

Child safety seat fatality Investigation / Vehicle to Vehicle
Dynamic Science, Inc. / Case Number: DS04007
1994 Oldsmobile Cutlass
Colorado
April, 2004

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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 crash-worthiness performance of the involved vehicle(s) or their safety systems.

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| 16. Abstract <p>This crash occurred in April, 2004 at 1620 hours. The crash occurred on a two-lane, undivided US highway. The asphalt roadway was straight and level. The case vehicle was a 1994 Oldsmobile Cutlass Supreme four-door sedan driven by a 26-year-old female. She was wearing the automatic three point lap and shoulder belt system. This vehicle was equipped with a driver's air bag. The rear left seat was occupied by a 3-year-old female who was seated in a Century Breverra Premier booster seat. The rear middle seat was occupied by a 4-month-old female who was seated in a rear facing Evenflo Discovery infant safety seat. The rear right seat was occupied by a 2-year-old male who was seated in a Century 1000 STE convertible safety seat. The other vehicle was a 1997 Buick LeSabre four-door sedan driven by 40-year-old female. There were two other occupants in the vehicle—a 31-year-old female and a 61-year-old female.</p> <p>The Oldsmobile was traveling west. The Buick was traveling east. The driver of the Buick lost control of her vehicle, possibly due to a steering over correction. The Buick began a counterclockwise rotation and entered the eastbound travel lane. It was struck in the right side by the front of the Oldsmobile.</p> <p>The driver of the Oldsmobile was seriously injured. The rear left seat child occupant was fatally injured. The remaining child occupants sustained minor injuries. All three occupants of the Buick were fatally injured.</p> | | | | |
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Dynamic Science, Inc.
Crash Investigation
Case Number: DS04007

TABLE OF CONTENTS

| | |
|---|----|
| Background | 1 |
| Description | 1 |
| Investigation Type | 1 |
| Crash Location | 1 |
| Crash Date | 1 |
| Notification Date | 1 |
| Field Work Completed | 1 |
| | |
| Summary | 1 |
| Crash Site | 1 |
| Pre-crash | 1 |
| Crash | 3 |
| Post-crash | 3 |
| | |
| Vehicle Data - 1994 Oldsmobile Cutlass | 5 |
| Vehicle Damage | 6 |
| Exterior Damage | 6 |
| Interior Damage | 7 |
| Rear Seat Back Failure Discussion | 8 |
| Child Safety Seat Discussion | 9 |
| Manual Restraint Systems | 12 |
| Frontal Air Bag System | 12 |
| | |
| Vehicle Data - 1997 Buick LeSabre | 13 |
| | |
| Occupant Demographics | 15 |
| | |
| Occupant Injuries | 19 |
| | |
| Occupant Kinematics | 26 |
| | |
| Attachment 1. Scene Diagram | 28 |
| | |
| Attachment 2. NHTSA CAMPAIGN ID Number : 99X001000 | 29 |
| | |
| Attachment 3. Child safety seat failure discussion | 30 |

BACKGROUND:

Description: This Child Safety Seat fatality case was identified by a National Transportation Safety Board (NTSB) investigator. The case had been identified to him by a state highway patrolman. The National Highway Traffic Safety Administration (NHTSA) was notified on April 23, 2004. DSI was assigned the case on April 23, 2004 after it was determined that both the vehicle and the child seat would be available for inspection. DSI inspected the scene, both vehicles, and the three child safety seats on April 27, 2004. The NTSB investigator and the investigating officer were present during the inspection of the Buick LeSabre, Oldsmobile Cutlass, and the child seats.

Investigation Type: Child safety seat fatality
Crash Location: Colorado
Crash Date: April, 2004
Notification Date: April 23, 2004
Field Work Completed: April 27, 2004

SUMMARY**Crash Site**

This crash occurred in April, 2004 at 1620 hours. The crash occurred on a two-lane, undivided US highway. The asphalt roadway was straight and level. The travel lanes were separated by a dashed yellow line. Both sides of the roadway were bordered by solid white lines and 2.4 m (8.0 ft) asphalt shoulders with 0.6 m (2.0 ft) wide rumble strips. Adjacent to the shoulders were negative grade grass ditches. It was raining at the time of the crash and the roadway was wet. It was dark and there were no streetlights available. The speed limit is 105 km/h (65 mph).



Figure 1. Approach to area of impact (east)

Pre-Crash

The case vehicle was a 1994 Oldsmobile Cutlass Supreme four-door sedan (VIN: 1G3WH55M9RDxxxxxx) driven by a 26-year-old female. She was wearing the automatic three point lap and shoulder belt system. This vehicle was equipped with a driver's air bag.

The rear left seat was occupied by a 3-year-old female who was seated in a Century Breverra Premier booster seat.

The rear middle seat was occupied by a 4-month-old female who was seated in a rear facing Evenflo Discovery infant safety seat. The seat was attached to the base and the base was anchored to the vehicle using the available lap belt. The carrying handle was in the down position and the shoulder harnesses were in the lower slots. According to first responders, the infant seat was tightly anchored to the vehicle.



Figure 2. Area of impact and final rest (west)

The rear right seat was occupied by a 2-year-old male who was seated in a Century 1000 STE convertible safety seat. The child seat was anchored to the vehicle using the available lap and shoulder belt. The lap and shoulder belt was equipped with an switchable retractor. It is not known if the retractor was in the ALR or ELR mode. There was no indication that a locking clip was used.

The other vehicle was a 1997 Buick LeSabre four-door sedan (VIN: 1G4HP52K7VHxxxxxx) driven by 40-year-old female. There were two other occupants in the vehicle—a 31-year-old female and a 61-year-old female.

The Oldsmobile (case vehicle) was traveling west. The Buick was traveling east.



Figure 3. Child seat configuration in rear seat. Front of vehicle to the right. From top to bottom, Century Breverra Premier booster seat, Evenflo Discovery infant safety seat, Century 1000 STE convertible safety seat.

Crash

The driver of the Buick lost control of her vehicle, possibly due to a steering over correction. The Buick began a counterclockwise rotation and entered the eastbound travel lane. It was struck in the right side (03RDAW6) by the front (12FDEW2) of the Oldsmobile. The total velocity change for the Oldsmobile calculated by the damage algorithm of WinSmash was 63.2 km/h (39.3 mph). The longitudinal and lateral components were -62.2 km/h (-38.7 mph) and 11.0 km/h (6.8 mph), respectively. The driver's air bag deployed at this time. The rear seat back failed at impact. The total velocity change for the Buick was 59.3 km/h (36.9 mph). The longitudinal and lateral components were 10.3 km/h (6.4 mph) and -58.4 km/h (-36.3 mph), respectively. According to Buick's speedometer, the Buick was traveling at approximately 63 km/h (39.0 mph) at impact.

The Buick was pushed into a clockwise rotation and came facing north with the rear tires resting on the grass

Post-Crash

The driver of the Oldsmobile sustained a ruptured spleen with blood within the peritoneal cavity, a C2 fracture, bilateral ankle fractures, and multiple contusions and abrasions. She was trapped in the vehicle and required extrication. She was awake at the time of EMS arrival. She was transported from the scene to a local hospital and admitted at 1713 hours–53 minutes post crash. Upon arrival, she was aware of her person but not of time and place. She had a Glasgow Coma Scale (GCS) Score of 14 upon arrival that improved to 15 approximately ½ hour later. She was evaluated for 2-1/2 hours. Arrangements were made to transport her by air to an area trauma center. Weather conditions would not permit air transport and she was transported by ground ambulance. She was discharged for transport at 1940 hours–2 hours 20 minutes post crash. She was then hospitalized for an unknown number of days.



Figure 5. Front of case vehicle (Oldsmobile Cutlass)



Figure 4. Right side, other vehicle (Buick LeSabre)



Figure 6. Speedometer, Buick

The 3-year-old rear left seat occupant was fatally injured. She sustained skull fractures, cerebral lacerations, diffuse axonal brain injury, and multiple abrasions and contusions. The crotch strap for the Century Breverra seat failed (see Attachment 3) and the harness was threaded improperly.

The 4-month-old rear middle occupant sustained minor injuries, including: forehead laceration, forehead contusion, right scalp abrasion, and a laceration behind the right ear. She was transported from the scene to a local hospital and admitted for 24-hour observation.

The 2-year-old rear right occupant sustained bilateral shoulder abrasions from the child seat harness, multiple contusions, an abrasion to the right side of his forehead, and a laceration to the back of his head. He was removed from the vehicle and transported from the scene in his child seat. The child seat was later recovered from the hospital and placed in police custody. He arrived at the hospital with a GCS score of 15. He was treated and then admitted for 24 hour observation.

The 31-year-old driver of the Buick was fatally injured. She sustained multiple skull fractures, a diffuse axonal injury, and an atlanto-occipital dislocation. She also sustained serious injuries to the lungs, liver, spleen, and right kidney.

The 40-year-old female front right seat occupant of the Buick was fatally injured. She sustained an atlanto-occipital dislocation with transection of the spinal cord.. There were additional severe injuries to the lungs, liver, spleen, vertebral column, great vessels and right kidney.

The 61-year-old female second row right seat occupant of the Buick was fatally injured. She sustained an atlanto-occipital dislocation with transection of the spinal cord. Additional severe injuries included a fracture of the third thoracic vertebral body with transection of the aorta and vena cava. There were also multiple hepatic lacerations, splenic lacerations, rupture of the bladder, and lacerations of the right kidney.

Both vehicles were towed from the scene due to damage and placed on a police hold.

VEHICLE DATA - 1994 Oldsmobile Cutlass

The case vehicle was a 1994 Oldsmobile Cutlass Supreme SL four-door sedan. The vehicle was equipped with a 3.1-liter V6 engine, four-speed automatic transmission, front wheel drive, standard anti-lock brakes, air conditioning, power steering, and a tilt steering wheel.

VIN: 1G3WH55M9RDxxxxxxx

Odometer: Unknown

Reported Defects: NHTSA recalls. 1994-95: Wiper/washer may not operate. 1993-94: Brake lines can contact transmission bracket and wear through.

Cargo: Three child seats, two soft luggage bags and a bag containing travel materials (i.e., hair dryer, cosmetics, etc.). None of the bags appear to weigh more than 23 kg (50 lbs) as they were moved about by this investigator.

The 1994 Oldsmobile Cutlass was equipped with Toyo Spectrum Touring Radial P225/60R16 tires on the front and Grand Am Radial GT P255/60R16 tires on the rear. The specific tire data is as follows:

| Tire | Tread | Measured pressure | Manufacturer recommended pressure |
|-------------|-----------------|--------------------------|--|
| LF | 9 mm (11/32 in) | Flat | 303 kPa (44 psi) |
| LR | 6 mm (8/32 in) | 234 kPa (34 psi) | 303 kPa (44 psi) |
| RF | 9 mm (11/32 in) | 234 kPa (34 psi) | 303 kPa (44 psi) |
| RR | 6 mm (8/32 in) | 200 kPa (29 psi) | 303 kPa (44 psi) |

The front seating positions in the 1994 Oldsmobile Cutlass were configured with fabric covered split bench with separate back cushions and adjustable head restraints for the outboard seating positions. The rear seating positions were configured with a fabric covered bench seat with a folding back and integral head restraints for the outboard positions.

VEHICLE DAMAGE

Exterior Damage - 1994 Oldsmobile Cutlass

| | | | |
|---------------------|--|----------------------------------|--|
| Damage Description: | Major front end damage. Left door jammed. Left wheelbase shorted by 33.0 cm (12.9 in). Vehicle towed from the scene due to damage. | | |
| CDC: | 12FDEW2 | | |
| Delta V: | Total | 63.2 km/h (39.3 mph) | |
| | Longitudinal | -62.2 km/h (-38.7 mph) | |
| | Latitudinal | 11.0 km/h (6.8 mph) | |
| | Energy | 91,771 joules (67,686 ft-lbs) | |

Direct damage from the impact with the Buick LeSabre began at the left front bumper corner. It extended across the entire end width and measured 136.0 cm (53.5 in). A crush profile was taken at the bumper which measured: C1= 33.0 cm (12.9 in), C2= 49.0 cm (12.3 in), C3=40.0 cm (15.7 in), C4=26.0 cm (10.2 in), C5=15.0 cm (5.9 in), C6=9.0 cm (3.5 in). The maximum crush was found between C2/C3 and measured 50.0 cm (19.7 in).



Figure 7. Front left, Oldsmobile Cutlass

Interior Damage - 1994 Oldsmobile Cutlass

Interior damage to the Oldsmobile Cutlass was significant and was attributed to occupant contact and passenger compartment intrusion. The windshield was fractured damage from impact forces. All side glass on the left side was disintegrated. Both left side doors had been jammed shut but were pried open by rescue personnel. There was intrusion into the front seating area from the instrument panel and toe pan. There was intrusion into the rear seating area as the result of a rear seat back failure. There were blood patterns found on the right C pillar, the left and right sides of the rear seat, and the driver's air bag. The front seat backs were deformed forward. The steering wheel was deformed 9.0 cm (3.5 in) forward.



Figure 8. Driver's seated position



Figure 9. Lateral view of rear seat

Rear seat back failure discussion

Both halves of the rear bench seat back and the rear center fold-down arm failed due to loading from the trunk area. The bottoms of the two seat backs are held in place by metal pins that are inserted into holes at the center and at both outboard ends—forming a hinge. In normal operation, the seat rotates about the left and right hinges as this seat is folded down to allow access to the trunk area. At impact, the seat backs were loaded from materials in the trunk and forced forward. This forced the pins out of the respective holes at the left, middle left, and middle right positions (as seen facing toward the front of the vehicle). The right pin remained in place. The trunk lid was jammed shut but the materials in the trunk as viewed from the inside of the vehicle rearward consisted of two soft luggage bags and a bag containing travel materials (i.e., hair dryer, cosmetics, etc.). None of the bags appear to weigh more than 23 kg (50 lbs) as they were moved about by this investigator.



Figure 11. Overview of rear seat failure/intrusion



Figure 10. View of the bottom of the right rear seat back, the center arm rest, and the pin and pin hole

Child safety seat discussion

The rear left seat was occupied by a 3-year-old female who was seated in a Century Breverra Premier booster seat (Model 4885, manufacture date 2/27/97)¹. This seat is designed to be used with or without the 5-point harness system, depending on the weight and height of the child. In this case, the seat was being used with the harness system threaded in a 3-point mode. For use of this seat, the manufacture states that the child must meet the following requirements: weight is 14-18 kg (30-40 lbs), height is 89-103 cm (35-43 in), the child is able to sit upright unassisted, and the child's shoulders are not above the top harness slots. It is not known if the child met the height and requirements, though she would likely be nearer to the upper end of the usage range. The harness was threaded through the lower harness slots. Also, at some point the harness had been removed and then re-threaded incorrectly. The hip harness slots were bypassed, essentially converting the seat from a 5-point restraint to a 3-point restraint. The child seat was anchored to the vehicle using the available lap and shoulder belt. The lap and shoulder belt was equipped with an switchable retractor. It is not known if the retractor was in the automatic locking retractor (ALR) or emergency locking retractor (ELR) mode. There was no indication that a locking clip was used. According to first responders, the child seat was tightly in place and the seat belt needed to be cut in order to remove the seat. However, given the deformation of the rear seat back, slack in the vehicle restraint system would have been reduced or eliminated.



Figure 12. Century Breverra Premier booster seat (rear left)

¹See Attachment 1. NHTSA CAMPAIGN ID Number : 99X001000

The rear middle seat was occupied by a 4-month-old female 7 kg (16 lbs) who was seated in a rear facing Evenflo Discovery infant safety seat (Model 2093 M9, manufactured date 7/24/2001). The manufacturer recommends that the seat be used for infants weighing 2-8 kg (5-20 lbs). The seat was attached to the base and the base was anchored to the vehicle using the available lap belt. The carrying handle was in the down position and the shoulder harnesses were in the lower slots. According to first responders, the infant seat was tightly anchored to the vehicle. However, given the deformation of the rear seat back, slack in the vehicle restraint system would have been reduced or eliminated.

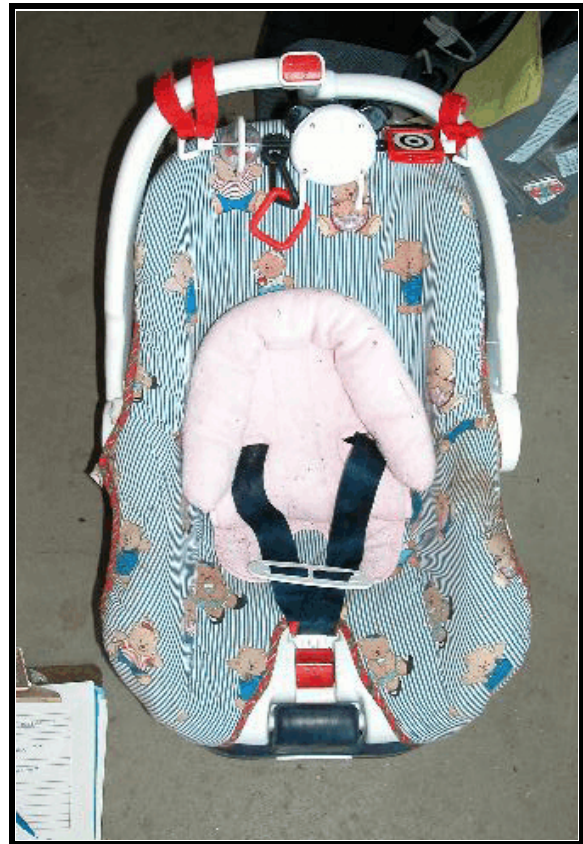


Figure 13. Evenflo Discovery infant safety seat (rear middle)



Figure 14. Evenflo Discovery infant safety seat (rear middle)

The rear right seat was occupied by a 2-year-old male who was seated in a Century 1000 STE convertible safety seat (manufacture date 8/21/2002). This seat is designed to be used in the rear facing mode for children weighing 10 kg (22 lbs) or less, or if the child is less than a year old. It is designed to be used in the forward facing mode for children weighing 18 kg (40 lbs) or less. In this crash the seat was being used in the forward facing mode and the harness was threaded through the middle set of slots. The five point harness was latched. The retainer clip was found to be in a low position at the time of inspection. The child seat was anchored to the vehicle using the available lap and shoulder belt. The lap and shoulder belt was equipped with a switchable retractor. It is not known if the retractor was in the ALR or ELR mode. There was no indication that a locking clip was used.



Figure 15. Century 1000 STE convertible safety seat (rear right)



Figure 16. Century 1000 STE convertible safety seat (rear right)

MANUAL RESTRAINT SYSTEMS - 1994 Oldsmobile Cutlass

The 1994 Oldsmobile Cutlass was equipped with 3-point, door mounted automatic lap and shoulder belts for the front seating positions and a manual center lap belt. The rear seat was equipped with manual 3-point lap and shoulder belts for the outboard seating positions and a manual lap belt in the center positions.

FRONTAL AIR BAG SYSTEM - 1994 Oldsmobile Cutlass

The 1994 Oldsmobile was equipped with a driver's frontal air bag that deployed as a result of the impact with the 1997 Buick LeSabre. The driver's air bag was housed in the steering wheel hub split I configuration cover flaps. The top and bottom flaps measured 16.0 cm (6.3 in) wide, 8.0 by 8.0 cm (3.1 by 3.1 in). The center vertical tear seam measured 13.0 cm (5.1 in). The driver's air bag was circular in shape and measured 48.0 cm (18.9 in) in diameter in its deflated state. There were nine horizontal folds. The air bag was vented by two circular ports which were located at the 3 and 9 o'clock positions on the rear aspect. There were no tethers. There were post-crash drip blood patterns found on both the air bag face and the back of the air bag.



Figure 17. Driver's air bag



Figure 18. Blood drip pattern on air bag face

VEHICLE DATA - 1997 Buick LeSabre

| | | |
|---------------------|--|------------------------------------|
| Description: | 1997 Buick LeSabre Custom four door sedan | |
| VIN: | 1G4HP52K7VHxxxxxx | |
| Odometer: | 173,874 km (108,040 miles) | |
| Engine: | 3.8L, V6 | |
| Reported Defects: | None | |
| Cargo: | None | |
| Damage Description: | Major right side crush, extending greater than halfway into the vehicle. Vehicle towed from the scene due to damage. | |
| CDC: | 03RDAW6 | |
| Delta V: | Total | 59.3 km/h (36.9 mph) |
| | Longitudinal | 10.3 km/h (6.4 mph) |
| | Latitudinal | -58.4 km/h (-36.3 mph) |
| | Energy | 447,184 joules (329,825 ft-lbs) |

Direct damage began 50.0 cm (21.7 in) rear of the rear axle and extended forward 246.0 cm (96.8 in). The direct plus induced damage began 55.00 cm (21.7 in) rear of the rear axle and extended forward 286.0 cm (112.6 in). Measurements were taken generally along the sill and measured as follows: C1 = 0 cm (0 in), C2 = 63.0 cm (24.8 in), C3 = 113.0 cm (44.5 in), C4 = 77.0 cm (30.3 in), C5 = 40.0 cm (15.7 in), C6 = 0 cm (0 in).



Figure 19. Overhead view of Buick, looking towards rear of vehicle



Figure 20. Overhead view of side damage as seen from the rear of the vehicle (1997 Buick LeSabre)



Figure 21. Overview of front seat area (1997 Buick LeSabre)



Figure 22. Overview of rear seat area (1997 Buick LeSabre)

OCCUPANT DEMOGRAPHICS - 1994 Oldsmobile Cutlass

| | | |
|---------------------------------|---|---|
| | Driver | Occupant 2 |
| Age/Sex: | 26/Female | 3/Female |
| Seated Position: | Front left | Rear left |
| Seat Type: | Split bench with separate back cushions | Fabric covered bench seat with folding back |
| Height: | Unknown | Unknown |
| Weight: | Unknown | Unknown |
| Occupation: | Unknown | NA |
| Pre-existing Medical Condition: | None noted | None noted |
| Alcohol/Drug Involvement: | None | None |
| Driving Experience: | Unknown | NA |
| Body Posture: | Normal, upright | Forward facing, upright, in child safety seat |
| Hand Position: | Unknown | Unknown |
| Foot Position: | Unknown | Unknown |
| Restraint Usage: | Automatic lap and shoulder belt available, used | Child seat anchored to the vehicle using the available lap and shoulder belt. |
| Air bag: | Steering wheel mounted air bag, deployed | NA |

OCCUPANT DEMOGRAPHICS - 1994 Oldsmobile Cutlass

| | Occupant 3 | Occupant 4 |
|---------------------------------|---|---|
| Age/Sex: | 4 months/Female | 2 year/Male |
| Seated Position: | Rear middle | Rear right |
| Seat Type: | Fabric covered bench seat with folding back | Fabric covered bench seat with folding back |
| Height: | Unknown | Unknown |
| Weight: | 7 kg (16 lbs) | Unknown |
| Occupation: | NA | NA |
| Pre-existing Medical Condition: | None noted | None noted |
| Alcohol/Drug Involvement: | NA | NA |
| Driving Experience: | NA | NA |
| Body Posture: | Rearward facing, supine, in infant safety seat | Forward facing, upright, in child safety seat |
| Hand Position: | Unknown | Unknown |
| Foot Position: | Unknown | Unknown |
| Restraint Usage: | Infant seat anchored to the vehicle using the available lap belt. | Child seat anchored to the vehicle using the available lap and shoulder belt. |

OCCUPANT DEMOGRAPHICS - 1997 Buick LeSabre

| | | |
|---------------------------------|---|--|
| | Driver | Occupant 2 |
| Age/Sex: | 31/Female | 40/Female |
| Seated Position: | Front left | Front right |
| Seat Type: | Fabric covered 55-45 split-bench, unknown track position | Fabric covered 55-45 split-bench, unknown track position |
| Height: | Unknown | Unknown |
| Weight: | Unknown | Unknown |
| Occupation: | Unknown | Unknown |
| Pre-existing Medical Condition: | Chronic cervicitis ² Lymphocytic thyroiditis ³ | Cholecystectomy ⁴ |
| Alcohol/Drug Involvement: | None | NA |
| Driving Experience: | Unknown | Unknown |
| Body Posture: | Unknown | Unknown |
| Hand Position: | Unknown | Unknown |
| Foot Position: | Right foot presumed to be on brake, left on floor board | Unknown |
| Restraint Usage: | Lap and shoulder belt available, used | Lap and shoulder belt available, used |
| Air bag: | Driver's air bag available, did not deploy | Front passenger's air bag available, did not deploy |

²Inflammation of the cervix

³An inflammation of the thyroid gland which is characterized by transient hyperthyroidism, followed by hypothyroidism and then recovery. <http://health.allrefer.com>

⁴Removal of gall bladder

OCCUPANT DEMOGRAPHICS - 1997 Buick LeSabre

| | |
|---------------------------------|---|
| | Occupant 3 |
| Age/Sex: | 61/Female |
| Seated Position: | Rear right |
| Seat Type: | Fabric covered bench |
| Height: | Unknown |
| Weight: | Unknown |
| Occupation: | Unknown |
| Pre-existing Medical Condition: | Serous cystadenoma, left ovary. Pulmonary interstitial fibrosis ⁵ |
| Alcohol/Drug Involvement: | NA |
| Driving Experience: | NA |
| Body Posture: | Unknown |
| Hand Position: | Unknown |
| Foot Position: | Unknown |
| Restraint Usage: | Lap and shoulder belt available, used |

⁵ A group of disorders characterized by inflammation and eventually scarring of the deep lung tissues, leading to shortness of breath.

OCCUPANT INJURIES -1994 Oldsmobile Cutlass

Driver: Injuries obtained from the emergency room report and multiple radiological reports.

| <u>Injury</u> | <u>OIC Code</u> | <u>Injury Mechanism</u> | <u>Confidence Level</u> |
|---|-----------------|---------------------------------|-------------------------|
| Ruptured spleen, with blood with peritoneal cavity | 544220.2,2 | Steering wheel rim | Probable |
| Hangman's fracture at C2. Transverse fracture through the body of the base of C2 with fragment projection of approximately 4 mm. No neurological dysfunction. | 650204.2,6 | Shoulder harness, impact forces | Probable |
| Fracture, left ankle. Fracture through talar body with mild subluxation | 852200.2,2 | Floor | Certain |
| Fracture, right ankle, comminuted | 852000.2,1 | Brake pedal | Certain |
| Abrasion, both legs | 890202.1,3 | Lower instrument panel | Probable |
| Abrasion upper chest, left clavicle area | 490202.1,2 | Shoulder harness | Certain |
| Abrasion, right hand | 790202.1,1 | Unknown | Unknown |
| Contusion, left knee | 890402.1,2 | Lower instrument panel | Probable |
| Laceration, left lower leg | 890600.1,2 | Lower instrument panel | Probable |
| Laceration, right ear | 290600.1,1 | Unknown | Unknown |

Left rear occupant: Injury obtained from autopsy report.

| <u>Injury</u> | <u>OIC Code</u> | <u>Injury Mechanism</u> | <u>Confidence Level</u> |
|---|-----------------|-------------------------|-------------------------|
| Complex fractures, base of skull | 150206.4,8 | Left front seat back | Probable |
| Diffuse axonal injury | 140628.5,9 | Left front seat back | Probable |
| Depressed complex fractures to left side of calvarium | 150406.4,2 | Left front seat back | Probable |
| Mild subarachnoid hemorrhage | 140684.3,9 | Left front seat back | Probable |

| | | | |
|---|--|------------------------------------|----------|
| Left side dural cerebral lacerations | 140688.4,9 | Left front seat back | Probable |
| Contusions with focal laceration, left side of face | 290600.1,2 290402.1,2 | Left front seat back, flying glass | Probable |
| Patterned abrasion, left shoulder/upper chest | 709202.1,2 490202.1,2 | CSS harness | Certain |
| Contusions of abdomen | 590402.1,9 | CSS harness | Certain |
| Contusions of back | 690402.1,7 | Back of CSS | Probable |
| Contusions of vulva | 545610.1,8 | CSS harness | Certain |
| Abrasions, contusions, lacerations to extremities | 990200.1,9 990400.1,9 990600.1,9 | Unknown | Unknown |
| Right hip dislocation | 850610.2,1 | Bottom strap, CSS harness | Possible |

Middle rear occupant: Injuries obtained from emergency physician record, emergency department trauma record, history and physical report, and several radiological reports.

| Injury | OIC Code | Injury Mechanism | Confidence Level |
|--------------------------------------|------------|------------------|------------------|
| Abrasion/laceration behind right ear | 190600.1,1 | Flying glass | Possible |
| Laceration, forehead | 290600.1,7 | Flying glass | Possible |
| Contusion, forehead | 290402.1,7 | Unknown | Unknown |
| Glass cut to right ear | 290602.1,1 | Flying glass | Possible |
| Abrasion, right forehead | 290202.1,7 | Unknown | Unknown |

Rear right occupant: Injuries obtained from history and physical report, several radiological reports, and the emergency physician record.

| <u>Injury</u> | <u>OIC Code</u> | <u>Injury Mechanism</u> | <u>Confidence Level</u> |
|----------------------------------|-----------------|-------------------------|-------------------------|
| Bilateral shoulder abrasions | 790402.1,3 | CSS harness | Probable |
| Multiple contusions about head | 290402.1,0 | CSS seat back | Probable |
| Abrasion, right side of forehead | 290202.1,7 | CSS seat back | Possible |
| Laceration, back of head | 190600.1,8 | CSS seat back | Probable |

| | | | |
|-------------------|------------|-------------|----------|
| Abrasions to neck | 390202.1,9 | CSS harness | Probable |
| Contusion to neck | 390402.1,9 | CSS harness | Probable |

OCCUPANT INJURIES -1997 Buick LeSabre

Driver: Injuries obtained the autopsy report.

| <u>Injury</u> | <u>OIC Code</u> | <u>Injury Mechanism</u> | <u>Confidence Level</u> |
|--|--------------------------|---|-------------------------|
| Right mandible fracture/dislocation | 250600.1,1 251604.2,1 | Occupant 2 | Possible |
| Ring fracture of base of skull extending through lambdoidal suture | 150206.4,8 | Occupant 2 | Possible |
| Mild subarachnoid hemorrhage | 140684.3,9 | Occupant 2 | Possible |
| Atlanto-occipital fracture with transection of spinal cord | 640276.6,6 | Impact forces | Possible |
| Axonal injury of midbrain | 140206.5,8 | Occupant 2 | Possible |
| Patterned linear abrasions of abdomen | 590202.1,9 | Lap belt | Certain |
| Transection, aorta | 420210.5,4 | Unknown | Unknown |
| Bilateral pulmonary contusions of lungs | 441410.4,3 | Right seat back | Possible |
| Pulpefication of spleen | 544228.5,2 | Unknown | Unknown |
| Multiple hepatic lacerations | 541820.2,1 | Right seat back | Possible |
| Partial transection of right kidney | 541626.4,1 | Right seat back | Possible |
| Rib fractures, right 1-7, left 1-6 | 450240.4,3 | Right: Front right seat back Left: Left door | Possible |
| Fracture, left pelvis | 852600.2,2 | Left door | Possible |
| Rupture, diaphragm | 440604.3,8 | Unknown | Unknown |
| Rupture, urinary bladder | 540640.3,8 | Unknown | Unknown |
| Compound fracture, right radius/ulna | 752804.3,1 753204.3,1 | Right seat back | Possible |
| Closed fracture, left femur | 851800.3,2 | Lower instrument panel | Possible |
| Closed fracture, left tibia/fibula | 853404.2,2 851605.2,2 | Lower instrument panel | Possible |
| Multiple non specific contusions to extremities | | Unknown | Unknown |

Right front occupant: Injuries obtained from autopsy report.

| <u>Injury</u> | <u>OIC Code</u> | <u>Injury Mechanism</u> | <u>Confidence Level</u> |
|--|--------------------------|-------------------------|--------------------------|
| Atlanto-occipital dislocation with spinal cord transection | 640246.5,6 | Side door (indirect) | Probable |
| Displaced T3 vertebral body fracture with avulsion of spinal cord and transection of great vessels | 640440.5,7 | Side door | Probable |
| Transection, aorta | 520208.5,4 | Side door | Probable |
| Transection, vena cava | 521206.4,7 | Side door | Probable |
| Mild subarachnoid hemorrhage | 140684.3,9 | Unknown | Unknown |
| Fractures of maxilla, nasal septum | 250800.2,9 251000.1,4 | Side door | Possible |
| Chin lacerations | 290600.1,8 | Unknown | Unknown |
| Right periorbital hematoma | 297402.1,1 | Unknown | Unknown |
| Multiple fractures of all ribs | 450240.4,3 | Side door | Probable |
| Pelvis fracture | 852600.2,9 | Side door | Probable |
| Right clavicle fracture | 752200.2,1 | Side door | Probable |
| Maceration of right lobe of liver | 541820.2,1 | Side door | Probable |
| Maceration of spleen | 544228.5,2 | Side door | Probable |
| Bilateral lung lacerations | 441450.4,3 | Side door | Probable |
| Lacerations of right kidney | 541620.2,1 | Side door | Probable |
| Rupture, left hemidiaphragm | 440604.3,8 | Side door | Probable, compression |
| Rupture, stomach | 544426.4,7 | Side door | Probable, compression |
| Rupture, urinary bladder | 540640.3,8 | Side door | Probable, compression |
| Compound fracture, left elbow | 751900.2,2 | Occupant 1 | Possible |

| | | | |
|--|--------------------------|-----------|----------|
| Bilateral tibia compound fractures | 853405.3,1 853405.3,2 | Sill | Possible |
| Closed, right humerus fracture | 752602.2,1 | Side door | Probable |
| Non specific and linear patterned abrasions/contusions | 990200.1,0 990400.1,0 | Seat belt | Unknown |
| Non specific lacerations | 990600.1,0 | Unknown | Unknown |

Right rear occupant: Injuries obtained from autopsy report.

| <u>Injury</u> | <u>OIC Code</u> | <u>Injury Mechanism</u> | <u>Confidence Level</u> |
|--|--------------------------|-------------------------|-------------------------|
| Atlanto-occipital subluxation with transection of spinal cord | 640246.5,6 | Side door, indirect | Probable |
| Displaced T3 vertebral body fracture with avulsion of spinal cord and transection of great vessels | 640440.5,7 | Side door, indirect | Probable |
| Mild subdural and subarachnoid blood | 140684.3,9 | Unknown | Unknown |
| Multiple displaced rib fractures | 450210.2,9 | Side door | Probable |
| Multiple displaced pelvic fractures | 852604.3,9 | Side door | Certain |
| Hepatic lacerations | 541820.2,1 | Side door | Certain |
| Splenic lacerations | 544220.2,2 | Side door | Certain |
| Right renal laceration | 541620.2,1 | Side door | Certain |
| Urinary bladder laceration | 540620.2,8 | Unknown | Unknown |
| Pulmonary contusions | 441410.4,3 | Side door | Probable |
| Diaphragm rupture | 440604.3,8 | Side door | Probable |
| Bilateral lower leg amputations | 811000.3,3 | Side door | Probable |
| Bilateral maceration and multiple fractures femurs | 851800.3,1 851800.3,2 | Side door | Probable |
| Bilateral maceration and multiple fractures lower legs | 852002.2,1 852002.2,2 | Side door | Probable |
| Bilateral closed humerus fractures | 752602.2,1 752602.2,2 | Side door | Probable |
| Dicing of right parietal scalp | 190202.1,1 | Side glass | Possible |
| Laceration of left parietal scalp | 190600.1,2 | Unknown | Unknown |
| Non specific contusions of abdomen | 590402.1,9 | Side door | Possible |
| Hyper-extension type lacerations, left inguinal ⁶ region | 590600.1,9 | Unknown | Unknown |

⁶Of, relating to, or located in the groin.

OCCUPANT KINEMATICS - 1994 Oldsmobile Cutlass

The 26-year-old female driver of the Oldsmobile was seated in a normal, upright fashion on the fabric covered 60/40 split bench seat. She was wearing the automatic three point lap and shoulder belt system. Prior to impact, the driver was braking with her right foot. Her left foot was on the floor board. Both hands were likely on the steering wheel. This occupant pitched forward and likely began to load the shoulder harness as she braked. The Oldsmobile struck the right side of the Buick. The impact was sufficient to deploy the driver's air bag. The driver's head and torso engaged the deployed air bag. The steering wheel rim was deformed by occupant loading. The driver pitched forward sharply at impact loading the shoulder belt and causing the upper chest abrasions. The driver's head pitched forward over the shoulder belt causing a hangman's fracture at C2. The driver sustained fractures to both ankles; the right while in contact with the brake pedal, the left while in contact with the floor pan.



Figure 23. Driver's seated position



Figure 24. Overview of rear seating area

The rear left seat was occupied by a 3-year-old female who was seated in a Century Breverra Premier booster seat (see Attachment 3). It is not known if the child met the height and requirements, though she would likely be nearer to the upper end of the usage range given her age. The harness was threaded through the lower harness slots. At some point in the past the harness had been removed and then re-threaded incorrectly. The hip harness slots were bypassed, essentially converting the seat from a 5-point restraint to a 3-point restraint. The crotch strap is connected to the seat structure using a metal bar that is attached to the base of the seat. At impact, the rear left seat occupant loaded the crotch strap and it failed at the webbing. This occupant sustained abrasions to the chest, abdomen, and vulva as the child seat harness was initially loaded. As the harness failed, this occupant pitched out of the child seat and struck the rear of the driver's seat causing the multiple head and brain injuries which were ultimately fatal.

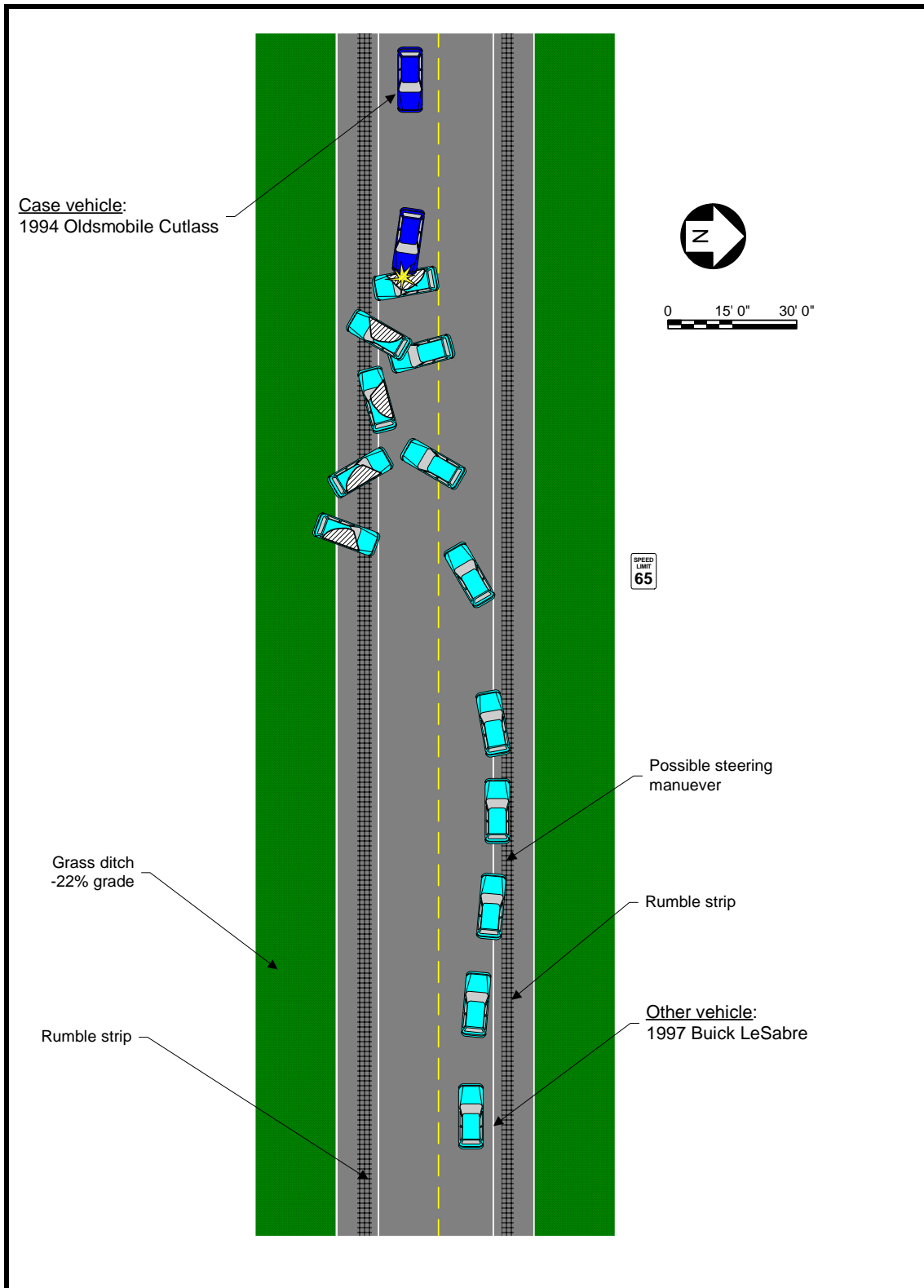


Figure 25. Back of driver's seat

The rear middle seat was occupied by a 4-month-old female who was seated in a rear facing Evenflo Discovery infant safety seat. The seat was attached to the base and the base was anchored to the vehicle using the available lap belt. The carrying handle was in the down position and the shoulder harnesses were in the lower slots. According to first responders, the infant seat was tightly anchored to the vehicle. At impact, she loaded the infant seat back. She sustained several flying glass related lacerations and a contusion to her forehead from an unknown source.

The rear right seat was occupied by a 2-year-old male who was seated in a forward facing Century 1000 STE convertible safety seat. The five point harness was latched. The retainer clip was found to be in a low position at the time of inspection. The child seat was anchored to the vehicle using the available lap and shoulder belt. The lap and shoulder belt was equipped with an switchable retractor. It is not known if the retractor was in the ALR or ELR mode. There was no indication that a locking clip was used. At impact, this occupant pitched forward and loaded the safety seat harness which was threaded through the middle set of slots—causing bilateral shoulder abrasions. The rear of the child seat was struck by the rear bench back as it failed. This occupant sustained several abrasions/contusions due to contact with the interior of the child seat.

Attachment 1. Scene Diagram



Attachment 2. NHTSA CAMPAIGN ID Number : 99X001000

Make : CENTURY Model : BREVERRA PREMIERE Build Dates : FEB 01, 1995 - JUL 10, 1998 NHTSA CAMPAIGN ID Number : 99X001000 Recall Date : DEC 10, 1999 Component: CHILD SEAT:BUCKLE:BOOSTER Potential Number Of Units Affected : 927149 Summary:

THIS IS NOT A SAFETY RECALL IN ACCORDANCE WITH THE SAFETY ACT. HOWEVER, IT IS DEEMED A PRODUCT IMPROVEMENT CAMPAIGN BY THE AGENCY. EQUIPMENT DESCRIPTION: 4885 BREVERRA PREMIERE AND 4875 BREVERRA CONTOUR BOOSTER CAR SEATS MANUFACTURED FROM FEBRUARY 1995 THROUGH JULY 10, 1998. THE BUCKLE FOR THE HARNESS SYSTEM ON THESE BOOSTER SEATS CAN CRACK OR BREAK.

Consequence:

IN THE EVENT OF A VEHICLE CRASH, THE OCCUPANT MAY NOT BE PROPERLY RESTRAINED CAUSING INCREASED RISK OF PERSONAL INJURY.

Remedy:

OWNERS ARE BEING ASKED TO CHECK THE BUCKLE AT THE TOP AND DOWN THE SIDE ON THEIR CAR SEAT AND CENTURY WILL REPLACE THE BUCKLE IF IT IS CRACKED.

Notes:

CENTURY HAS DECIDED TO CONDUCT A PRODUCT IMPROVEMENT CAMPAIGN TO REPLACE THE BUCKLES ON THESE SEATS. OWNERS CAN CONTACT CENTURY AT 1-800-445-6881 FOR A FREE REPLACEMENT.

Attachment 3. Child safety seat failure discussion

The Century Breverra Premier booster seat in the left rear seat position was being used with the harness modified as a 3 point system. The harness was threaded through the lower harness slots. At some point in the past the harness had been removed and then re-threaded incorrectly. The hip harness slots were bypassed, essentially converting the seat from a 5-point restraint to a 3-point restraint.

The crotch strap with buckle is connected to the seat structure using a metal bar that is attached to the base of the seat. The strap passes through the seat cushion, through a slot in the seat base, loops around the bar, and returns back through the slot and the seat cushion, and then is fixed in place by stitches to the buckle. The strap can be removed by removing the metal bar. At impact, the rear left seat occupant loaded the crotch strap and it failed at the webbing. The metal bar remained in place and undamaged.



Figure 27. Seat from case vehicle, upper thigh straps not in place



Figure 28. Exemplar seat with upper thigh harness in place

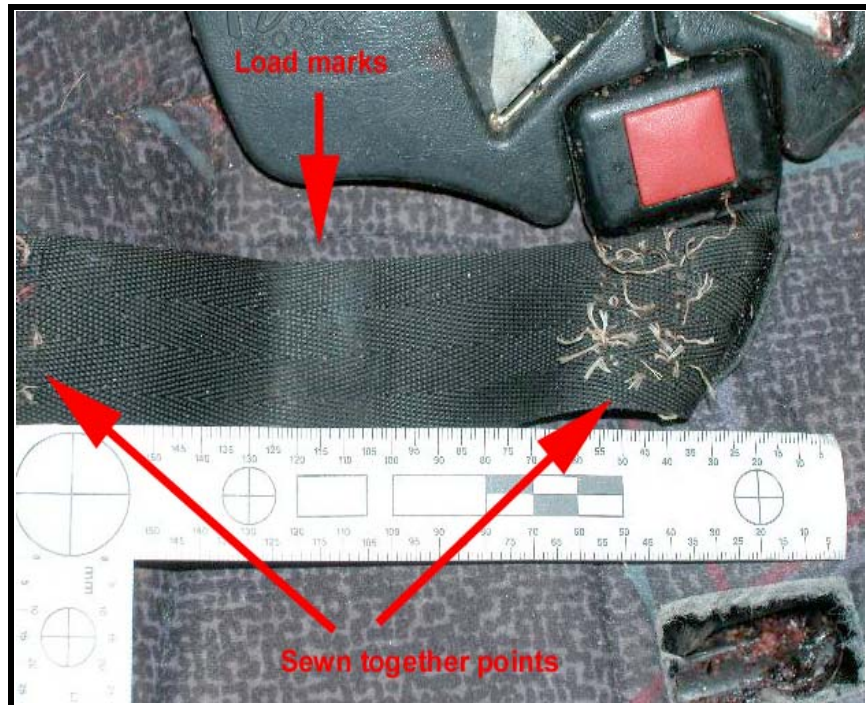


Figure 29. Crotch strap

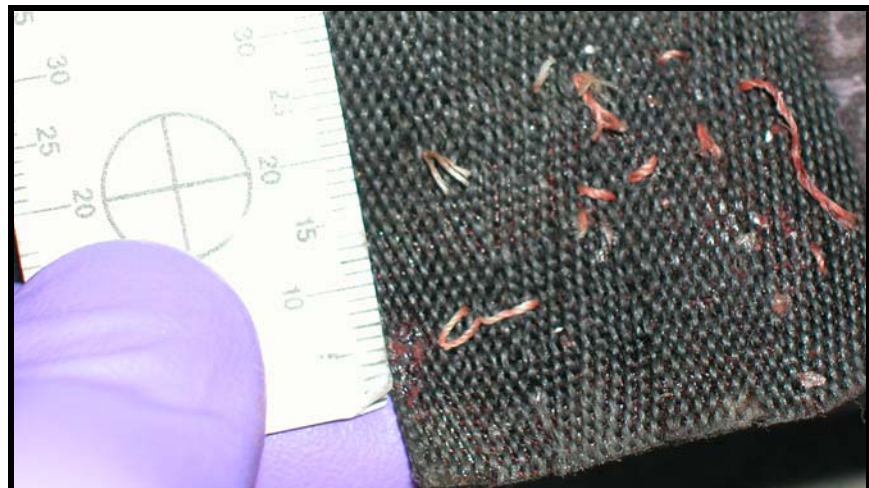


Figure 30. Close up of stitching to end furthest from latch