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ON-SITE CHILD SAFETY SEAT INVESTIGATION

CASE NUMBER - IN01-022
LOCATION - TEXAS
VEHICLE - 1997 CHEVROLET SUBURBAN
CRASH DATE - July 2001

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

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

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15. Supplementary Notes On-site Child Safety Seat investigation involving a 1997 Chevrolet Suburban, four-door sport utility vehicle, with three-point, manual safety belts and dual air bags, and a 1989 Honda Prelude SI.					
16. Abstract This report covers an on-site investigation of a crash that involved a 1997 Chevrolet Suburban (case vehicle) and a 1989 Honda Prelude (other vehicle). This crash is of special interest because the case vehicle's third seat left passenger (5-year-old male), who was restrained in a belt-positioning booster seat, sustained only very minor injuries as a result of the crash (i.e., a success story). The case vehicle was traveling east in the outside eastbound lane of a five-lane, undivided county roadway, negotiating a curve right and intending to continue eastward. The Honda was also traveling east and was attempting to pass the case vehicle on the right by traveling on the shoulder. The Honda's driver decided to abort the passing maneuver, steered to the left and braked, and the Honda impacted the case vehicle. The case vehicle's driver made no avoidance maneuvers prior to the crash. The case vehicle's right rear area was impacted by the Honda's front left corner (event #1). The case vehicle rotated approximately 180 degrees clockwise and skidded off the south edge of the roadway and across the shoulder. It impacted a W-beam steel guardrail (event #2), began to roll over (event #3), impacted a delineator post (event #4) and rolled over onto the grassy incline on the roadside beyond the guardrail. The case vehicle's driver and front right passenger air bags did not deploy. The case vehicle rolled left four quarter-rolls and came to rest on the roadside, on its wheels, heading in a westerly direction. The case vehicle's third seated left passenger was seated in his belt-positioning booster seat and restrained by his available, active, three-point, lap-and-shoulder, safety belt system. According to the front right passenger (mother), he sustained only minor injuries and did not receive any medical treatment. His injuries consisted of: an abrasion to the left side of his neck from the seat belt webbing and a few small lacerations to his left hand from flying glass. The other three occupants in the case vehicle also sustained minor injuries and were not transported or treated.					
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This on-site investigation was brought to the NHTSA's attention on August 16, 2001 by the wife of the case vehicle driver. This crash involved a 1997 Chevrolet Suburban (case vehicle), a 1989 Honda Prelude SI (other vehicle), and a guardrail. The crash occurred in July, 2001, at 10:50 a.m., in Texas and was investigated by the applicable county sheriff. This crash is of special interest because the case vehicle's third seat left passenger [5-year-old, White (non-Hispanic) male], who was restrained in a belt-positioning booster seat, did not sustain any injuries during the crash (i.e., a success story). This contractor inspected the scene, vehicles, and booster seat on August 20-21, 2001 and interviewed the case vehicle's front right passenger on August 21, 2001. This summary is based on the Police Crash Report, an interview with the front right passenger, scene and vehicle inspections, occupant kinematic principles, and this contractor's evaluation of the evidence.

SUMMARY

The case vehicle was traveling east in the outside eastbound lane of a five-lane, undivided county roadway (i.e., there were two through lanes in both directions and center bi-directional left turn lane), negotiating a curve right and intending to continue eastward. The Honda had been traveling east in the outside eastbound lane of the same roadway at higher speed and was attempting to pass the case vehicle on the right by traveling on the shoulder. The Honda's driver decided to abort the passing maneuver, steered to the left and braked, and the Honda impacted the case vehicle. The case vehicle's driver made no avoidance maneuvers prior to the crash. The first harmful event occurred in the outside eastbound lane of the roadway.

The case vehicle's right rear overhang, wheel/tire and wheel well area were impacted by the Honda's front left corner (event #1). The case vehicle rotated approximately 180 degrees clockwise and skidded off the south edge of the roadway and across the shoulder. It impacted the down-sloping end treatment of a steel W-beam guardrail (event #2), began to roll over (event #3), impacted a delineator post (event #4) and rolled over onto the grassy incline on the roadside beyond the guardrail. The case vehicle's driver and front right passenger air bags did not deploy. The Honda subsequently lost control and struck the guardrail (event #5) further east of the case vehicle's impact area. The case vehicle rolled left four quarter-rolls (rotation about the longitudinal axis) and came to rest on the roadside, on its wheels, heading in a westerly direction. The Honda came to rest on the shoulder adjacent to the guardrail heading in a southwesterly direction.

The 1997 Chevrolet Suburban was a rear wheel drive, four-door sport utility vehicle (VIN: 1GNEC16R1VJ-----). The case vehicle was equipped with anti-lock brakes. Based on the vehicle inspection, the CDCs for the case vehicle were determined to be: **05-RBEW-2 (150)** (event #1, impact with the Honda); **09-LBEW-2 (260)**, (event #2, impact with guardrail that tripped the case vehicle initiating the rollover); **00-TYDO-3** (event #3, roll left four quarter-rolls); and **00-LBAN-2** (event #4, non-horizontal impact with a delineator post). The WinSMASH reconstruction program, missing vehicle algorithm, was used on the case vehicle's impact with the Honda (event #1) which was the second highest severity impact. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 6 km.p.h. [3.7 m.p.h.], +5.2 km.p.h. [+3.2 m.p.h.], and

-3.0 km.p.h. [-1.9 m.p.h.]. These results should be considered marginal. This contractor's visually estimated Delta V for the left side impact with the guardrail is between 10 km.p.h. [6 m.p.h.] and 16 km.p.h. [10 m.p.h.]. This contractor's visually estimated Delta V for the rollover event is between 13 km.p.h. [8 m.p.h.] and 19 km.p.h. [12 m.p.h.]. The case vehicle was towed due to damage.

The case vehicle's contact with the Honda involved the right rear quarter panel. Direct damage began 60 centimeters [23.6 inches] rearward of the right rear axle and extended forward a measured distance 172 centimeters [67.7 inches] ending at the right rear door. Maximum crush for the impact with the Honda was measured as 14 centimeters [5.5 inches] between C3 and C4. The case vehicle's contact with the guardrail involved the left rear quarter panel and wheel. Direct damage began 59 centimeters [23.2 inches] rearward of the left rear axle and extended forward a measured distance of 170 centimeters [66.9 inches], ending at the left rear door. Maximum crush for the impact with the guardrail was measured as 11 centimeters [4.3 inches] between C4 and C5. The case vehicle's rollover involved the front half of the top surface. Direct damage began at the front edge of the hood and extended rearward a measured distance of 270 centimeters [106.3 inches], ending just beyond the right B-pillar. Maximum crush was measured as 17 centimeters [6.7 inches]. The case vehicle's wheelbase on both sides was shortened 2 centimeters [0.8 inches]. The case vehicle's hood, roof, left and right rear quarter panels were directly damaged and crushed inward. The case vehicle's left front and both rear tires were damaged and deflated but none of the tires were physically restricted. Remote buckling was also found on the roof and hood. The glazing of the left backlight, left rear cargo area, and the right front and right doors was disintegrated. The case vehicle had a moderate amount of intrusion by the roof, right roof rail, and windshield.

The case vehicle's driver air bag was located in the steering wheel hub and the front right passenger's air bag was located in the middle of the instrument panel. Because this crash did not involve significant longitudinal deceleration, the air bags did not deploy.

Inspection of the case vehicle's interior revealed no conclusive evidence of occupant contact. However, there was a red scuff on the front right passenger's knee bolster as well as a reddish smear to the third seated left passenger's seat back and seat belt webbing.

The 1989 Honda Prelude SI was a front wheel drive, two-door coupe (VIN: JHMBA4130KC-----). Because of the overlapping damage on the Honda's front end, only partial CDC's could be determined: **12-F9EW-1 (350)** (event #1, impact with the case vehicle) and **99-F9EW-9** (event #6, impact with the guardrail). Maximum crush for the impact with the case vehicle is estimated as 12 centimeters [4.7 inches]. The Honda was towed due to damage.

Immediately prior to the crash the case vehicle's third seated left passenger (5-year-old male, white, non-Hispanic, 122 centimeters and 21 kilograms [48 inches, 47 pounds]) was seated in an upright posture with his back against the seat back, his feet hanging down over the front edge of the seat's cushion angled downward, and both his hand in his lap holding his security blanket. His seat track and seat back were not adjustable.

The case vehicle's third seated left passenger was seated in his belt-positioning booster seat restrained by his available, active, three-point, lap-and-shoulder, safety belt system. There was evidence of belt pattern abrasions on his neck, and inspection of his seat belt webbing and latch plate showed evidence of loading.

The case vehicle's driver made no known pre-crash avoidance maneuvers. As a result and independent of the use of his available safety belts, the third seated left passenger's pre-impact body position did not change just prior to impact. The case vehicle's impact with the Honda resulted in the passenger moving slightly back and to his right toward the case vehicle's 150 degree direction of principal force as the case vehicle was knocked into a clockwise rotation. As the case vehicle continued in an easterly direction, it rotated clockwise approximately 180 degrees and this passenger continued leaning to the right. Upon impact with the guardrail, he moved leftward and upward as the case vehicle rolled over. This leftward and upward movement caused his neck abrasion from interacting with his shoulder restraint. His movements from the initial rollover point to final rest are unknown. At final rest, he remained in his belt-positioning booster seat.

The third seated left passenger was not transported by ambulance to the hospital. According to an interview with the front right passenger (mother), he sustained minor injuries but was not treated. These injuries consisted of: an abrasion to the left side of his neck from the seat belt webbing and a few small lacerations to his left hand from flying glass.

The child safety seat in use by the case vehicle's third seated left passenger was a belt-positioning booster Child Safety Seat (CSS) manufactured by Evenflo on August 30, 1995 and was identified by model name "Sidekick" (model number 244187P1). The seat was not designed with any type of harness or tether. It was, however, designed with a shield, which was not in use at the time of the crash. The forward facing child seat showed very little wear to the padding or shell. There were no visible areas of stress evidence to the plastic shell of the CSS.

The case vehicle's driver (44-year-old male, white, non-Hispanic, 185 centimeters and 88 kilograms [73 inches, 195 pounds]) was seated in an upright posture with his back against the seat back, his left foot on the floor, his right foot on the accelerator, and both his hands on the steering wheel. His seat track was located in its rearmost position, and the seat back was slightly reclined, and the tilt steering wheel was located in its middle position.

The case vehicle's driver was restrained by his available, active, three-point, lap-and-shoulder, safety belt system. The driver was not transported by ambulance to the hospital. According to the interview with the front right passenger (wife of driver), he sustained minor injuries and was not treated. The injuries sustained by the case vehicle's driver included: right thigh contusion, multiple small glass lacerations to lower legs and feet, and a contusion to his right upper arm.

The case vehicle's front right passenger (40-year-old female, white, non-Hispanic, 165 centimeters and 54 kilograms [65 inches, 120 pounds]) was seated leaning/bent forward, both feet on the floor, and both hands reaching for an object on the floor. Her seat track was located in its rearmost position, the seat back was slightly reclined.

The case vehicle's front right passenger was restrained by her available, active, three-point, lap-and-shoulder, safety belt system. The front right passenger was not transported by ambulance to the hospital. According to her interview, she sustained only minor injuries and was not treated. The injuries sustained by the case vehicle's front right passenger included: contusion to her right forearm, small lacerations from flying glass to her left lower leg, and a small laceration and contusion to her left cheek.

The case vehicle's third seated right passenger (10-year-old female, white, non-Hispanic, 152 centimeters and 51 kilograms [60 inches, 112 pounds]) was seated in an upright posture with her back against the seat back, her feet on the floor, and both her hands in her lap reading a book. Her seat track and seat back were not adjustable.

The case vehicle's third seated right passenger was restrained by her available, active, three-point, lap-and-shoulder, safety belt system. She was not transported by ambulance to the hospital. According to an interview with the front right passenger (mother), the case vehicle's third seated right passenger did not sustain any injuries as a result of this crash.

CRASH CIRCUMSTANCES

The case vehicle was traveling eastbound in the outside eastbound lane of a five-lane, undivided county roadway (i.e., there were two through lanes in both directions and center bi-directional left turn lane), negotiating a curve right and intending to continue eastward. The roadway was curved right and had a positive slope of 3.7 %. The travel lanes, two eastbound and westbound lanes were separated by painted white dashed lane markings. The center bi-directional turn lane was separated from the east and westbound lanes by painted yellow dashed and solid lines. The exact roadway widths are unknown. The only traffic control was a yellow curve sign off the south edge of the roadway. There was a steel W-beam guardrail along the north and south edges of the roadway, immediately adjacent to a wide bituminous shoulder. The legal speed limit is 97 km.p.h. [60 m.p.h.]. The estimated coefficient of friction was approximately 0.60.

The case vehicle was traveling in an easterly direction in the outside eastbound lane and intended on continuing travel east. The case vehicle driver was unaware of a minor road rage incident occurring between the Honda's driver and the driver of a uninvolved vehicle which was in the inside eastbound lane. The driver of the Honda was attempting to illegally overtake the case vehicle on the paved shoulder. As the Honda driver started to overtake the case vehicle along the shoulder he aborted the maneuver and braked while steering back toward the outside eastbound lane. The case vehicle driver was unaware of the Honda driver's intention and made no avoidance

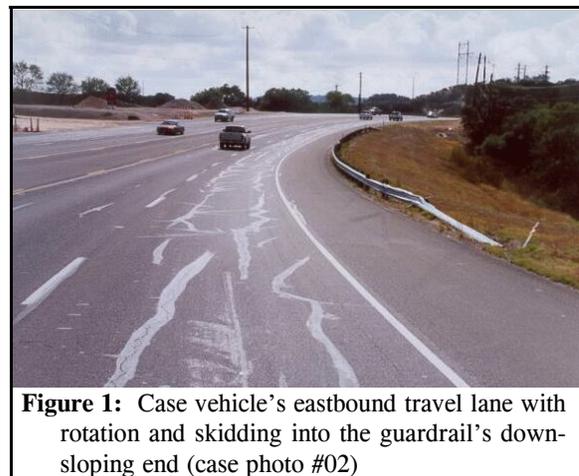


Figure 1: Case vehicle's eastbound travel lane with rotation and skidding into the guardrail's down-sloping end (case photo #02)

maneuvers. The crash occurred along the south edge of the outside eastbound lane (**Figure 1**). The Honda's impact to the case vehicle resulted in the case vehicle losing control and rotating approximately 180 degrees clockwise. The case vehicle continued in a southeasterly direction, going off the roadway and impacting the down-sloping end treatment of the steel W-beam guardrail (event #2). The case vehicle began to roll over (event #3), impacted a delineator post (event #4) and rolled over onto the grassy incline on the roadside beyond the guardrail. Both vehicles deposited tire marks leading into the guardrail (**Figure 2**)

The Honda impacted the case vehicle's right rear quarter panel and wheel. This initial impact is what triggered the case vehicle's clockwise rotation. The case vehicle's left front tire impacted the side of the down-sloping guardrail end, causing it to trip. and impact the guardrail and delineator with the left rear quarter panel as it rolled left four quarter-rolls (rotation about the longitudinal axis) and came to rest on the roadside, on all four wheels, heading in a westerly direction. The case vehicle was towed from the scene due to damage.

Upon impacting the case vehicle, the Honda went into a clockwise rotation off the south edge of the roadway and impacted the steel, W-beam guardrail with the front left half of the bumper. The Honda rotated off the guardrail coming to rest along the paved shoulder on the south edge of the roadway heading in a westerly direction. The Honda was towed from the scene due to damage.

CASE VEHICLE

The case vehicle was a rear wheel drive 1997 Chevrolet Suburban four-door sport utility vehicle (VIN: 1GNEC16R1VJ-----), with three seat rows. The case vehicle had a wheelbase of 334 centimeters [131.5 inches], and was equipped with power-assisted rack-and-pinion steering, 4-speed automatic transmission, and a 5.7 liter V8 engine. Braking was achieved by an hydraulic, power-assisted, front disc and rear drum anti-lock system. The case vehicle had a recorded mileage of 117,724 kilometers [73,152 miles].

The interior of the case vehicle was equipped with a six-way power adjustable driver bucket seat and manual adjustable front right passenger bucket seat with adjustable head restraints (**Figure 3**),

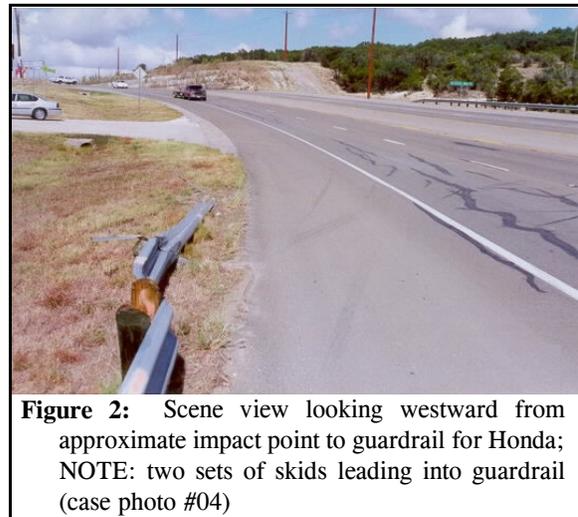


Figure 2: Scene view looking westward from approximate impact point to guardrail for Honda; NOTE: two sets of skids leading into guardrail (case photo #04)

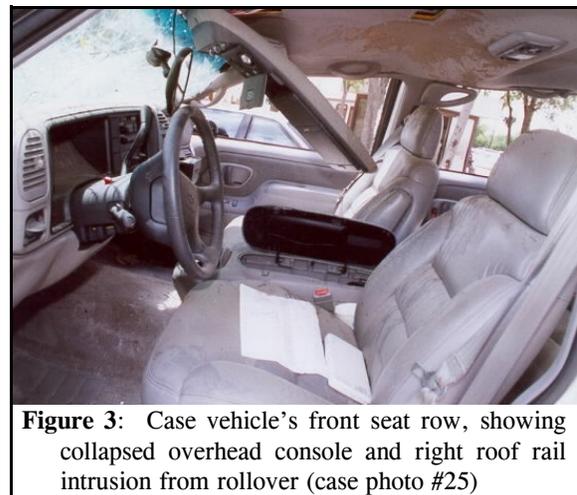


Figure 3: Case vehicle's front seat row, showing collapsed overhead console and right roof rail intrusion from rollover (case photo #25)

three-point lap and shoulder belts in the six outboard seated positions, and a lap belt in the second and third center seat positions. The vehicle was equipped with knee bolsters for the driver and front right passenger. The second seat row consisted of a 60/40 split bench seat with separate folding backs and the third seat row consisted of a single bench seat with a folding back. Both the second and third seat rows had adjustable head restraints for the outboard seat positions, with the second row head restraints removed prior to the crash. The front and second seat three-point belt systems were equipped with manually operated height adjusters for the D-rings. Automatic restraint was provided by a Supplemental Restraint System (SRS) that consisted of a frontal air bag for the driver and front right passenger.

CASE VEHICLE DAMAGE

The case vehicle's contact with the Honda involved the right rear quarter panel (**Figure 4**). Direct damage began 60 centimeters [23.6 inches] rearward of the right rear axle and extended forward a measured distance 172 centimeters [67.7 inches] ending at the right rear door. Maximum crush for the impact with the Honda was measured as 14 centimeters [5.5 inches] between C3 and C4. The case vehicle's contact with the guardrail involved the left rear quarter panel and wheel (**Figure 5**). Direct damage began 59 centimeters [23.2 inches] rearward of the left rear axle and extended forward a measured distance of 170 centimeters [66.9 inches], ending at the left rear door. Maximum crush for the impact with the guardrail was measured as 11 centimeters [4.3 inches] between C4 and C5. The case vehicle's rollover involved the front half of the top surface. Direct damage began at the front edge of the hood and extended rearward a measured distance of 270 centimeters [106.3 inches], ending just beyond the right B-pillar (**Figure 6**). Maximum crush was measured as 17 centimeters [6.7 inches]. The case vehicle's wheelbase on both sides was shortened 2 centimeters [0.8 inches]. The case vehicle's hood, roof, left and right rear quarter panels were directly damaged and crushed inward. The case vehicle's left front and both rear tires were damaged and deflated but none of the tires were physically restricted. Remote buckling was also found on the roof and hood.



Figure 4: View of damaged area to case vehicle from impact with other vehicle (case photo #17)

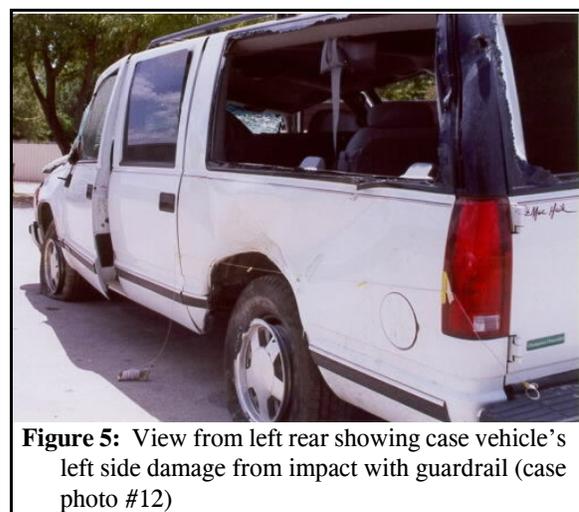


Figure 5: View from left rear showing case vehicle's left side damage from impact with guardrail (case photo #12)

Based on the vehicle inspection, the CDCs for the case vehicle were determined to be: **05-RBEW-2 (150)** (event #1, impact with the Honda); **09-LBEW-2 (260)**, (event #2, impact with guardrail that tripped the case vehicle initiating the rollover); **00-TYDO-3** (event #3, roll left four quarter-rolls); and **00-LBAN-2** (event #4, non-horizontal impact with a delineator post). The WinSMASH reconstruction program, missing vehicle algorithm, was used on the case vehicle's impact with the Honda (event #1) which was the second highest severity impact. The preliminary Total, Longitudinal, and Lateral Delta Vs are, respectively: 6 km.p.h. [3.7 m.p.h.], +5.2 km.p.h. [+3.2 m.p.h.], and -3.0 km.p.h. [-1.9 m.p.h.]. These results should be considered marginal. This contractor's visually estimated Delta V for the left side impact with the guardrail is between 10 km.p.h. [6 m.p.h.] and 16 km.p.h. [10 m.p.h.]. This contractor's visually estimated Delta V for the rollover event is between 13 km.p.h. [8 m.p.h.] and 19 km.p.h. [12 m.p.h.]. The case vehicle was towed due to damage.

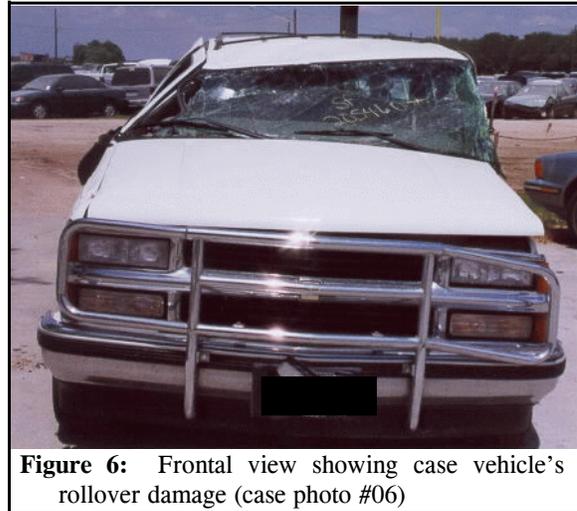


Figure 6: Frontal view showing case vehicle's rollover damage (case photo #06)

An examination of the case vehicle's interior revealed; a cracked windshield from the rollover event. The rearview mirror was knocked off the windshield. The glazing for the left backlight, left rear cargo area, and the right front and right rear doors was disintegrated. The energy absorbing steering column (i.e., shear capsule) showed no evidence of compression. There was a red scuff to the front right passenger knee bolster, the seat back of the third seated passenger, and the seat belt webbing of the third seat passenger (**Figure 10**). The adjustable head restraint on the second seat left seat back was pulled out of its mounts.

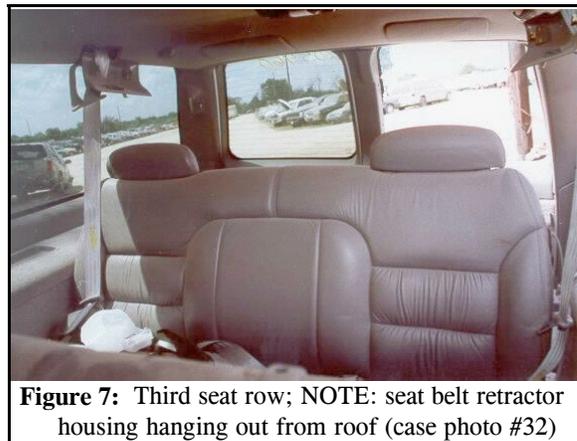


Figure 7: Third seat row; NOTE: seat belt retractor housing hanging out from roof (case photo #32)

Both the retractor housing brackets for the outside third seat positions were pulled out from the roof and hanging down (**Figure 7**). The case vehicle had a moderate amount of intrusion by the roof, overhead center console, right roof rail, windshield header, and windshield (**Figure 3**).

AUTOMATIC RESTRAINT SYSTEM

The case vehicle's driver air bag was located in the steering wheel hub and the front right passenger's air bag was located in the middle of the instrument panel. Because this crash did not involve significant longitudinal deceleration, the air bags did not deploy.

The child safety seat used by the case vehicle's third seated left passenger was a belt positioning booster Child Safety Seat (CSS) manufactured by Evenflo on August 30, 1995 and was identified by model name "Sidekick" (model number 244187P1). The seat was not designed with any type of harness or tether. It was, however, designed with a shield, which was not in use at the time of the crash. The forward facing child seat showed very little wear to the padding or shell (**Figure 8**). There were no visible areas of stress evidence to the plastic shell of the CSS (**Figure 9**).

CASE VEHICLE DRIVER KINEMATICS

The case vehicle's driver ([44-year-old male, white, non-Hispanic, 185 centimeters and 88 kilograms [73 inches, 195 pounds]) was restrained by his available, active, three-point, lap-and-shoulder, safety belt system. He was seated in an upright posture with his back against the seat back, his left foot on the floor, his right foot on the accelerator, and both his hands on the steering wheel. His seat track was located in its rearmost position, and the seat back was slightly reclined, and the tilt steering wheel was located in its middle position.

The case vehicle's driver made no known pre-crash avoidance maneuvers. As a result and independent of the use of his available safety belts, the driver's pre-impact body position did not change just prior to impact. The case vehicle's impact with the Honda resulted in the driver moving slightly back and to his right toward the case vehicle's 150 degree direction of principal force as the case vehicle was knocked into a clockwise rotation. As the case vehicle continued in an easterly direction, it rotated clockwise approximately 180 degrees and the driver fought back leaning to his left trying to keep the case vehicle under control. Upon impact with the guardrail, he moved further leftward and then upward as the case vehicle rolled over. This leftward and upward movement caused him to strike the steering wheel rim with his right thigh. His movements from the initial rollover point to final rest are unknown. At final rest, he remained in his seat near his original seat position.



Figure 8: Belt-positioning booster seat in use at the time of the crash (case photo #37)



Figure 9: Underside view of booster seat showing no visible stress evidence (case photo #39)

CASE VEHICLE DRIVER INJURIES

IN01-022

The driver was not transported by ambulance to the hospital. According to the interview with the front right passenger (wife of driver), he sustained minor injuries and was not treated. The injuries sustained by the case vehicle's driver included: right thigh contusion, multiple small glass lacerations to lower legs and feet, and a contusion to his right upper arm.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1.	Contusion, right upper arm	790402.1 minor	Overhead center console	Possible	Interview
2.	Contusion, right inner thigh	890402.1 minor	Steering wheel rim	Probable	Interview
3.	Superficial lacerations, bilateral lower legs and feet	890602.1 minor	Flying glass	Probable	Interview

CASE VEHICLE FRONT RIGHT PASSENGER KINEMATICS

The case vehicle's front right passenger (40-year-old female, white, non-Hispanic, 165 centimeters and 54 kilograms [65 inches, 120 pounds]) was restrained by her available, active, three-point, lap-and-shoulder, safety belt system. She was seated leaning/bent forward, both feet on the floor, and both hands reaching for an object on the floor. Her seat track was located in its rearmost position, the seat back was slightly reclined.

The case vehicle's driver made no known pre-crash avoidance maneuvers. As a result and independent of the use of her available safety belts, the front right passenger's pre-impact body position did not change just prior to impact. The case vehicle's impact with the Honda resulted her moving slightly back and to her right toward the case vehicle's 150 degree direction of principal force as the case vehicle was knocked into a clockwise rotation. The impact resulted in the front right passenger immediately sitting up as the case vehicle continued in an easterly direction, while rotating clockwise approximately 180 degrees. Upon impact with the guardrail, she moved leftward and then upward as the case vehicle rolled over. This passenger's seat belt restraint kept her in a relatively secure seat position as the vehicle started rolling over. Her movements from the initial rollover point to final rest are unknown. At some point during the rollover event the front right passenger struck the overhead center console which fell down striking her in the left cheek/eye area of her face. At final rest, she remained in her seat in an upright position.

CASE VEHICLE FRONT RIGHT PASSENGER INJURIES

The front right passenger was not transported by ambulance to the hospital. According to her interview, she sustained only minor injuries and was not treated. The injuries sustained by the case vehicle's front right passenger included: contusion to her right forearm, small lacerations

from flying glass to her left lower leg, and a small laceration and contusion to her left cheek.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1.	Laceration, left cheek near eye	290602.1 minor	Overhear center console	Probable	Interview
2.	Contusion, left cheek near eye	290402.1 minor	Overhear center console	Probable	Interview
3.	Laceration, right forearm	790602.1 minor	Flying glass	Probable	Interview
4.	Contusion, right forearm	790402.1 minor	Right instrument panel	Possible	Interview
5.	Lacerations, left lower leg	890602.1 minor	Flying glass	Probable	Interview

CASE VEHICLE THIRD SEAT LEFT PASSENGER KINEMATICS

Immediately prior to the crash the case vehicle's third seated left passenger (5-year-old male, white, non-Hispanic, 122 centimeters and 21 kilograms [48 inches, 47 pounds]) was seated in an upright posture with his back against the seat back, his feet hanging down over the front edge of the seat's cushion angled downward, and both his hand in his lap holding his security blanket. His seat track and seat back were not adjustable.

The case vehicle's third seated left passenger was seated in his belt-positioning booster seat restrained by his available, active, three-point, lap-and-shoulder, safety belt system. There was evidence of belt pattern abrasions on his neck, and inspection of his seat belt webbing and latch plate showed evidence of loading. In addition, there was a reddish smear (possibly blood) to the seat back and the seat belt webbing of the third seat passenger (**Figure 10**).

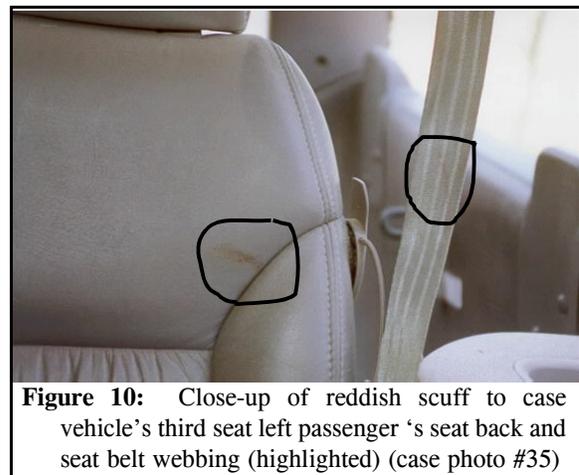


Figure 10: Close-up of reddish scuff to case vehicle's third seat left passenger's seat back and seat belt webbing (highlighted) (case photo #35)

The case vehicle's driver made no known pre-crash avoidance maneuvers. As a result and independent of the use of his available safety belts, the third seated left passenger's pre-impact body position did not change just prior to impact. The case vehicle's impact with the Honda resulted in the passenger moving slightly back and to his right toward the case vehicle's 150 degree direction of principal force as the case vehicle was knocked into a clockwise rotation. As the case vehicle continued in an easterly direction, it rotated

clockwise approximately 180 degrees and this passenger continued leaning to the right. Upon impact with the guardrail, he moved leftward and upward as the case vehicle rolled over. This leftward and upward movement caused his neck abrasion from interacting with his shoulder restraint. His movements from the initial rollover point to final rest are unknown. At final rest, he remained in his belt-positioning booster seat.

CASE VEHICLE THIRD SEAT LEFT PASSENGER INJURIES

The third seated left passenger was not transported by ambulance to the hospital. According to an interview with the front right passenger (mother), he sustained minor injuries but was not treated. These injuries consisted of: an abrasion to the left side of his neck from the seat belt webbing and a few small lacerations to his left hand from flying glass.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1.	Abrasion, left side of neck	390202.1 minor	Safety belt webbing	Certain	Interview
2.	Superficial lacerations, left hand	790202.1 minor	Flying glass	Probable	Interview

CASE VEHICLE THIRD SEAT RIGHT PASSENGER KINEMATICS

The case vehicle's third seated right passenger (10-year-old female, white, non-Hispanic, 152 centimeters and 51 kilograms [60 inches, 112 pounds]) was seated in an upright posture with her back against the seat back, her feet on the floor, and both her hands in her lap reading a book. Her seat track and seat back were not adjustable.

The case vehicle's driver made no known pre-crash avoidance maneuvers. As a result and independent of the use of her available safety belts, the third seat right passenger's pre-impact body position did not change just prior to impact. The case vehicle's impact with the Honda resulted her moving slightly back and to her right toward the case vehicle's 150 degree direction of principal force as the case vehicle was knocked into a clockwise rotation. The impact resulted in the front right passenger leaning to the right as the case vehicle continued in an easterly direction, while rotating clockwise approximately 180 degrees. Upon impact with the guardrail, she moved leftward and then upward as the case vehicle

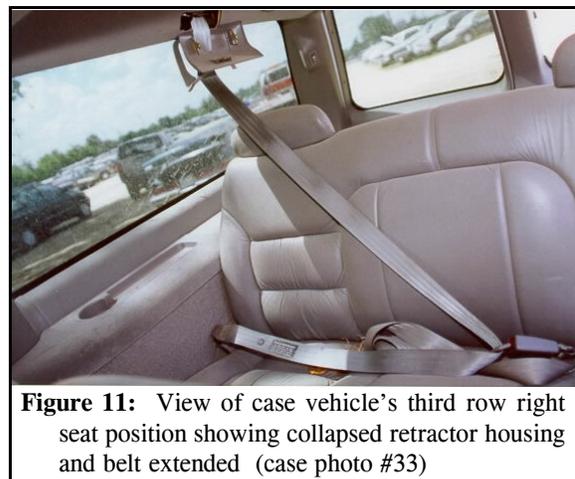


Figure 11: View of case vehicle's third row right seat position showing collapsed retractor housing and belt extended (case photo #33)

rolled over. This passenger's seat belt restraint kept her in a relatively secure seat position as the vehicle started rolling over. Her movements from the initial rollover point to final rest are unknown. At final rest, she remained near her original upright seat position.

The case vehicle's third seated right passenger was restrained by her available, active, three-point, lap-and-shoulder, safety belt system. An inspection of her seat belt restraint showed evidence of recent usage only to the buckle portion. As previously mentioned, the roof anchored seat belt retractor housing was hanging down (**Figure 11**).

CASE VEHICLE THIRD SEAT RIGHT PASSENGER INJURIES

The third seated right passenger was not transported by ambulance to the hospital. According to an interview with the front right passenger (mother), the case vehicle's third seated right passenger did not sustain any injuries as a result of this crash.

OTHER VEHICLE

The 1989 Honda Prelude SI was a front wheel drive, two-door coupe (VIN: JHMBA4130KC-----). Because of the overlapping damage on the Honda's front end, only partial CDC's could be determined: **12-F9EW-1 (350)** (event #1, impact with the case vehicle) and **99-F9EW-9** (event #6, impact with the guardrail). Maximum crush for the impact with the case vehicle is estimated as 12 centimeters [4.7 inches].

The Honda's contact with the case vehicle involved the front left half of the bumper and left front fender (**Figure 12**). The exact location of where the direct damage began for the impact with the case vehicle is unknown because of the overlapping damage from this vehicle's impact with the guardrail. There was direct contact down the left side of the Honda from impact with the case vehicle which extended 115 centimeters [45.3 inches] rearward, to just beyond the left front tire. The overall maximum crush to the Honda's front end was measured as 23 centimeters [9.1 inches] at C1. The Honda's contact with the guardrail also involved the front left half of the bumper and front end. The overall direct damage began 3 centimeters [1.2 inches] left of center (toward passenger side) and extended to the right a measured distance of 74 centimeters [29.1 inches], ending at the bumper corner. The case vehicle's hood, bumper, grille, and left fender were directly damaged and crushed rearward. The Honda's left front tire was damaged and deflated but none of the tires were physically restricted. The windshield glazing had several stress fractures. The case vehicle had no visible intrusion from outside the vehicle (locked). The Honda was towed due to damage.

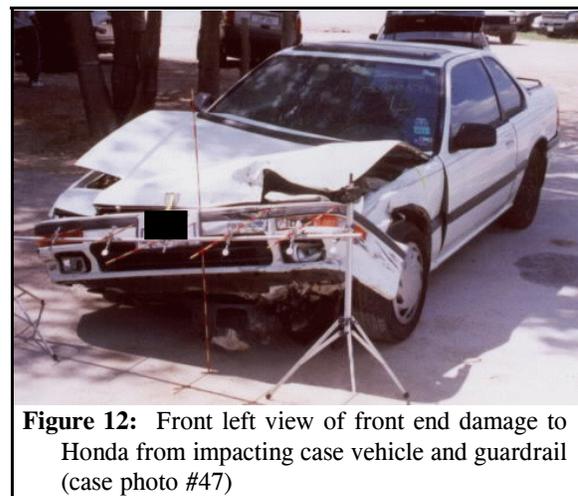


Figure 12: Front left view of front end damage to Honda from impacting case vehicle and guardrail (case photo #47)

