

**TRANSPORTATION SCIENCES
CRASH DATA RESEARCH CENTER**

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**VERIDIAN ON-SITE SIDE IMPACT OCCUPANT PROTECTION SYSTEM CRASH
INVESTIGATION
SCI TECHNICAL SUMMARY REPORT**

VERIDIAN CASE NO. CA01-045

VEHICLE - 2001 HONDA CIVIC

LOCATION - STATE OF COLORADO

CRASH DATE - AUGUST 2001

Contract No. DTNH22-01-C-17002

Prepared for:

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

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

TECHNICAL REPORT STANDARD TITLE PAGE

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<p>16. <i>Abstract</i> This on-site investigation focused on the roadside departure/rollover crash of a 2001 Honda Civic. The Civic was occupied by a 19-year-old male driver and four passengers ranging in age from 18 to 22-years-old. All of the occupants were probably restrained except the rear right passenger. The vehicle was equipped with frontal air bags and seat back-mounted side impact air bags for the front seated occupants. The front seats of the Civic were covered by after-market fleece seat covers. The driver lost control of the vehicle and departed the left side of the road. He overcorrected by steering right, and the vehicle crossed both travel lanes and departed the right roadside in a clockwise (CW) yaw. The Civic impacted two delineator posts and subsequently rolled over six quarter turns. The driver's side air bag deployed during the rollover event as a result of ground contact. The deployment sequence of the driver's side air bag was impeded by the seat cover which altered its normal deployment. The seat cover was torn in a saw-tooth pattern in the area surrounding the deployed side air bag. The unrestrained rear right passenger was ejected through the backlight and was fatally injured. The restrained occupants remained in the vehicle and sustained non-incapacitating and incapacitating injuries.</p>			
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INVESTIGATION
SCI TECHNICAL SUMMARY REPORT
VERIDIAN CASE NO. - CA01-045
SUBJECT VEHICLE - 2001 HONDA CIVIC
LOCATION - STATE OF COLORADO
CRASH DATE - AUGUST 2001**

BACKGROUND

This on-site investigation focused on the roadside departure/rollover crash of a 2001 Honda Civic (**Figure 1**). The Civic was occupied by a 19-year-old male driver and four passengers ranging in age from 18 to 22-years-old. All of the occupants were probably restrained except the rear right passenger. The vehicle was equipped with frontal air bags and seat back-mounted side impact air bags for the front seated occupants. The front seats of the Civic were covered by after-market fleece seat covers. The driver lost control of the vehicle and departed the left side of the road. He overcorrected by steering right, and the vehicle crossed both travel lanes and departed the right roadside in a clockwise (CW) yaw. The Civic impacted two delineator posts and subsequently rolled over six quarter turns. The driver's side air bag deployed during the rollover event as a result of ground contact. The deployment sequence of the driver's side air bag was impeded by the seat cover which altered its normal deployment. The seat cover was torn in a saw-tooth pattern in the area surrounding the deployed side air bag. The unrestrained rear right passenger was ejected through the backlight and was fatally injured. The restrained occupants remained in the vehicle and sustained non-incapacitating and incapacitating injuries.



Figure 1. Damaged 2001 Honda Civic

The Special Crash Investigations team at Veridian was notified of the crash by the Colorado State Police during a concurrent investigation. Veridian SCI subsequently informed NHTSA of the crash and a vehicle inspection was requested. The crash occurred in August 2001 and the vehicle inspection was completed on October 2, 2001.



Figure 2. Northbound view of crash site and tire marks

SUMMARY

Crash Site

This single-vehicle crash occurred during the daylight hours of August 2001 on the northbound lanes of a divided interstate highway (**Figure 2**). At the time of the crash, the asphalt

roadway surface was dry and there were no adverse conditions as the weather was clear. The north/south roadway consisted of two travel lanes in each direction that were separated by a grass median. The travel lanes were bordered by asphalt shoulders. The inboard shoulder measured 1.2 m (3.8') in width and the outboard shoulder measured 3.0 m (10.0') in width. The east roadside was bordered by a raised dirt/gravel frontage road that measured 5.3 m (17.5') in width. A grassy shoulder and ditch that measured 11.7 m (38.5') in width separated the frontage road from the northbound roadway. Adjacent to the east edge of the frontage road was a grass/gravel shoulder with a slight downward slope that measured 7.4 m (24.3') in width. A wire fence approximately 1.2 m (4.0') in height separated the frontage road shoulder from a grassy field. The roadside environment consisted of flat, grassy areas and telephone poles were present on the east side of the frontage road. The posted speed limit for the interstate roadway was 121 km/h (75 mph).

Pre-Crash

The 19-year-old male driver was operating the 2001 Honda Civic northbound on the inboard lane of the northbound travel lanes of the divided interstate highway. Police reported that the driver was operating the vehicle under the influence of a controlled substance, and that he may have fallen asleep. The driver lost control of the vehicle and the Civic departed the left roadside onto the left shoulder and traveled 16.8 m (55.2') on the grassy median. In an attempt to regain control, the driver overcorrected, steered right, and applied the brakes. The Civic initiated a clockwise yaw and traveled across both northbound lanes (**Figure 3**) and departed the right roadside. At the point of roadside departure, the Civic had rotated approximately 120 degrees in a clockwise direction. The Civic struck a delineator post with the left side as it traveled onto the east roadside (**Figure 4**). The vehicle traveled in a lateral direction across the grassy ditch which resulted in multiple gouge marks from the wheels. As the Civic approached the dirt/gravel frontage road, it impacted a second delineator post with the left side area and the raised uneven surface of the frontage road tripped a rollover with the left side leading (**Figure 5**).



Figure 3. Northbound approach and tire marks



Figure 4. Gouges in the grassy ditch and damaged delineator post



Figure 5. Raised dirt/gravel frontage road and second damaged delineator post

Crash

The Civic rolled one quarter turn onto the frontage road with the left side leading. The left side impact with the ground was sufficient to deploy the driver's side air bag. The Civic continued to roll and the unrestrained rear right passenger was redirected rearward and into the backlight glazing, which disintegrated from impact forces. The right rear passenger was partially ejected between the first and second quarter turns, and his head was crushed between the backlight header and the dirt/gravel road surface during the second quarter turn. The Civic rolled across the frontage road and onto the east grassy shoulder during the third quarter turn. The right rear passenger was probably fully ejected between the third and fourth quarter turn as the vehicle returned upright. The Civic completed the fifth and sixth quarter turns and rolled onto the wire fence. The vehicle came to rest on the grassy shoulder on its roof with the right front area resting against the fence. During the rollover event, the trunk lid opened and the spare tire was ejected from the trunk.

Post-Crash

The occupants exited the vehicle under their own power. The body of the rear right passenger was found lying face-down on the east roadside of the frontage road adjacent to the vehicle and was removed by the coroner. The remaining occupants were transported by ambulance to a local medical facility for treatment.

VEHICLE DATA - 2001 Honda Civic

The 2001 Honda Civic LX was identified by the Vehicle Identification Number (VIN): 1HGEM2159L (production sequence omitted). The vehicle was a two-door coupe and was equipped with a 1.7 liter, 4-cylinder engine, a 5-speed manual transmission, front wheel drive, front disc and rear drum brakes, power steering, and cruise control. Other features included power door locks, power windows, and power mirrors. The Civic was equipped with Firestone FR690 P185/70R14 tires. All of the tires had excellent tread at the time of the vehicle inspection.

The front seating positions in the Honda Civic were configured front bucket seats with folding backs. The front left seat track was positioned 1.3 cm (0.5") forward of full rear and the seat back recline angle was 30 degrees from vertical at the time of the vehicle inspection. The front right seat was positioned 9.5 cm (3.8") forward of full rear and 3.8 cm (1.5") rear of full forward and the seat back recline angle was 20 degrees from vertical.

Aftermarket seat covers were installed on both front bucket seats (**Figure 6**). There was no identification markings on the seat covers. The top aspect of each cover fit over the adjustable head restraint in the full-down position and completely enveloped the seat back to 64.8 cm (25.5") below the top aspect of the head restraint. The bottom aspect of the seat cover was placed over the top aspect of the seat cushion.



Figure 6. View showing front right passenger's aftermarket seat cover

The rear seating was configured with a three-person bench seat with a 60/40 split folding back. The outboard rear seating positions were configured with integral head restraints.

VEHICLE DAMAGE

Exterior Damage - 2001 Honda Civic

The 2001 Honda Civic sustained moderate damage as a result of the rollover (**Figure 7**). The front and rear bumper fascias were both completely separated from the vehicle. The hood, grille area, and lower radiator support were slightly displaced. The entire left side plane of the Civic sustained lateral abrasions, including the A, B, and C-pillars and the roof side rail. The left mirror was separated and the left door exhibited pocketing under the mirror area as a result of displacement against the door panel.



Figure 7. Left side view of the damaged Honda Civic

Impact with a delineator post resulted in a deep pocket in the side plane that measured 2.5 cm (1.0") in depth and was located 57.2 cm (22.5") aft of the face of the left B-pillar above the left rear wheel (**Figure 8**). A green paint transfer from the delineator was located 45.7 cm (18.0") aft of the face of the left B-pillar on the top aspect of the left C-pillar. The Collision Deformation Classification (CDC) for the first impact with the delineator post was 09-LPMN-1. The damage associated with the impact to the second delineator post could not be located since it was masked by the rollover damage. The CDC for the second impact with the delineator post was 09-L999-9.



Figure 8. Damage from the first delineator post

A section of the rear left corner of the roof that measured 10.2 cm (4.0") in length longitudinally, was buckled downward. The left front lower suspension was fractured, and the tire was rotated laterally outboard. The tire was deflated and the wheel cover was separated as a result of the tripped rollover. The left rear tire was deflated. The left rear wheel sustained abrasions on the outer edge and the wheel cover was fractured. The trunk lid was displaced to the right and exhibited longitudinal abrasions on the top left rear corner and lateral abrasions on the top right aspect. The right rear quarter panel and right C-pillar were abraded in a diagonal manner (**Figure 9**). The right roof side rail also sustained diagonal abrasions. The outer edge of the right mirror was abraded and the mirror glass was fractured. Body fluid (blood) and dirt were deposited on the face of the right C-pillar. The right front fender was abraded laterally on



Figure 9. Abraded right rear quarter panel and displaced trunk lid

the forward aspect. The right front wheel and wheel cover were abraded and the tire exhibited grass and gravel in the bead. The right rear wheel also had gravel in the tire bead and sustained abrasions to the wheel and wheel cover. The right rear corner of the roof that measured 66.0 cm (26.0") in length and 53.3 cm (21.0") in width was buckled downward and sustained left-to-right diagonal abrasions. Body fluid (blood) spattering was noted on the roof. The CDC for the rollover was 00-TDDO-2.

Interior Damage - 2001 Honda Civic

Interior damage to the 2001 Honda Civic was moderate and attributed to occupant contact and passenger compartment intrusion. The windshield glazing was fractured at the top left aspect from impact forces and on the top right aspect due to contact from the front right passenger. The circular fracture was located 30.5 cm (12.0") right of center and 20.3 cm (8.0") below the windshield header. The diameter of the fracture measured 17.8 cm (7.0"). The fracture was bowed outward 0.6 cm (0.3"), however there were no hair or tissue transfers in the glazing. The closed left front glazing and fixed left rear glazing, fixed right rear glazing, and the backlight were disintegrated as a result of the crash. The right front glazing was closed prior to the crash and was not damaged.

The left front sun visor was folded forward against the windshield, but there was no damage to the vanity mirror on opposite side of the visor. The interior left side door panel at the integral armrest was fractured from driver loading 16.5 cm (6.5") forward of the rear edge of the door and extended 7.6 cm (3.0") forward (**Figure 10**). The fracture was vertically located 29.2 cm (11.5") from the top of the door panel and extended downward 7.6 cm (3.0"). The pliable plastic panel below the arm rest was deflected outward approximately 3.8 cm (1.5"). The upper door panel was fractured from driver loading at the rear edge. The damage began at the rear edge and extended 8.9 cm (3.5") forward. The fracture was located 3.2 cm (1.3") below the top of the door panel and extended 10.8 cm (4.3") downward. The fabric on the rear edge of the left side interior door panel between the armrest and the upper plastic segments was abraded due to the contact with the deployed driver's side air bag. The abrasion was located 3.8 cm (1.5") forward of the rear edge of the left side door, and extended 7.6 cm (3.0") forward. The abrasion began 14.0 cm (5.5") below the top aspect of the door panel and extended 8.9 cm (3.5") downward.



Figure 10. Damaged left front door interior panel



Figure 11. Fractured center console from occupant contact

The right side aspect of the center console was impacted by the front right occupant's left lower leg and was scuffed and fractured (**Figure 11**). The fracture measured 17.8 cm (7.0") vertically by 8.9 cm (3.5") horizontally. The top aspect of the plastic center console aft of the gear shifter was fractured as a result of

loading from the front right passenger's left thigh. The fracture was located 35.6 cm (14.0") rearward of the mid-panel and extended 5.1 cm (2.0") rearward. It was laterally located 0.6 cm (0.3") right of center on the console.

Body fluid stains were noted on the headliner at the backlight over the rear left position. Hair was noted on the left C-pillar in the top aspect of the fixed quarter window frame at the bond area. The roof intruded into the rear seat area at the C-pillars (**Figure 12**), and the lateral distance between the C-pillars measured 78.7 cm (31.0").



Figure 12. View of backlight area

MANUAL RESTRAINT SYSTEM - 2001 Honda Civic

The front seat positions in the Honda Civic were equipped with manual 3-point, continuous loop, lap and shoulder belts with sliding latch plates and inertial lock/belt sensitive retractors. The front right lap and shoulder belt was also equipped with a switchable/automatic locking retractor (ALR). Both front manual restraints were configured with buckle pretensioners located on the inboard aspects of the front seat tracks which did not deploy in this crash. The D-rings for the front restraints were fixed.

At the time of the vehicle inspection, the front left latch plate remained buckled. There was no loading evidence on the left front latch plate, and it exhibited subtle routine usage wear marks. There was no loading evidence on the left front restraint webbing. The front left shoulder webbing was cut 154.9 cm (61.0") above the slider anchor bracket on the left front sill and 106.7 cm (42.0") forward of the D-ring anchor bolt with the webbing fully extended. The front right manual restraint exhibited no routine wear marks on the latch plate and had no evidence of loading to the webbing.

The rear seat positions were equipped with manual 3-point continuous loop lap and shoulder belts with sliding latch plates and inertial lock/belt sensitive retractors. Each rear seat restraint was configured with a switchable/ALR. The rear left latch plate showed subtle routine usage marks, but showed no evidence of usage in this crash. The center rear restraint retractor was located on the left side of the rear center occupant. At the time of the vehicle inspection, the webbing was gathered and captured in the fixed D-ring located on the top aspect of the rear seat back to the left of the rear center position. The webbing was also gathered at the latch plate 74.9 cm (29.5") above the anchor point. The length of webbing between the D-ring and the latch plate measured 79.4 cm (31.3"). This position of the webbing resulted in a large lap belt loop and a small shoulder belt section. The rear right retractor was jammed with the manual restraint webbing fully retracted.

FRONTAL AIR BAG SYSTEM - 2001 Honda Civic

The 2001 Honda Civic was equipped with advanced dual-stage frontal air bags for the driver and front-right passenger positions. The driver's air bag was housed in the center of the steering wheel with a dual cover flap design. The front right passenger's air bag was housed in a top-mount module with a lateral center tear seam. The frontal air bag system did not deploy as a result of the crash.

SIDE IMPACT AIR BAG SYSTEM - 2001 Honda Civic

The 2001 Honda Civic was equipped with side impact air bags for the driver and front right passenger positions. The side air bags were located in the outboard aspects of the front seat backs. The driver's side air bag deployed as a result of the left side impact with the ground during the first quarter turn of the rollover. The side air bag deployed forward from the driver's seat back (**Figure 13**). The single plastic module cover measured 10.2 cm (4.0") in width and 22.9 cm (9.0") in height. The cover flap was hinged at the rear aspect and opened to the rear of the vehicle (**Figure 14**).



Figure 13. Driver's side air bag

The driver's side air bag measured 28.9 cm (11.4") in length at the top aspect and 24.1 cm (9.5") on the bottom aspect. The height measured 25.4 cm (10.0") at the front aspect and the rear aspect was angled downward into the module and measured 15.2 cm (6.0"). The air bag was vented by two circular 6.7 cm (2.6") diameter external ports located on the forward aspect (**Figure 15**). The top port was centered 7.0 cm (2.8") below the top seam and the bottom port was centered 5.7 cm (2.3") above the bottom seam. The driver's side air bag was tethered internally by a lateral tether that measured 5.7 cm (2.3") in length and 1.5 cm (0.6") in width. Superficial scuff marks were noted on the bottom aspect of the air bag.



Figure 14. Side air bag cover flap with the seat cover removed

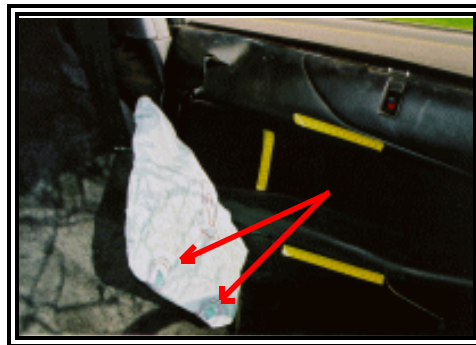


Figure 15. View of driver's side air bag showing vent ports

Aftermarket seat covers that fully covered the seat backs were present on both front seats. The driver's seat cover was ripped irregularly in a saw-tooth pattern at the location of the driver's side air bag cover flap. The tear measured 17.8 cm (7.0") vertically and 3.8 cm (1.5") longitudinally.

OCCUPANT DEMOGRAPHICS - 2001 Honda Civic

Driver

Age/Sex: 19-year-old male
 Height: 183 cm (72")
 Weight: 70 kg (155 lb)
 Seat Track Position: 1.3 cm (0.5") forward of full-rear
 Manual Restraint Use: Manual 3-point lap and shoulder belt
 Usage Source: Vehicle inspection
 Eyewear: Unknown
 Type of Medical Treatment: Transported by ambulance to a local medical facility and treated and released

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Two minor left scalp abrasions	Minor (190202.1,2)	Left roof side rail

Injury source: Emergency room records

Driver Kinematics

The 19-year-old driver was restrained by the manual 3-point lap and shoulder belt and presumed to have been seated in an upright posture. He may have been bracing with his hands on the steering wheel as he tried to regain control of the vehicle. As the vehicle rolled, the driver's side impact air bag deployed through the aftermarket seat cover and the driver initiated a lateral trajectory to the left and loaded the manual restraint and the deployed side air bag. The driver loaded the interior aspect of the left front door, evidenced by scuff marks and fractures to the interior door panel. His head struck the left roof side rail which resulted in two minor left scalp abrasions. The manual restraint prevented additional movement throughout the vehicle. The driver exited the vehicle under his own power and was transported by ambulance to a local medical facility where he was treated and released.

Front Right Passenger

Age/Sex: 19-year-old male
Height: 175 cm (69")
Weight: 82 kg (180 lb)
Seat Track Position: Between mid-track and full-forward
Manual Restraint Use: Manual 3-point lap and shoulder belt
Usage Source: Vehicle inspection, police report
Eyewear: Unknown
Type of Medical Treatment: Transported by ambulance to a local medical facility and treated and released

Front Right Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Right facial contusion	Minor (290402.1,1)	Right roof side rail
Forehead contusion	Minor (290402.1,7)	Right roof side rail
Multiple superficial forehead lacerations	Minor (290602.1,7)	Flying glass

Injury source: Emergency room records

Front Right Passenger Kinematics

The 19-year-old front right passenger was restrained by the manual 3-point lap and shoulder belt, although the vehicle inspection found no evidence of usage on the latch plate and no loading to the belt webbing. However, the lack of interior contacts and lack of ejection support belt usage. He was probably seated upright and bracing with his arms extended forward over the instrument panel. As the vehicle rolled over, he initiated a lateral trajectory to the left and loaded the manual restraint. He probably struck his left lower leg on the lower right aspect of the center console, evidenced by a fracture of the plastic console. He probably also loaded the upper aspect of the center console with his left thigh, evidenced by a fracture in the plastic console on the upper right aspect. During the rollover, his hand most likely struck the windshield, evidenced by a windshield fracture located 30.5 cm (20.0") right of center and 20.3 cm (8.0") below the windshield header. There was no hair or tissue noted in the windshield fracture. He sustained a right facial contusion and a forehead contusion from contact with the right roof side rail during the rollover. He also sustained multiple superficial forehead lacerations from flying glass. He exited the vehicle under his own power. He was transported by ambulance to a local medical facility and was treated and released.

Rear Left Passenger

Age/Sex: 22-year-old male
Height: 168 cm (66")
Weight: 61 kg (135 lb)
Seat Track Position: Fixed
Manual Restraint Use: Manual 3-point lap and shoulder belt
Usage Source: Lack of ejection, interview
Eyewear: Unknown
Type of Medical Treatment: Transported by ambulance to a local medical facility and admitted overnight

Rear Left Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Left non-depressed frontal skull fracture	Moderate (150402.2,5)	Left C-pillar, left roof side rail
8 cm (3") left scalp laceration on the left frontal region	Minor (190602.1,5)	Left C-pillar, left roof side rail
Minor left scalp abrasions near the left ear	Minor (290202.1,2)	Left C-pillar, left roof side rail
Left periorbital ecchymosis	Minor (290402.1,2)	Left C-pillar, left roof side rail
Bilateral anterior/posterior hand abrasions	Minor (790202.1,3)	Front seat back, left interior side panel

Injury source: Emergency room records

Rear Left Passenger Kinematics

The 22-year-old male rear left passenger was presumed to have been seated in an upright posture. Although there was no evidence of usage on the manual restraint, he was probably restrained due to lack of ejection and lack of additional injuries. As the Civic rolled over, he initiated a lateral trajectory to the left and struck the left C-pillar and left roof side rail. He sustained a left non-depressed frontal skull fracture, an 8 cm (3") left scalp laceration on the left frontal region, minor left scalp abrasions near the left ear and a left periorbital ecchymosis. He was redirected in the vehicle as it continued to roll over and his hands contacted the front left seat back and left interior side panel which resulted in bilateral anterior/posterior hand abrasions. The 22-year-old came to rest upside-down, suspended from the safety belt. The rear center passenger attempted to unbuckle the rear center safety belt, however, he unbuckled the rear left by mistake. The rear-left passenger fell onto the roof, striking his head. Although there was post-crash contact to the roof with his head, the head injuries were likely a result of interior contact during

the rollover. He was transported by ambulance to a local medical facility and admitted overnight.

Rear Center Passenger

Age/Sex: 18-year-old male
 Height: 185 cm (73")
 Weight: 66 kg (145 lb)
 Seat Track Position: Fixed
 Manual Restraint Use: Manual 3-point lap and shoulder belt
 Usage Source: Vehicle inspection
 Eyewear: Unknown
 Type of Medical Treatment: Transported by ambulance to a local medical facility and transferred to another hospital by private vehicle

Rear Center Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Dislocated right wrist	Moderate (751430.2,1)	Occupant-to-occupant contact with the rear right passenger
Displaced fracture of the right distal radius with dislocation of normal articulation between the radius and lunate bones	Moderate (752802.2,1)	Occupant-to-occupant contact with the rear right passenger
Right ulnar styloid process fracture	Moderate (753202.2,1)	Occupant-to-occupant contact with the rear right passenger
Anterior neck abrasion	Minor (390202.1,5)	Shoulder belt webbing

Injury source: Emergency room records

Rear Center Passenger Kinematics

The 18-year-old male rear center passenger was restrained by the manual 3-point lap and shoulder belt system. The center rear lap and shoulder belt retracted to the left side of the occupant. As the vehicle rolled over, he initiated a lateral trajectory and loaded the manual restraint. The manual restraint prevented him from additional movement throughout the vehicle as it continued to roll over. He sustained a dislocated right wrist, a displaced fracture of the right distal radius with dislocation of normal articulation between the radius and lunate bones, a right ulnar styloid process fracture, from probable occupant-to-occupant contact with the rear right passenger. He also sustained an anterior neck abrasion from probable engagement with the shoulder belt webbing. He came to rest upside-down, suspended by the safety belt. He mistakenly unbuckled the rear left passenger’s safety belt, and subsequently unbuckled his safety belt, and exited the vehicle under his own power through the backlight. He was transported by ambulance to

a local medical facility and admitted for treatment. He was transferred to a second hospital by private vehicle the same day.

Rear Right Passenger

Age/Sex: 19-year-old male
 Height: 183 cm (72")
 Weight: 70 cm (155 lb)
 Seat Track Position: Fixed
 Manual Restraint Use: Unrestrained
 Usage Source: Ejection, injury data
 Eyewear: Unknown
 Type of Medical Treatment: Fatality at scene

Rear Right Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
<p>Massive blunt force trauma with multiple comminuted open fractures predominately on the left side of the skull, extending from the bridge of the nose to the mid-occipital region. The brain has been extruded in the process of ejection and is markedly lacerated and hemorrhagic, studded with large pieces of gravel. The scalp on the left side is avulsed laterally and inferiorly. There are diffuse abrasions of the left side of the scalp from the mid-parietal region downward, extending to the left side of the face.</p>	<p>Maximum (113000.6,0)</p>	<p>Head crushed between backlight header and ground as vehicle rolled over (partial ejection)</p>
<p>The left side of the face is marked by diffuse abrasions originating in the scalp and extending downward to the left side of the neck.</p>	<p>Minor (290202.1,2)</p>	<p>Head crushed between backlight header and ground as vehicle rolled over (partial ejection)</p>
<p>Left side of the neck is marked by patterned, vertically oriented linear abrasions over a 5cm x 5cm area.</p>	<p>Minor (290202.1,2)</p>	<p>Head crushed between backlight header and ground as vehicle rolled over (partial ejection)</p>

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
There is a non-patterned 40mm x 40mm area of superficial lacerations within the left pre-auricular area of abrasions	Minor (390602.1,2)	Head crushed between backlight header and ground as vehicle rolled over (partial ejection)
The proximal portion of the strap muscles of the left neck is focally hemorrhagic.	Minor (390402.1,2)	Head crushed between backlight header and ground as vehicle rolled over (partial ejection)
The left external ear is lacerated at the attachment of the superior portion of the helix. A transversely oriented 10mm x 10mm puncture type laceration is present over the attachment of the lower portion of the left ear.	Minor (290602.1,2)	Head crushed between backlight header and ground as vehicle rolled over (partial ejection)
Vertical laceration of the bridge of the nose extends to a point 18mm from the tip of the nose	Minor (290602.1,4)	Head crushed between backlight header and ground as vehicle rolled over (partial ejection)
Contusion of the right upper and lower eyelids	Minor (297402.1,1)	Head crushed between backlight header and ground as vehicle rolled over (partial ejection)
15mm x 2mm midline transverse laceration of the right upper eyelid	Minor (297602.1,2)	Head crushed between backlight header and ground as vehicle rolled over (partial ejection)
The right conjunctiva is deeply hemorrhagic.	Minor (240416.1,1)	Head crushed between backlight header and ground as vehicle rolled over (partial ejection)
The left conjunctiva is deeply hemorrhagic.	Minor (240416.1,2)	Head crushed between backlight header and ground as vehicle rolled over (partial ejection)

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
10cm x 5cm area of abrasion on the right cheek	Minor (290202.1,1)	Head crushed between backlight header and ground as vehicle rolled over (partial ejection)
10cm x 5cm area of contusion on the right cheek	Minor (290402.1,1)	Head crushed between backlight header and ground as vehicle rolled over (partial ejection)
Contusion on the angle of the right side of the mouth and diffuse contusions to the upper left lip	Minor (290402.1,8)	Head crushed between backlight header and ground as vehicle rolled over (partial ejection)
Bilateral fracturing of the mandible. The fracture on the left is vertically oriented and to the left of the first and second bicuspid.	Minor (250602.1,3)	Head crushed between backlight header and ground as vehicle rolled over (partial ejection)
Bilateral fracturing of the maxilla and fracture of the posterior left side of the hard palate (LeFort II fracture)	Moderate (250806.2,4)	Head crushed between backlight header and ground as vehicle rolled over (partial ejection)
Capsular hemorrhage of the right and left lobes of the thyroid.	Minor (341402.1,5)	Head crushed between backlight header and ground as vehicle rolled over (partial ejection)
Diffuse abrasions of the posterior neck extend medially and posteriorly along the left shoulder to cover a total area of 14cm x 6cm. The abrasions are patterned, linear and diagonally oriented.	Minor (390202.1,6) (690202.1,7)	Head crushed between backlight header and ground as vehicle rolled over (partial ejection)
10mm x 10mm abrasion to the anterior chest, to the right of and just below the supra-sternal notch	Minor (490202.1,4)	Crushed between the vehicle and ground during the rollover (partial ejection)

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
6cmx 3cm area of contused abrasions over the lateral aspect of the right chest, inferior to the axilla	Minor (490202.1,1) (490402.1,1)	Crushed between the vehicle and ground during the rollover (partial ejection)
Bilateral flail chest and lung contusions : Right ribs 1-5 are fractured anteriorly in the mid-clavicular line. Left ribs 6 and 7 are fractured in the anterior axillary line. Bilateral paravertebral posterior fractures of ribs 1-8. Fracturing and hemorrhage on the right is greater than the left. There are diffuse contusions of the medial anterior aspects of the lungs.	Critical (450266.5,3)	Crushed between the vehicle and ground during the rollover (partial ejection)
Focal contusion over the anterior surface of the pericardium	Minor (441002.1,4)	Crushed between the vehicle and ground during the rollover (partial ejection)
Transverse fracture of the upper third of the body of the sternum	Moderate (450804.2,4)	Crushed between the vehicle and ground during the rollover (partial ejection)
Partial separation of the right sterno-clavicular joint	Moderate (751230.2,1)	Crushed between the vehicle and ground during the rollover (partial ejection)
Closed fracture of the proximal portion of the right humerus	Moderate (752602.2,1)	Crushed between the vehicle and ground during the rollover (partial ejection)

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Diffuse abrasions extend from the mid right upper arm to the fingertips over the dorsomedial aspect. There are contused abrasions over the knuckles of the proximal interphalangeal joints of the right index, middle, and ring fingers.	Minor (790202.1,1) (790402.1,1)	Ejection and contact with ground
7cm x 5 cm area of abrasion over the antero-medial aspect of the left shoulder. 30mm x 10mm longitudinally oriented contused abrasion over the dorsolateral aspect of the distal third of the left forearm. A 30mm x 15mm area of scattered punctate abrasions are present over the base of the left index finger.	Minor (790202.1,2) (790402.1,2)	Ejection and contact with ground
An 11cm x 4cm area of contused abrasions overlies the right knee. A 20mm x 30mm area of abrasion is noted over the distal third of the medial right lower leg. An 11mm x 8mm area of abrasion overlies the medial malleolus on the right.	Minor (890202.1,1) (890402.1,1)	Ejection and contact with ground
An 8cm x 5cm area of contused abrasion overlying the skin of the left hip. A collection of abrasions over a 5cm x 0.5cm area is noted on the skin above the lateral left knee. A 48mm x 12mm area of contused abrasion is noted over the anterolateral aspect of the proximal third of the left lower leg. Two non-patterned abrasions are present on the lateral aspect of the left ankle covering a 9cm x 4cm area. A 45mm x 40mm area collection of contused abrasions are present over the left posterior popliteal area.	Minor (890202.1,2) (890402.1,2)	Ejection and contact with ground

Injury source: Autopsy report

Rear Right Passenger Kinematics

The 19-year-old male rear right passenger was unrestrained. When the Civic initiated the rollover, he initiated a lateral trajectory to the left and probably contacted the rear center passenger. As the vehicle continued to roll onto the roof, his upper torso was redirected into the backlight area on the right side, and was partially ejected. His head was crushed between the backlight header and the dirt/gravel road surface on the second quarter turn of the rollover. The weight of the vehicle rolling over his head resulted in an explosive skull fracture and the expulsion of an extensive amount of brain matter. Facial fractures, multiple facial abrasions, lacerations, and contusions were also sustained as a result of the vehicle rolling over his head. During the partial ejection, his torso was also crushed between the vehicle and the ground which resulted in several anterior and posterior rib fractures with flail chest, a sternum fracture, partial separation of the sterno-clavicular joint, a closed humerus fracture, and lung contusions. He also sustained multiple chest abrasions and contusions related to this contact. The Civic continued to roll over and as the vehicle completed the fourth quarter turn, the rear right passenger was completely ejected through the backlight. He came to rest on the east roadside face-down as the Civic rolled an additional two quarter turns onto its roof. The ejection and contact with the ground resulted in multiple abrasions and contusions on both arms and legs. The rear right passenger was pronounced dead-at-the-scene and removed by the coroner.

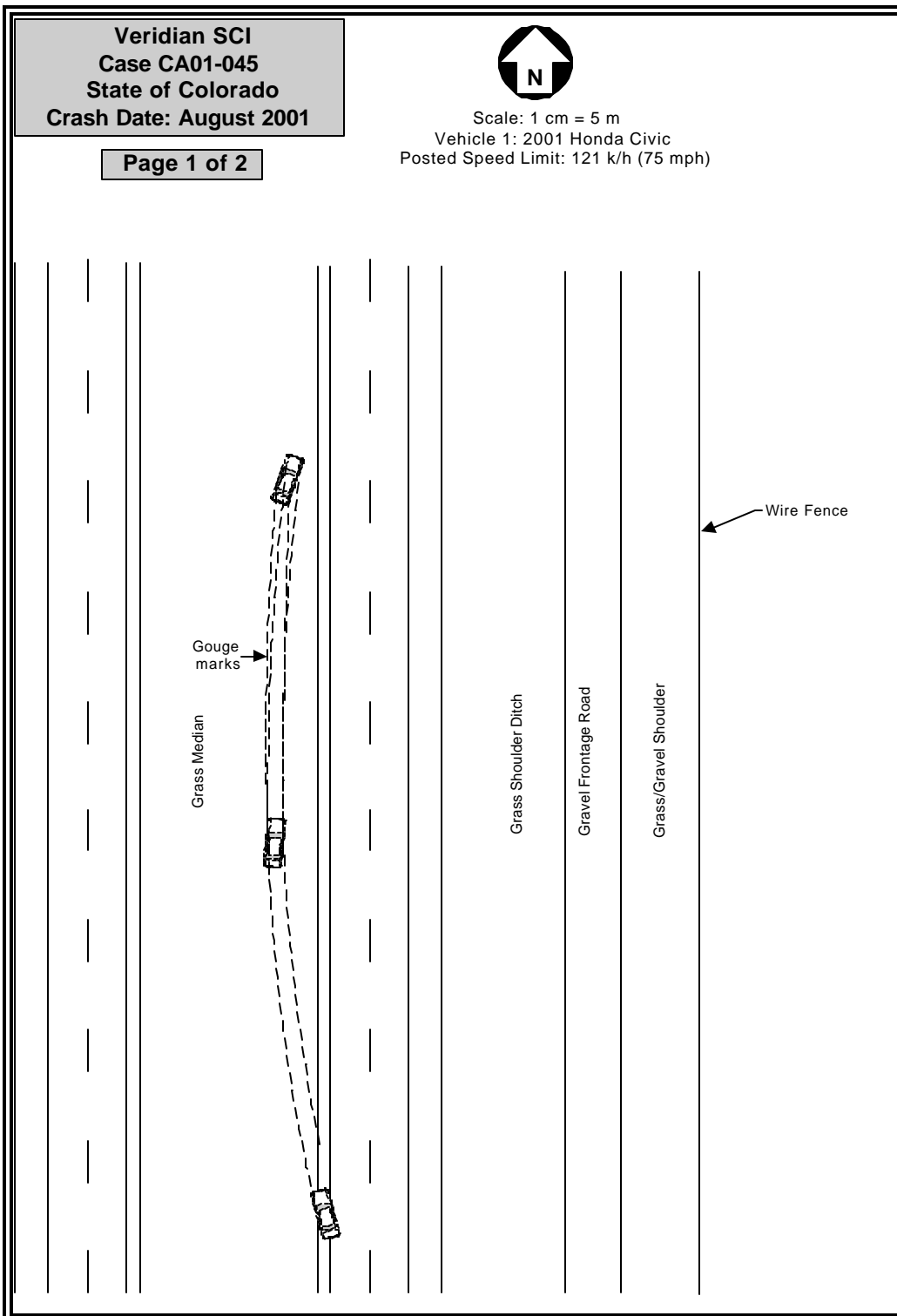


Figure 16. Scene schematic, Page 1



Scale: 1 cm = 5 m
Vehicle 1: 2001 Honda Civic
Posted Speed Limit: 121 k/h (75 mph)

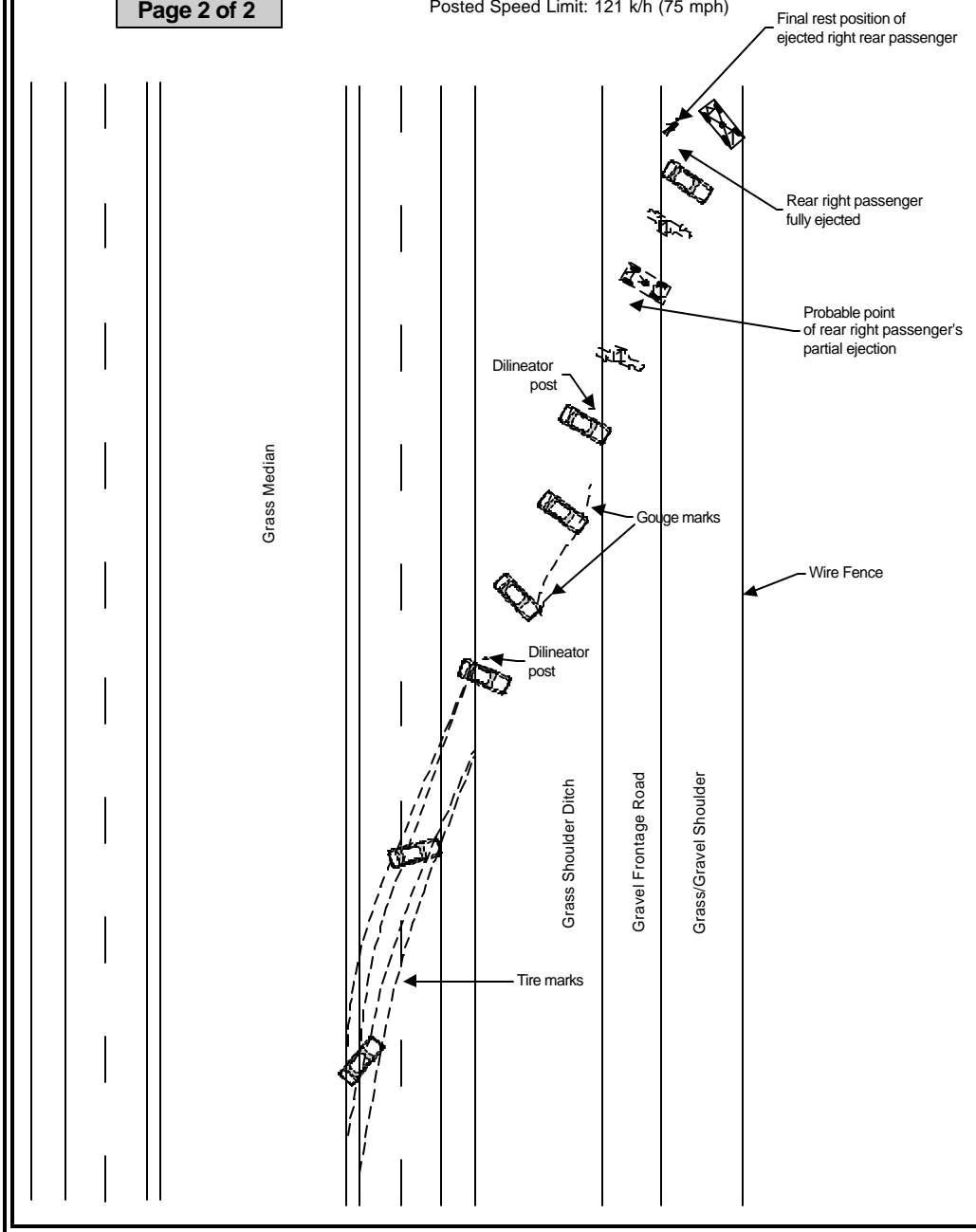


Figure 17. Scene schematic, Page 2