's frontal redesigned air bags) of the case vehicle deployed. Vehicle 1 came to rest in the center of the intersection facing south. Vehicle 2 came to rest engaged with Vehicle 3 facing northeast. Vehicle 3 came to rest in the original travel lane facing west. The driver of Vehicle 1 reportedly sustained non-incapacitating injuries of and unknown nature and severity. The occupants of Vehicle 2 sustained non-incapacitating injuries. They were not transported from the scene but sought treatment at a medical facility later that day. The driver of Vehicle 3 was reportedly uninjured. Vehicles 1 and 2 became disabled due to damage sustained in the crash and were towed from the scene. Vehicle 3 was still driveable and was driven from the scene by the original driver.

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Summary

This remote investigation focused on the redesigned air bag system deployment of a 1998 Buick Century 4-door sedan. This minor injury crash occurred in October, 1998 in the afternoon. The weather was clear and the bituminous roadways were dry. The crash occurred in a four-legged intersection. The northbound leg of the intersection is a two-way divided roadway and is comprised of seven travel lanes; one northbound right-turn lane, two northbound thru lanes, one northbound left-turn lane, and three southbound lanes. Northbound traffic is separated from southbound traffic by a raised concrete median strip. The speed limit for this road is 72 kmph (45 mph). It is controlled by overhead traffic signals. The road has a >2% uphill northbound grade at the area of impacts. The westbound leg of the intersection is a two-way undivided roadway and is comprised of three travel lanes; one westbound thru lane, one westbound left-turn lane, and one eastbound lane. The speed limit for this is 48 kmph (30 mph). It is controlled by overhead traffic signals. The road is level at the area of impacts.

Figure 1. Exterior, Vehicle 1 (1992 Chrysler Lebaron)

Vehicle 1, a 1992 Chrysler Lebaron 2-door coupe driven by a 44 year old female, was traveling south in the southbound left-turn lane approaching the intersection at an unknown speed. The driver was preparing to make a left turn at the intersection. The traffic signal was in the green phase at this time. It is unknown if the driver was restrained. There were no other occupants in Vehicle 1.

Figure 2. Exterior, Vehicle 2 (1998 Buick Century)

Vehicle 2, a 1998 Buick Century 4-door sedan (case vehicle) driven by a 69 year old male (173 cm/68 in, 73 kg/161 lbs), was traveling north in northbound lane 2 approaching the intersection at a driver estimated speed of 56-64 kmph (35-40 mph). The driver was preparing to travel straight through the intersection. The traffic signal was in the green phase at this time. The driver was restrained by the available manual lap/shoulder restraint. The front right seat was occupied by a 71 year old female (163 cm/64 in, 71 kg/156 lbs) who was restrained by the available manual lap/shoulder restraint.

Vehicle 3, a 1985 Toyota Pickup compact pickup truck driven by a 33 year old male, was stopped at the intersection in the right westbound travel lane facing west. The driver was preparing to travel straight through the intersection. The traffic signal was in the red phase at this time. It is unknown if the driver was restrained. There were no other occupants in Vehicle 3.

Figure 3. Exterior, Vehicle 3 (1985 Toyota Pickup)

Crash Events

The driver of Vehicle 1 failed to yield the right-of-way for opposing traffic and started the left turn. Vehicle 1 crossed the path of Vehicle 2 and was struck. The front plane of Vehicle 2 (11FYEW1) struck the front plane of Vehicle 1 (02FREE4) in the intersection (event 1). The two vehicles then sideslapped (event 2) with the left plane of Vehicle 2 (09LZEN1) striking the right plane of Vehicle 1 (03RBEW1). The initial impacts caused Vehicle 2 to travel northeast across the intersection and strike Vehicle 3 (event 3). The front plane of Vehicle 2 (12FYEW99) struck the front plane of Vehicle 3 (10FLEW2).

A Delta V was calculated for event 1 for the case vehicle, utilizing WinSMASH, as 13 kmph (8 mph). As a result of the first event front impact, the supplemental restraint system (driver's and passenger's frontal redesigned air bags) of the case vehicle deployed.

Vehicle 1 came to rest in the center of the intersection facing south. Vehicle 2 came to rest engaged with Vehicle 3 facing northeast. Vehicle 3 came to rest in the original travel lane facing west.

The driver of Vehicle 1 reportedly sustained non-incapacitating injuries of and unknown nature and severity. The occupants of Vehicle 2 sustained non-incapacitating injuries. They were not transported from the scene but sought treatment at a medical facility later that day. The driver of Vehicle 3 was reportedly uninjured.

Vehicles 1 and 2 became disabled due to damage sustained in the crash and were towed from the scene. Vehicle 3 was still driveable and was driven from the scene by the original driver.

Table 1. Delta V

	Case Vehicle		Other Vehicle	
	km/h	mph	km/h	mph
Total	13	8.1	16	9.9
Longitudinal	-12	-7.5	-10	-6.2
Lateral	5	3.1	-12	-7.5
Barrier speed	22	13.7	9	5.6

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1998 Buick Century
VIN	2G4WS52M4W1
CDC	11FYEW1

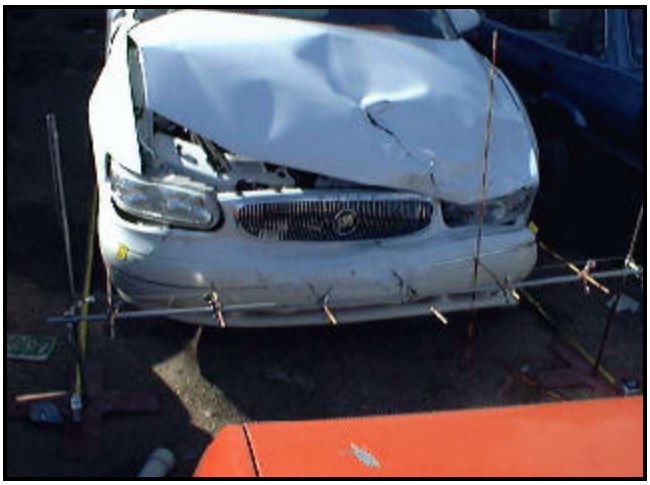

Figure 4. Exterior, Vehicle 2 (1998 Buick Century)

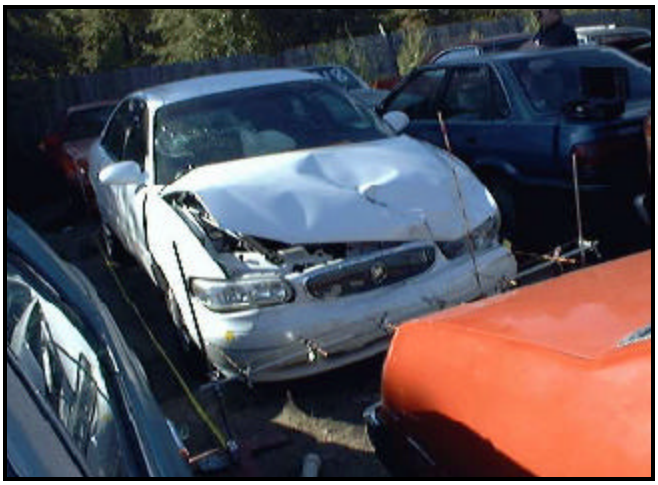

Figure 5. Exterior, Vehicle 2 (1998 Buick Century)

Table 3. Crush Measurements

Plane of Impact	Field L cm/in.	C1 cm/in.	C2 cm/in.	C3 cm/in.	C4 cm/in.	C5 cm/in.	C6 cm/in.
Bumper	151	9	7	6	3	3	1
	59.4	3.5	2.8	2.4	1.2	1.2	0.4

Interior of Case Vehicle

There were no areas of intrusion into the passenger compartment of the Buick Century. There was occupant contact evidence on both frontal air bags.

The case vehicle was equipped with bench seats with separate back cushions in the three frontal seating positions. They were all adjusted between the forward most and middle track positions. The outboard seats were equipped with adjustable head restraints which were not damaged while the middle seat was not equipped with a head restraint system. The rear of the vehicle was equipped with bench seats in all three seating positions. The back seats were not adjustable.

Case Vehicle Occupant Protection Systems

The Buick Century 4-door sedan was equipped with a redesigned air bag system which consisted of front left and front right air bag modules which housed air bags and depowered inflator units.

Figure 6. Interior, case vehicle. Driver's side frontal air bag.

The front left air bag was housed in the steering wheel hub and was concealed by symmetrical I-configuration cover flaps which were not damaged. The circular air bag was equipped with two tether straps and two vent ports. Contact evidence consisting of what appeared to be black cloth transfers was found on the front of the bag. The air bag was not damaged in the crash.

The front right air bag was housed in the top-instrument panel position. The single air bag module cover flap was a rectangular configuration. The bottom edge of the flap was damaged slightly from impacting the windshield. The rectangular air bag was not equipped with tether straps or vent ports. Contact evidence consisting of black cloth transfers and blood was found on the front of the bag. The air bag was not damaged in the crash.

Case Vehicle Occupant Demographics

Table 4. Case Vehicle Occupant(s) Demographics

	Occupant 1	Occupant 2
Age/Sex:	69/Male	71/Female
Seated Position:	Front left	Front right
Seat Type:	Bench with separate back cushions - cloth covered	Bench with separate back cushions - cloth covered
Height (cm/in:):	173 68	163 64
Weight (kg/lbs).:	73 161	71 156
Pre-existing Medical Condition:	None noted	None noted
Body Posture:	Normal - upright facing forward	Normal - upright facing forward
Hand Position:	Both on steering wheel rim at 10 & 4 o'clock positions	Both on lap
Foot Position:	On floor or foot controls	On floor
Restraint Usage:	Manual lap & shoulder restraint	Manual lap & shoulder restraint
Air bag:	Deployed redesigned air bag system	Deployed redesigned air bag system

Occupant Injuries

Table 5. Injuries

Occupant #	Injury	Injury Severity (AIS)	Injury Mechanism
1	Bilateral forearm abrasions	1	Driver's side frontal air bag
1	Right forearm contusion	1	Driver's side frontal air bag
1	Bilateral chest abrasions	1	Driver's side frontal air bag
1	Left chest contusion	1	Driver's side frontal air bag
1	Right chest contusion	1	Driver's side frontal air bag
1	Left upper arm contusion	1	Seat back support
2	Nose abrasion	1	Passenger's side frontal air bag
2	Left arm abrasion	1	Passenger's side frontal air bag
2	Left chest contusion	1	Belt restraint webbing
2	Left chest abrasion	1	Belt restraint webbing
2	Right knee abrasion	1	Right instrument panel
2	Right shoulder contusion	1	Belt restraint webbing
2	Lower abdominal contusion	1	Belt restraint webbing
2	Left knee contusion	1	Right instrument panel

Occupant Kinematics

The driver (case occupant 01) of the Buick Century was seated in a normal upright posture in the front left position of the vehicle. He was wearing the manual lap/shoulder restraint. The front right passenger (case occupant 02) was also seated in a normal posture and was wearing the manual lap/shoulder restraint. Seat belt usage was determined through visual inspection by the researcher, the lack of prominent frontal contact evidence, and observations by the investigating police officer at the scene of the crash. The driver reported that he attempted to avoid the collision by applying the brakes, causing the case occupants to begin loading the lap/shoulder restraints.

At impact, the occupants reacted to the 340 degree principle direction of force by moving forward and slightly left and further loading the lap/shoulder restraints. As the restraints locked, further forward movement of the occupants was prevented. The driver (case occupant 01) had moved far enough forward to engage the deploying driver's side frontal air bag-causing the bilateral forearm abrasions, right forearm contusion, bilateral chest abrasions, and chest contusions. Contact evidence consisting of black cloth transfers was found on the front of the bag. It also appears that the driver's upper left arm impact the seat back support-causing the left arm contusion. The passenger (case occupant 02) also had moved far enough forward to engage the deploying passenger's side frontal air bag-causing the nose and left arm abrasions. Contact evidence consisting of black cloth transfers and blood was found on the front of the bag. Impact with the locked lap/shoulder restraint caused the chest contusion and abrasion, right shoulder contusion, and lower abdominal contusion. It also appears that the driver's knees impacted the right instrument panel-causing the right knee abrasion and left knee contusion. Neither case occupant was transported from the scene medical attention but both went to a hospital later that day where they were treated and released.

Figure 7. Interior, case vehicle. Driver's side frontal air bag contact evidence.

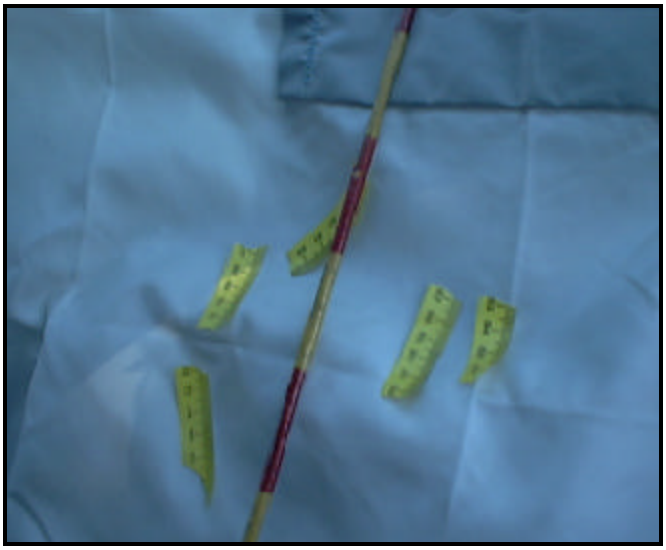

Figure 8. Interior, case vehicle. Passenger's side frontal air bag contact evidence.

Scene Diagram