

CRASH DATA RESEARCH CENTER

Calspan Corporation
Buffalo, NY 14225

**CALSPAN ON-SITE CHILD SAFETY SEAT / SIDE IMPACT AIR BAG
INVESTIGATION**

CALSPAN CASE NO. – CA03-060

SUBJECT VEHICLE – 2000 ACURA 3.2 TL

LOCATION - STATE OF MARYLAND

CRASH DATE – SEPTEMBER 2003

Contract No. DTNH22-01-C-17002

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
Washington, D.C. 20590

DISCLAIMER

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no responsibility for the contents or use thereof.

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the National Highway Traffic Safety Administration.

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.

TECHNICAL REPORT STANDARD TITLE PAGE

<p>1. Report No. CA03-060</p>	<p>2. Government Accession No.</p>	<p>3. Recipient's Catalog No.</p>	
<p>4. Title and Subtitle Calspan On-Site Child Safety Seat / Side Impact Air Bag Investigation Vehicle: 2000 Acura 3.2 TL Location: State of Maryland</p>		<p>5. Report Date: July 2005</p>	
		<p>6. Performing Organization Code</p>	
<p>7. Author(s) Crash Data Research Center</p>		<p>8. Performing Organization Report No.</p>	
<p>9. Performing Organization Name and Address Crash Data Research Center Calspan Corporation P.O. Box 400 Buffalo, New York 14225</p>		<p>10. Work Unit No. C00410.0000.0163</p>	
		<p>11. Contract or Grant No. DTNH22-01-C-17002</p>	
<p>12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Washington, D.C. 20590</p>		<p>13. Type of Report and Period Covered Technical Report Crash Date: September 2003</p>	
		<p>14. Sponsoring Agency Code</p>	
<p>15. Supplementary Note On-site investigation focused on the performance of two child safety seats (CSS) in a 2000 Acura 3.2 TL and the deployment of a side impact air bag.</p>			
<p>16. Abstract This on-site investigation focused on the performance of two child safety seats (CSS) in a 2000 Acura 3.2 TL and the deployment of a side impact air bag. The Acura was involved in an intersection crash with a 1998 Pontiac Transport. The Acura was occupied by a restrained 38-year-old male driver, a restrained 37-year-old female front right passenger, a 7-year-old female seated in a belt positioning booster seat in the rear left, and a 4-year-old female seated in the rear right in a belt positioning booster seat. Both children were restrained by the vehicle's lap and shoulder belts. The Pontiac was occupied by a 35-year-old male driver, a 5-year-old male seated in an unknown type child safety seat in the left side second row, 5-year-old female seated in the right side second row in an integrated child safety seat, and a 5-year-old male seated in the left side third row in a unknown type child safety seat. As a result of the crash, the driver of the Acura sustained six left side rib fractures and a collapsed lung and was transported to a local hospital where he was hospitalized for one day. The front right and rear right occupants in the Acura were not injured. The 7-year-old female rear left occupant sustained minor severity injuries and was transported to a local hospital where she was treated and released. The driver and three child passengers in the Pontiac sustained police reported possible injuries; however, they were not transported to a hospital.</p>			
<p>17. Key Words Child Safety Seat Belt Positioning Booster Seat Side Impact Air Bag Deployment</p>		<p>18. Distribution Statement General Public</p>	
<p>19. Security Classif. (of this report) Unclassified</p>	<p>20. Security Classif. (of this page) Unclassified</p>	<p>21. No. of Pages 14</p>	<p>22. Price</p>

TABLE OF CONTENTS

BACKGROUND.....	1
SUMMARY.....	2
CRASH SITE.....	2
CRASH SITE.....	2
CRASH SEQUENCE.....	2
PRE-CRASH.....	2
CRASH.....	3
POST-CRASH.....	3
VEHICLE DATA – 2000 ACURA 3.2 TL.....	3
1998 PONTIAC TRANSPORT.....	4
VEHICLE DAMAGE.....	5
EXTERIOR DAMAGE – 2000 ACURA 3.2 TL.....	5
INTERIOR DAMAGE – 2000 ACURA 3.2 TL.....	5
EXTERIOR DAMAGE – 1998 PONTIAC TRANSPORT.....	6
INTERIOR DAMAGE– 1998 PONTIAC TRANSPORT.....	6
SIDE IMPACT AIR BAGS – 2000 ACURA 3.2 TL.....	7
FRONTAL AIR BAGS – 2000 ACURA 3.2 TL.....	7
MANUAL RESTRAINTS SYSTEMS – 2000 ACURA 3.2 TL.....	8
CHILD SAFETY SEATS – 2000 ACURA 3.2 TL.....	8
MANUAL RESTRAINTS – 1998 PONTIAC TRANSPORT.....	9
FRONTAL AIR BAGS – 1998 PONTIAC TRANSPORT.....	10
SIDE IMPACT AIR BAGS – 1998 PONTIAC TRANSPORT.....	10
INTEGRATED CHILD SAFETY SEAT – 1998 PONTIAC TRANSPORT.....	10
OCCUPANT DEMOGRAPHICS – 2000 ACURA 3.2 TL.....	11
DRIVER.....	11
DRIVER INJURIES.....	11
DRIVER KINEMATICS.....	11
DRIVER MEDICAL TREATMENT.....	12
FRONT RIGHT PASSENGER.....	12
FRONT RIGHT PASSENGER INJURIES.....	12
FRONT RIGHT PASSENGER KINEMATICS.....	12
MEDICAL TREATMENT.....	12
REAR LEFT PASSENGER.....	13
REAR LEFT PASSENGER INJURIES.....	13
REAR LEFT PASSENGER KINEMATICS.....	13
REAR RIGHT PASSENGER.....	13
REAR RIGHT PASSENGER KINEMATICS.....	13
SCENE SCHEMATIC: FIGURE 20.....	14

**CALSPAN ON-SITE CHILD SAFETY SEAT / SIDE IMPACT AIR BAG
INVESTIGATION
CALSPAN CASE NO: CA03-060
SUBJECT VEHICLE – 2000 ACURA 3.2 TL
LOCATION - STATE OF MARYLAND
CRASH DATE – SEPTEMBER 2003**

BACKGROUND

This on-site investigation focused on the performance of two child safety seats (CSS) in a 2000 Acura 3.2 TL (**Figure 1**) and the deployment of a side impact air bag. The Acura was involved in an intersection crash with a 1998 Pontiac Transport. The Acura was occupied by a restrained 38-year-old male driver, a restrained 37-year-old female front right passenger, a 7-year-old female seated in a belt positioning booster seat in the rear left, and a 4-year-old female seated in the rear right in a belt positioning booster seat. Both children were restrained by the vehicle's lap and shoulder belts. The Pontiac was occupied by a



Figure 1. 2000 Acura 3.2 TL.

35-year-old male driver, a 5-year-old male seated in an unknown type child safety seat in the left side second row, 5-year-old female seated in the right side second row in an integrated child safety seat, and a 5-year-old male seated in the left side third row in an unknown type child safety seat. As a result of the crash, the driver of the Acura sustained six left side rib fractures and a collapsed lung and was transported to a local hospital where he was hospitalized for one day. The front right and rear right occupants in the Acura were not injured. The 7-year-old female rear left occupant sustained minor severity injuries and was transported to a local hospital where she was treated and released. The driver and three child passengers in the Pontiac sustained police reported possible injuries; however, they were not transported to a hospital.

This September 2003 crash was identified by the National Automotive Sampling System through the weekly review of police crash reports. The crash information was forwarded to the Crash Investigation Division of the National Highway Traffic Safety Administration (NHTSA) due to the presence of the child safety seats. The case was assigned to the Calspan Special Crash Investigations (SCI) team on October 2003 and an on-site investigation was initiated on October 2003. A partial in-person interview with the driver of the Acura was obtained; the driver of the Pontiac failed to respond by telephone and letter of correspondence. The treating medical facilities would not comply with our request for medical records.

SUMMARY

Crash Site

This crash occurred at a four-leg intersection (**Figure 2**) during the daytime hours of September 2003. At the time of the crash, the weather was clear with no adverse conditions. The north/southbound lanes were configured with two through traffic lanes, a right turn lane, and a left turn lane. The north/south roadway was divided by a raised concrete median that consisted of trees and grass. The east/westbound roadway consisted of four lanes. The westbound lanes were configured with one through traffic lane, a left turn lane, and a right turn lane. The eastbound lanes were configured with two through traffic lanes. The east/west roadway was divided by double yellow centerlines. Traffic flow through the intersection was controlled by overhead three-phase traffic signals. A thunder storm disabled the traffic lights and temporary stops signs were placed at the intersection to control traffic at the time of the crash. The posted speed limit for both roadways was 56 km/h (35 mph). The scene schematic is included as (**Figure 20**) of this report.



Figure 2. Crash site viewed from the northwest quadrant.

Traffic flow through the intersection was controlled by overhead three-phase traffic signals. A thunder storm disabled the traffic lights and temporary stops signs were placed at the intersection to control traffic at the time of the crash. The posted speed limit for both roadways was 56 km/h (35 mph). The scene schematic is included as (**Figure 20**) of this report.

Crash Sequence

Pre-Crash

The 38-year-old male restrained driver of the Acura was operating the vehicle eastbound in the left lane approaching the intersection (**Figure 3**). The 35-year-old restrained male driver of the Pontiac was traveling southbound (**Figure 4**) approaching the same intersection. The Pontiac failed to stop at the temporary stop sign and entered the intersection. The police reported that the Acura had stopped at the intersection and then proceeded into the intersection.



Figure 3. Acura's approach to the intersection.



Figure 4. Pontiac's approach to the intersection.

Crash

The full frontal aspect of the Pontiac impacted the left aspect of the Acura in the intersection (**Figure 5**). Three small gouges in the asphalt road surface were present in the area of the point of impact. The resultant directions of force were 10 o'clock for the Acura and 1 o'clock for the Pontiac. The damage algorithm of the WINSMASH program computed a total delta-V of 24.0 km/h (14.9 mph) for the Acura. The longitudinal and lateral components for the Acura were -12.0 km/h (-7.5 mph) and 20.8 km/h (12.9 mph), respectively. The total delta V for the Pontiac was 23.0 km/h (14.3 mph). The longitudinal and lateral components for the Pontiac were -19.9 km/h (-12.4 mph) and -11.5 km/h (-7.1 mph) respectively. As a result of the impact, the Acura's frontal air bags deployed and the driver's side impact air bag deployed. The Pontiac's frontal air bags deployed and the front safety belt pretensioners fired as a result of the crash.



Figure 5. Area of impact from Acura's approach.

Post-Crash

Both vehicles came to rest in the northwest quadrant of the intersection. The driver of the Acura sustained six left side rib fractures and was transported to a local hospital where he was hospitalized for one day. The front right and rear right occupant's in the Acura were not injured. The 7-year-old female rear left occupant sustained minor severity injuries and was transported to a local hospital where she was treated and released. The driver and three child passengers in the Pontiac sustained police reported possible injuries, however, they were not transported to a hospital. Both vehicles sustained disabling damage and were towed from the crash site.

Vehicle Data – 2000 Acura 3.2 TL

The 2000 Acura 3.2 TL was identified by the Vehicle Identification Number (VIN): 19UUA5663Y (production sequence omitted). The odometer reading was unknown due to the vehicle having no power. The vehicle was a four-door sedan that was equipped with a 3.2-liter, V6-engine, front-wheel drive, five-speed automatic transmission, traction control, power-front/rear disc brakes with anti-lock, OEM alloy wheels, power steering, and tilt steering wheel. The Acura was equipped with Michelin MXV4 radials, size P205/60R16 tires with a maximum pressure of 303.4 kPa (44.0 PSI) listed on the sidewall. The vehicle manufacturer's recommended tire was pressure was 220.6 kPa (32.0 PSI). The specific tire data was as follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	317 kPa (46 PSI)	6 mm (7/32)	No	None
LR	186 kPa (27 PSI)	3 mm (4/32)	No	None
RF	179 kPa (26 PSI)	7 mm (9/32)	No	None
RR	207 kPa (30 PSI)	3 mm (4/32)	No	None

The seating positions in the Acura were configured with front bucket seats with height adjustable head restraints. The front seat head restraints were both adjusted to the full-down position at the time of the vehicle inspection. The rear seat was configured with a bench seat with a folding center armrest and integrated head restraints for the outboard seating positions.

1998 Pontiac Transport

The 1998 Pontiac Transport was identified by the VIN: 1GMDX03E2W (production sequence omitted). At the time of the vehicle inspection, the odometer reading was 186,782 km (116,064 miles). The vehicle was a four-door minivan that was equipped with a 3.4-liter, V6-engine, front-wheel drive, four-speed automatic transmission, front disc and rear drum brakes with anti-lock, OEM alloy wheels, power steering, and tilt steering wheel. The front tires on the Pontiac were Winston Californian; size P215/70R15 with a maximum pressure of 241.3 kPa (35.0 PSI) listed on the sidewall. The rear tires were Goodyear Integrity; size P215/70R15 with a maximum pressure of 303.3 kPa (44.0 PSI) listed on the sidewall. The vehicle manufacturer's recommended tire pressure was 241.3 kPa (35.0 PSI). The specific tire data was as follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	145 kPa (21 PSI)	6 mm (8/32)	No	None
LR	145 kPa (21 PSI)	5 mm (6/32)	No	None
RF	172 kPa (24 PSI)	1 mm (1/32)	No	None
RR	0 kPa (0 PSI)	7 mm (9/32)	No	Air out

The seating positions in the Pontiac were configured with front bucket seats with height adjustable head restraints. The front seat head restraints were adjusted to the full-down position at the time of the vehicle inspection. The second row seat was configured with removable three-passenger modular type seats. The second row right seat contained an integrated CSS. The third row was configured with removable two-passenger modular type seats.

Vehicle Damage

Exterior Damage – 2000 Acura 3.2 TL

The 2000 Acura 3.2 TL sustained moderate left side damage as a result of the impact with the Pontiac (Figure 6). The maximum crush was 29.2 cm (11.5”) and was located on the left rear door. The direct contact damage began 78.7 cm (31.0”) rear of the left front axle and was 173.3 cm (68.3”) in length. The damage consisted of laterally displaced left front and left rear doors, disintegrated left rear and right front glazing and the forward aspect of the left rear quarter panel was displaced laterally. Six crush measurements were documented at the mid-door level using a combined direct and induced damaged width of 234.9 cm (92.5”) and were as follows: C1 = 0.0 cm, C2 = 17.8 cm (7.0”), C3 = 27.9 cm (11.0”), C4 = 25.4 cm (10.0”), C5 = 18.4 cm (7.3”), C6 = 1.9 cm (0.8”). The Collision Deformation Classification (CDC) for the impact was 10-LPEW-3.



Figure 6. Damage profile of 2000 Acura 3.2 TL.

Interior Damage – 2000 Acura 3.2 TL

The interior damage to the 2000 Acura 3.2 TL was moderate and attributed to passenger compartment intrusion and occupant contact (Figure 7). The driver’s occupant contacts consisted of a scuff to the rear aspect of the door-mounted armrest from contact with the driver’s hip. The front right passenger’s contacts consisted of a left hip contact to the center arm rest which was deflected to the left, a fracture to the center console from contact with the occupant’s left hip, and the center console trim panel was separated from contact with the occupant’s left hip. A fabric transfer to the front right seat back was noted from contact with the right front occupants back. No occupant contacts were noted in the rear. The intrusions are listed in the table below:



Figure 7. Interior damage to 2000 Acura 3.2 TL.

Component	Intrusion	Direction
Left front roof side rail	2.5 cm (1.0”)	Lateral
Left front door	12.2 cm (4.8”)	Lateral
Left front sill	7.6 cm (3.0”)	Lateral
Left B-pillar	15.2 cm (6.0”)	Lateral

Left rear roof side rail	2.5 cm (1.0")	Lateral
Left rear door	19.1 cm (7.5")	Lateral
Left rear sill	10.8 cm (4.3")	Lateral

Exterior Damage – 1998 Pontiac Transport

The 1998 Pontiac Transport sustained moderate frontal damage (**Figure 8**) as a result of the impact with the Acura. The damage consisted of a longitudinally displaced bumper beam, separated bumper fascia, and longitudinally deformed left and right fenders, hood and grille. Both headlight assemblies were disintegrated. The left and right front frame rails were shifted laterally left 16.5 cm (6.5"). The direct contact damage on the bumper fascia was 122.0 cm (48.0") and began 77.5 cm (30.5") right of the centerline to 44.5 cm (17.5") left of the centerline. Six crush measurements were documented at the bumper beam using a combined direct and induced damage width of 132.1 cm (52.0") and were as follows: C1= 0.0 cm, C2= 11.3 cm (4.5"), C3= 16.5 cm (6.5"), C4= 17.1 cm (6.7"), C5= 14.9 cm (5.9"), C6= 0.0 cm. The CDC for this impact was 81-FDEW-2 with an incremented shift value of 80.



Figure 8. Damage profile of 1998 Pontiac Transport.

Six crush measurements were documented at the bumper beam using a combined direct and induced damage width of 132.1 cm (52.0") and were as follows: C1= 0.0 cm, C2= 11.3 cm (4.5"), C3= 16.5 cm (6.5"), C4= 17.1 cm (6.7"), C5= 14.9 cm (5.9"), C6= 0.0 cm. The CDC for this impact was 81-FDEW-2 with an incremented shift value of 80.

Interior Damage– 1998 Pontiac Transport

The 1998 Pontiac Transport (**Figure 9**) sustained minor interior damage as result of occupant contacts and air bag deployment. The occupant contacts consisted of the driver loading the manual 3-point lap and shoulder belt which resulted in a D-ring transfer on the safety belt. The damage from air bag deployment consisted of the frontal passenger air bag cover flap contacting and fracturing the windshield and a vinyl transfer on the windshield. Also noted were multiple abrasions and indentations on the second and third row seat backs, cushions, and head restraints that were consistent with the frequent installation and removal of child safety seats.



Figure 9. Interior of 1998 Pontiac from rear of vehicle.

Side Impact Air Bags – 2000 Acura 3.2 TL

The 2000 Acura 3.2 TL was equipped with front left and front right seatback mounted side impact air bags. The driver's side air bag deployed (**Figure 10**) as result of the impact with the Pontiac. The air bag was concealed in the left front seat back and was covered by a leather flap that was 21.1 cm (8.3") in height and 7.1 (2.8") in width. The top of the air bag extended from the seatback to 34.3 cm (13.5") forward and the bottom extended 22.9 cm (9.0") forward. The air bag was 25.4 cm (10.0") in height at the seatback and the forward edge was 19.1 cm (7.5"). The air bag contained a single tether that was stitched at the center of the air bag membrane. The tether was 8.9 cm (3.5") in width and 4.6 cm (1.8") in height. Two 2.0 cm (0.8") diameter vent ports vented the air bag at the forward edge. No occupant contact evidence was noted to the air bag.



Figure 10. Deployed driver's side impact air bag.

The front right side impact air bag did not deploy. Additionally, the right front seat was equipped with an occupant position sensor for the right front side impact air bag.

Frontal Air Bags – 2000 Acura 3.2 TL

The 2000 Acura 3.2 TL was equipped dual-stage frontal air bags for the front left and front right positions. The air bags deployed (**Figure 11**) as result of the impact with the Pontiac. It's not known if one or both stages deployed in the crash. Two non-symmetrical cover flaps covered the front left air bag module. The top flap was 17.5 cm (6.9") at its widest point and 8.4 cm (3.3") in height. The lower flap was 13.5 cm (5.3") at its widest point and 4.6 cm (1.8") in height. The air bag was 58.4 cm (23.0") in diameter and contained two 19.1 cm (7.5") tethers on the face of the air bag at the 12 and 6 o'clock positions. Two 3.6 cm (1.4") diameter vent ports that were located on the rear of the air bag at the 10 and 2 o'clock positions vented the air bag. No occupant contact evidence was noted to the driver's frontal air bag.



Figure 11. Deployed frontal air bags.

The front right air bag module was located on the top right instrument panel. The air bag module was covered by a single cover flap that was hinged on the forward aspect and measured 25.6 cm (10.1") in width and 8.9 cm (3.5") in height. The air bag was 57.2 cm

(22.5”) in width and 58.4 cm (23.0”) in height. The air bag was not tether and contained two symmetrical vent ports that were 4.6 cm (1.8”) in diameter and were located on the side panels of the air bag at the 3 and 9 o’clock positions. No occupant contact evidence was noted to the air bag.

Manual Restraints Systems – 2000 Acura 3.2 TL

The 2000 Acura 3.2 TL was equipped with manual 3-point lap and shoulder belts for all five seating positions. The driver’s safety belt was configured with a continuous loop webbing, sliding latch plate, and a belt sensitive Emergency Locking Retractor (ELR). The front right safety belt was configured with continuous loop webbing, sliding latch plate, and a switchable ELR/Automatic Locking Retractor (ALR). The driver and front right passenger utilized their safety belts at the time of the crash. The rear safety belts were configured with continuous loop webbings, sliding latch plates and switchable ELR/ALR retractors. The two outboard rear safety belts were used with belt positioning booster seats. A plastic transfer was noted to the rear left safety belt from use with the belt positioning booster seat.

Child Safety Seats – 2000 Acura 3.2 TL

Two child safety seats were used in the rear of the Acura during the crash. The rear left seat was a Cosco Eddie Bauer Model No. 02849EBG and was manufactured on 01/2/00 (**Figure 12**). The seat was designed to be used as a forward facing CSS with the 5-point harness for children weighing 12.2-18.1 kg (22-40 lbs) or as a belt-positioning booster for children weighing 13.6-36.3 kg (30-80 lbs). The seat was used as a belt-positioning booster and was occupied by a 7-year-old female. The booster seat was equipped with a five-point harness system that was attached to the seat and positioned in the top slots at the time of the inspection. It’s unknown if the child was sitting on the harness system at the time of the crash. The plastic transfer that was noted to the rear left safety belt indicated that the child safety seat was used as a belt positioning booster seat at the time of the crash. The booster seat sustained minor damage as a result of intrusion. The rear left foot/leg at the base of the seat was deflected inward 0.3 cm (0.1”) from contact with the intruding left rear door.

The rear right CSS was a Cosco Eddie Bauer Model No. 02849EBG and was manufactured on 7/10/00 (**Figure 13**). A 4-year-old female occupied the CSS. The CSS was designed to be used as a forward facing CSS with the 5-point harness for children weighing 12.2-18.1 kg (22-40 lbs) or as a belt-positioning booster for children weighing 13.6-36.3 kg (30-80 lbs). The seat was used as a belt positioning booster seat in the subject crash. The 5-point harness was still attached to the booster seat. The harness straps were positioned on the top slots at the time of the inspection. It was unknown where the internal harness system was stored in relation to the child at the time of the crash. The booster seat sustained minor damage as result of the crash. The damage consisted of abrasions to the CSS from the vehicle’s lap and shoulder belt. The abrasions were noted to the right side outboard belt path from the lap belt portion of vehicle’s safety belt. The abrasion measured 4.6 cm (1.8”) in height and 1.0 cm (0.4”) wide. An abrasion from loading was noted to the left apex of the left side inboard belt path and was measured as 2.3 cm (0.9”) in height by 1.0 cm (0.4”) width.



Figure 12. Cosco booster that was occupied by the 7-year-old female.



Figure 13. Cosco booster seat that was occupied by the 4-year-old female.

Manual Restraints – 1998 Pontiac Transport

The 1998 Pontiac Transport was equipped manual 3-point lap and shoulder belts for the six outboard seating positions. The second row center was equipped with a manual 2-point lap belt. The front left safety belt was configured with a sliding latch plate, belt sensitive Emergency Locking Retractor (ELR), and a buckle pretensioner. The pretensioner fired as a result of the crash with the Acura (**Figure 14**). The stroke of the fired driver's pretensioner was measured 0.5 cm (0.2"). The driver utilized the lap and shoulder belt in this crash. This was evidenced by a D-ring transfer to the safety belt. The front right safety belt was configured with a sliding latch plate, switchable ELR/Automatic Locking Retractor (ALR), and a buckle pretensioner. The stroke of the unoccupied front right seat pretensioner measured 4.3 cm (1.7").



Figure 14. Fired driver's buckle pretensioner.

The outboard second row safety belts were configured with sliding latch plates and switchable ELR/ALR. The center safety belt was configured with a sewn-on latch plate and an ALR. The third row safety belts were configured with locking latch plates and switchable ELR/ALR. The webbings for the second and third row outboard seating positions were gathered at the D-rings and abraded from use with child safety seats.

Frontal Air Bags – 1998 Pontiac Transport

The 1998 Pontiac Transport was equipped redesigned frontal air bags that deployed as a result of the impact with the Acura. The Pontiac was equipped with a Sensing and Diagnostic Module (SDM) that had EDR capabilities. The EDR could only be downloaded from this vehicle through the Diagnostic Link Connector (DLC) with a 12-volt power source and the ignition key. The ignition key was not present with the vehicle; therefore the EDR could not be downloaded. The driver's air bag was located in the center of the steering wheel hub (**Figure 15**) and was covered by "I" configuration cover flaps that measured 8.9 cm (3.5") in height and 10.9 cm (4.3") in width. The air bag was 67.3 cm (26.5") in diameter. The air bag was not tethered and was vented by two 2.5 cm (1.0") diameter vent ports on the rear aspect of the air bag at the 3 and 9 o'clock positions. No occupant contact evidence was noted to the air bag; however, expansion marks were noted on the face of the air bag at the 6 o'clock position.

The front right air bag was located on the top right instrument panel (**Figure 16**). The air bag contained a single cover flap. The air bag was 52.1 cm (20.5") in height and 55.6 cm (22.0) in width. The air bag contained four tethers and was vented by two 2.5 cm (1.0") vent ports on the on the side panels at the 3 and 9 o'clock positions. No occupant contact evidence was noted to the air bag.



Figure 15. Deployed driver's frontal air bag.



Figure 16. Deployed front right frontal air bag.

Side Impact Air Bags – 1998 Pontiac Transport

The 1998 Pontiac Transport was equipped with seatback mounted side impact air bags for the front (**Figure 17**) seating positions. The Pontiac did not sustain a side impact, therefore the side impact air bags did not deploy in this crash.

Integrated Child Safety Seat – 1998 Pontiac Transport

The 1998 Pontiac Transport was equipped with an integrated child safety seat in the second row right seating position (**Figure 18**). The



Figure 17. Non-deployed driver's side impact air bag.

integrated safety seat was designed to be used for children that weigh between 9.9-18.1 kg (22.0-40.0 lbs) and between 85.1-101.6 cm (33.5-40.0”) in length as specified on the warning label (**Figure 19**). The integrated safety seat was configured with a five-point harness system. The harness system exhibited evidence of frequent use. The police reported that the 5-year-old male occupied this seat during the crash. No evidence of loading or failures were noted to the seat.



Figure 18. Integrated child safety seat in the second row right of the 1998 Pontiac Transport.



Figure 19. Warning label on the integrated child safety seat.

Occupant Demographics – 2000 Acura 3.2 TL

Driver

Age/Sex: 38-year-old male
 Height: 177.8 cm (70.0”)
 Weight: 81.6 kgs (180.0 lbs)
 Seat Track Position: 1.5 cm (0.6”) forward of full rear.
 Manual Restraint Use: Manual 3-point lap and shoulder belt
 Usage Source: Vehicle inspection
 Eyewear: None
 Type of Medical Treatment: Transported to a hospital admitted for one day

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Six left side rib fractures, NFS	Serious (450230.3,2)	Left door panel
Collapsed lung unknown side, NFS	Not coded due to incomplete injury data	Left door panel

Source – Partial driver interview.

Driver Kinematics

The 38-year-old male driver of the 2000 Acura 3.2 TL was seated in an upright posture. He was restrained by the manual 3-point lap and shoulder belt. At impact, he initiated a left and slightly forward trajectory in response to the 10 o'clock direction of force. The driver's left torso contacted the door panel, which resulted in the six left side rib fractures

and unknown collapsed lung. The driver was transported to local hospital where he was admitted for one day.

Driver Medical Treatment

Although the driver was hospitalized, the medical records were not obtained due to the lack of cooperation with the subject hospital. The above injury information was obtained from the driver interview. The collapsed lung injury was not coded in the Electronic Data System (EDS) due to coding regulations, as medical records were not available to substantiate the injury.

Front Right Passenger

Age/Sex: 37-year-old female
 Height: 170.2 cm (67.0")
 Weight: 61.3 kgs (135.0 lbs)
 Seat Track Position: 12.0 cm (4.7") rear of full forward and 11.6 cm (4.6") forward of full rear.
 Manual Restraint Use: Manual 3-point lap and shoulder belt
 Usage Source: Vehicle inspection
 Eyewear: None
 Type of Medical Treatment: Transported to a local hospital. Treated and released

Front Right Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Neck and back pain, NFS	Not coded under AIS	Impact forces

Source – Partial driver interview.

Front Right Passenger Kinematics

The 37-year-old female front right passenger of the 2000 Acura 3.2 TL was seated in an upright posture. She was restrained by the manual 3-point lap and shoulder belt. At impact, she initiated a left slightly forward trajectory. The front right passenger’s left hip contacted the center console displacing it left. As a result of her lateral displacement, she sustained soft tissue injuries to her neck and back. She was transported to a local hospital where she was treated and released.

Medical Treatment

The medical records for this occupant were not obtained due to the lack of cooperation with the subject hospital.

Rear Left Passenger

Age/Sex: 7-year-old female
Height: 116.8 cm (46.0’’)
Weight: 18.1 kgs (40.0 lbs)
Seat Track Position: Not adjustable
Manual Restraint Use: Manual 3-point lap and shoulder belt used with the belt positioning booster seat.
Usage Source: Vehicle inspection
Eyewear: None
Type of Medical Treatment: Transported to a local hospital. Treated and released.

Rear Left Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Bloody nose, NFS	Minor (251090.1,4)	Unknown

Source – Partial driver interview.

Rear Left Passenger Kinematics

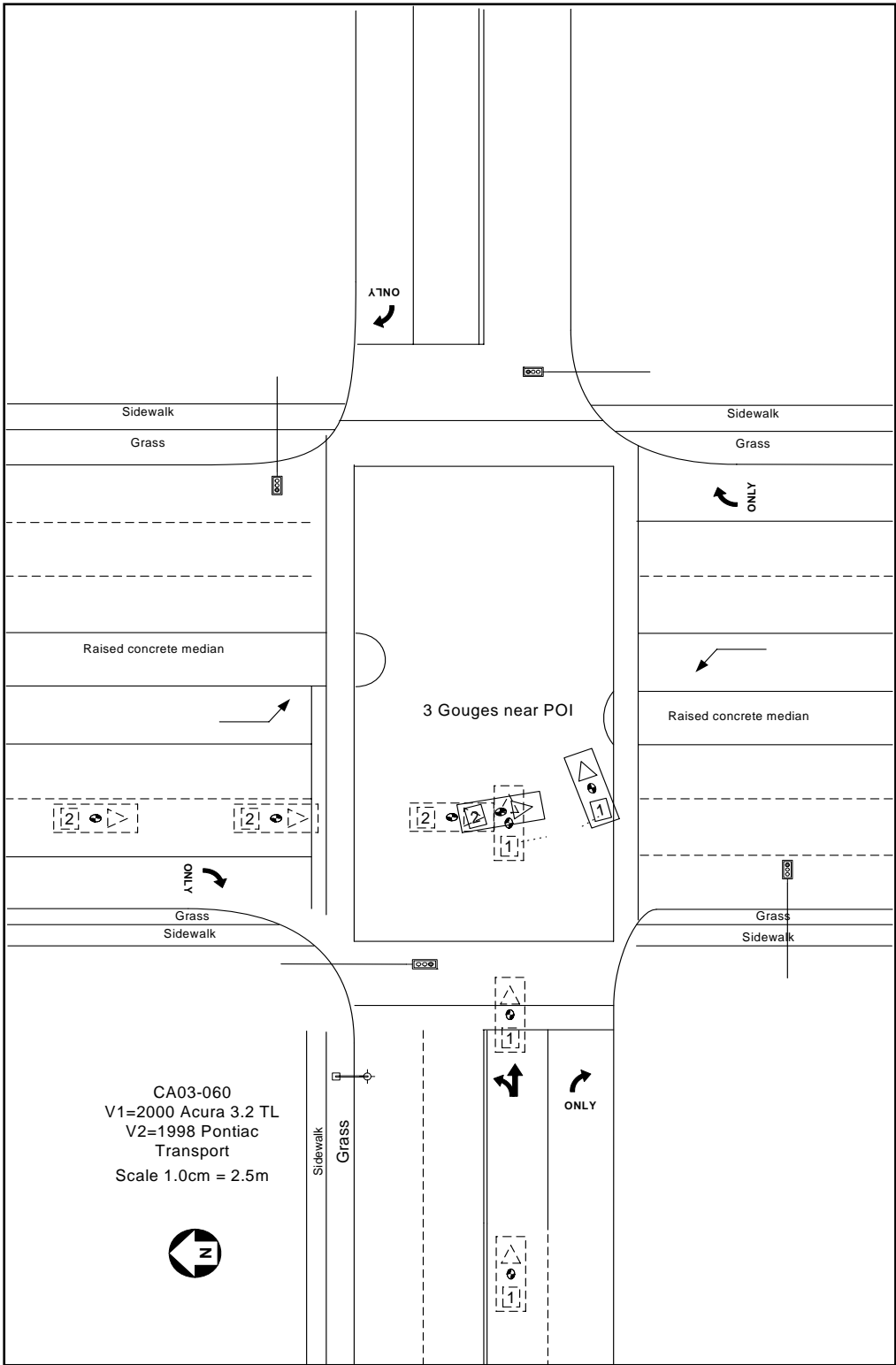
The 7-year-old female rear left passenger of the 2000 Acura 3.2 TL was seated in a belt positioning booster seat in a presumed upright posture. She was restrained by the vehicle’s manual 3-point lap and shoulder belt. At impact, she initiated a left trajectory and in response to the velocity change and the vehicle’s direction of force. She sustained a bloody nose; however, it could not be determined if she contacted an interior component or if it occurred as a result of the impact forces. The rear left passenger was transported to a local hospital where she was treated for the nosebleed and was released. The medical records were not obtained for this occupant due to the lack of hospital cooperation.

Rear Right Passenger

Age/Sex: 4-year-old female
Height: 116.8 cm (46.0’’)
Weight: 19.1 kgs (42.0 lbs)
Seat Track Position: Not adjusted seat track
Manual Restraint Use: Manual 3-point lap and shoulder belt used with belt positioning booster seat.
Usage Source: Vehicle inspection
Eyewear: None
Type of Medical Treatment: Not injured

Rear Right Passenger Kinematics

The 4-year-old female rear right passenger of the 2000 Acura 3.2 TL was seated in a belt positioning booster seat in an upright posture. She was restrained by the vehicle’s manual 3-point lap and shoulder belt. At impact, she initiated a left trajectory. The rear right passenger was not injured as a result of the crash.



Scene Schematic: Figure 20