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CALSPAN ON-SITE CHILD RESTRAINT SYSTEM CRASH INVESTIGATION
SCI CASE NO.: CA08017

VEHICLE: 1995 SATURN SL1

LOCATION: SOUTH CAROLINA

CRASH DATE: APRIL 2008

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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.

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16. Abstract This on-site investigation focused on the installation and effectiveness of a forward-facing Child Restraint System (CRS) that restrained a 2-year-old male in the second row left seat of a 1995 Saturn SL1 four-door sedan during a single-vehicle multiple event crash. The forward-facing CRS was secured by the vehicle's safety belt system but the belt was routed through the rear-facing belt path. The Saturn was equipped with a frontal air bag system that deployed as a result of the crash. The driver of the Saturn was an unrestrained 25-year-old female, who lost directional control of the vehicle as she attempted to negotiate an S-curve with a downgrade. The vehicle entered a ditch and impacted a private driveway culvert. The Saturn subsequently rotated counterclockwise (CCW) and rolled over. The driver was fully ejected from the Saturn and sustained fatal injuries. The child passenger and the CRS remained in the vehicle and were removed by emergency response personnel. The child sustained incapacitating injuries and was transported to a regional pediatric trauma center where he was admitted for treatment.			
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BACKGROUND

This on-site investigation focused on the installation and effectiveness of a forward-facing Child Restraint System (CRS) that restrained a 2-year-old male in the second row left seat of a 1995 Saturn SL1 four-door sedan (**Figure 1**) during a single-vehicle multiple event crash. The forward-facing CRS was secured by the vehicle's safety belt system but the belt was routed through the rear-facing belt path. The Saturn was equipped with a frontal air bag system that deployed as a result of the crash. The driver of the Saturn was an unrestrained 25-year-old female, who lost directional control of the vehicle as she attempted to negotiate an S-curve with a downgrade. The vehicle entered a ditch and impacted a private driveway culvert. The Saturn subsequently rotated counterclockwise (CCW) and rolled over. The driver was fully ejected from the Saturn and sustained fatal injuries. The child passenger and the CRS remained in the vehicle and were removed by emergency response personnel. The child sustained incapacitating injuries and was transported to a regional pediatric trauma center where he was admitted for treatment.

Figure 1: Left side view of the Saturn.

The Calspan Special Crash Investigations (SCI) team identified this crash on April 28, 2008 through an internet news search of potential cases of interest to the program. The SCI team forwarded the notification to the National Highway Traffic Safety Administration's (NHTSA) Crash Investigation Division. The SCI team was assigned the case for on-site investigation, and established cooperation with the investigating police agency and the local tow yard. The on-site investigation took place during the week of May 1, 2008, and involved the inspection and documentation of the Saturn, the CRS, and crash site. An interview was conducted with the Fire Chief who was the first to respond to the scene of the crash. The hospital would not release the medical records for the child without authorization. The SCI team was unable to obtain authorization from a family member. There was no autopsy performed on the ejected driver.

SUMMARY

Crash Site

The crash occurred on a two-lane road in a rural residential area during nighttime hours. The conditions were clear, dry, and dark. The road consisted of two asphalt-surfaced travel lanes for the north and southbound travel directions. **Figure 2** is a northbound trajectory view of the Saturn. The road was not painted with lane lines or edge markings. In the vicinity of the crash site, the road curved right and then left forming a lazy S-curve for northbound traffic. The road grade was negative for northbound travel with a slope of -3.5 percent for the initial approach, -2.5 percent at the point of impact, and -3 percent at the location of final rest. The posted speed limit was 56 km/h (35 mph).

Figure 2: Northbound trajectory view of the Saturn.

The road sides consisted of residential driveways with lawns extending to the road edges; there were no shoulders. A shallow drainage ditch paralleled the west (left) roadside with the centerline of the ditch located 1.3 m (4 ft) outboard of the pavement edge. Culverts extended under the driveways. The struck driveway culvert consisted of a 30 cm (12 in) diameter steel corrugated pipe with a 15x15 cm (6x6 in) timber positioned on the top of the culvert. A concrete driveway apron that was 2 m (6.5 ft) in width and 6.5 m (21 ft) in length transitioned the roadway to the residential driveway. Located north of the driveway, the ditch bank was approximately 1 m (3 ft) in height due to a change in the grade for the residence. The crash schematic is attached as **Figure 14**.

Vehicle Data - 1995 Saturn SL1

The involved vehicle in this crash was a 1995 Saturn SL1, four-door sedan. An exemplar vehicle is provided in **Figure 3**. The Saturn was identified by the Vehicle Identification Number (VIN): 1G8ZH5287SZ (production number deleted). Due to the death of the driver, the history of the vehicle is unknown. The vehicle's odometer reading at the time of the SCI inspection was 316,794 km (196,847 mi).

Figure 3: Left front oblique view of an exemplar Saturn SL.

The Saturn was powered by a transverse-mounted 1.9-liter, 4-cylinder gasoline engine linked to a 4-speed automatic transmission with a

console mounted shifter. The service brakes were power-assisted four-wheel disc. The Saturn was equipped with OEM steel wheels and plastic hubcaps with vehicle manufacturer recommended P175/70R14 tires. The tire pressure placard was concealed by the jammed left front door and was not visible. Published tire data indicated the recommended cold tire pressures were 207 kPa (30 PSI) and 180 kPa (26 PSI) for the front and rear, respectively. The specific tire data at the time of the SCI inspection was as follows:

Position	Make / Model	Pressure	Tread Depth	Damage
LF	Dunlop SP40	Flat	2 mm (2/32”)	Wheel deformed, sidewall cut
LR	Douglas Xtra Trac A/W	76 kPa (11 PSI)	5 mm (6/32”)	None, grass and dirt embedded in outer bead
RF	Douglas Xtra Trac A/W	228 kPa (33 PSI)	1 mm (1/32”)	None
RR	Futura 2000	Flat	5 mm (6/32”)	None

The interior of the Saturn SL1 was configured with cloth-surfaced front bucket seats and a rear bench with a 60/40 split, forward folding seatback, driver side wide. A view of the exemplar interior front row is provided in **Figure 4**. The front seats were equipped with adjustable head restraints. The left was adjusted 5 cm (2 in) above the seatback while the right was in the full-down position. The windows were manually operative as were the front seat track adjustments. The cloth headliner was previously removed from the vehicle and the fiber backer was exposed to the interior. The appearance of the backer indicated that it had been exposed for a considerable length of time.

Figure 4: Exemplar interior.

Crash Sequence

Pre-Crash

Prior to the crash, the driver of the Saturn was issued a summons for a taillight violation. She was returning to her residence and was transporting one of her two children in the second row left position of the vehicle with the child secured in a forward-facing CRS. The driver was proceeding in a northbound direction on the two-lane road at an estimated speed of 64 km/h (40 mph). As she was attempting to negotiate the right curve with a downgrade, the vehicle drifted to the left and crossed into the opposing travel lane.

Physical evidence at the crash scene indicated that as she entered the southbound travel lane, the driver steered right and applied the brakes with sufficient force to lock the front wheels of the

Saturn as she attempted to regain the northbound lane. The tire marks began on the asphalt roadway and continued into the ditch to the culvert impact. The left front tire mark measured 3.4 m (11 ft) in length and extended into the ditch as the left side of the Saturn departed the edge of the roadway. The right front tire mark on the asphalt road surface measured 11.7 m (38.5 ft) in length. The right steering input and the slope of the ditch induced a clockwise (CW) yaw. This was evidenced by separation of the left side tire marks on the grass and ditch surfaces. The left rear tire mark began at the edge of the pavement and extended 11.6 m (38.3 ft) through the ditch to impact. The CW yaw prior to impact was approximately 10 degrees.

Crash

The front left area of the Saturn impacted the concrete slab and the culvert of the private driveway (**Figure 5**). As the front corner area crushed rearward, the left front tire and wheel engaged the culvert, displacing the left front axle position rearward. This initial impact resulted in a 12 o'clock direction of force. The offset engagement, coupled with the vehicle's forward momentum, reversed the vehicle's rotation from CW to counterclockwise (CCW). During the rapid rotation, the Saturn initiated a right side leading rollover sequence.

Figure 5: View of the culvert/driveway impact.

The Saturn rolled across the driveway and the opposing ditch before re-entering the road. Based on the distance traveled and the resultant damage, the vehicle completed a minimum of five-quarter turns during the violent rollover sequence with approximately 480 degrees of CCW rotation about its longitudinal axis. The unrestrained driver was fully-ejected during this sequence, coming to rest on the roadway in close proximity to the back right corner of the vehicle. The second row left child passenger remained within the CRS restrained by the internal 5-point harness. The forward-facing CRS was secured to the vehicle by the 3-point lap and shoulder belt system with the belt routed across the rear-facing belt path.

The Saturn traveled 30 m (98 ft) during the rollover sequence before it came to final rest on its right side within the roadway. This final rest position was identified by paint markings on the road surface from the investigating law enforcement agency. The Fire Chief of the local Fire Department stated that the vehicle was positioned on its right side within the southbound travel lane, facing in a diagonal southwest direction.

Post-Crash

The local emergency response system was notified of the crash and subsequently dispatched local police, fire, and emergency medical personnel to the scene. The Chief of the local Fire Department was the first responder to arrive on scene. He observed the location and condition of the driver in relation to the vehicle. He immediately checked the interior of the Saturn and observed the child passenger secured in the CRS, with the CRS suspended by the vehicle's safety belt system. He also noted that the child was unconscious and bleeding profusely, with labored respirations.

The Fire Chief reported that he reached into the vehicle though the backlight opening and manually located the vehicle safety belt webbing. He stated that he could not locate the buckle assembly to release the latch plate due to the dark conditions, as he was attending to the child passenger without the use of a flashlight. He requested a knife from a passerby in order to cut the shoulder belt and lap belt webbings of the vehicle safety belt system to remove the CRS and the child from the vehicle. The Chief secured the position of the CRS, and cut the Saturn's second row left safety belt. He removed the child and CRS as a whole unit though the Saturn's backlight opening. This extrication process resulted in the repositioning of the child within the CRS. The Fire Chief noted that the child's condition appeared to decline, and he subsequently placed the CRS on the ground, unbuckled the 5-point harness system, and removed the child from the CRS. It was at this point in time that an ambulance arrived on scene, and the crew assumed treatment of the child. They determined that his condition was critical and requested a helicopter to transport the child to a regional pediatric trauma center. The child was flown to the aforementioned facility where he was admitted for treatment of his injuries.

Emergency response personnel found the driver unconscious at the scene with faint vital signs. The Fire Chief reported that driver was placed on a backboard and transported by ground ambulance to a local hospital. However, she expired en route to the hospital and was pronounced deceased upon arrival at the facility.

1995 Saturn SL1

Exterior Damage

The Saturn sustained severe frontal damage from the initial culvert impact, undercarriage damage from engagement with the culvert, and moderate damage to the remaining planes from the rollover sequence. **Figure 6** is a frontal view of the damage to the Saturn. The bumper fascia was separated from the vehicle and was missing at the time of the inspection. The direct contact damage was estimated at 25 cm (10 in) in width originating at

Figure 6: Frontal damage to the Saturn.

the left bumper corner and extending inboard. The initial culvert impact deformed the full-width of the bumper beam, resulting in damage length of 102 cm (40 in). The maximum crush at mid-bumper level was 53 cm (21 in). A crush profile documented at the bumper beam produced the following measurements: C1 = 53 cm (20.9 in), C2 = 35 cm (13.8 in), C3 = 27 cm (10.6 in), C4 = 18 cm (7.1 in), C5 = 13 cm (5.1 in), C6 = 12 cm (4.7 in). The Collision Deformation Classification (CDC) was 12FLLE8.

Damage from the engagement with the culvert extended through the front undercarriage of the vehicle. There was severe deformation to the structure of the engine compartment, which resulted in the separation of the engine and transmission from the vehicle. The left front axle position was displaced rearward, resulting in separation of the drive axle, suspension, and steering systems. The left front tire and wheel were displaced rearward to the location of the left B-pillar, as seen in **Figure 7.** This resulted in the corresponding longitudinal and vertical displacement of the left toe and floor pans, causing interior intrusions.

Figure 7: Left side view of the Saturn.

The most severe damage associated with the rollover was identified to the top plane of the vehicle as seen in **Figure 8**. The direct contact damage was 114 cm (45 in) and extended across the full-width of the windshield header. The maximum roof crush was crush 10 cm (3.9 in), located at the right A-pillar. The maximum lateral crush to the greenhouse area was located at the right A-pillar and measured 4 cm (1.5 in). The associated CDC was 00TDDO3.

Figure 8: Top plane damage from rollover event.

The remaining planes of the vehicle exhibited damage patterns attributable to induced crush and direct rollover damage. The left front, left rear, and right front doors were jammed closed due to body deformation. The right rear door remained closed during the crash and was operational post-event. The full height and width of the laminated windshield was fractured as a result of the impact events. The laminate was torn along the left A-pillar and the left two-thirds of the windshield header, though the bond remained intact. The tempered left front door glazing was closed pre-crash and had disintegrated during the culvert impact. The left rear door glazing was closed pre-crash and remained intact post crash, but the fixed left rear quarter window had disintegrated during the rollover sequence. The right front door glazing was fully opened pre-

crash and remained intact at the time of SCI inspection. The right rear glazing was opened 5 cm (2 in) pre-crash and also remained intact post-crash. The adjacent right rear quarter window remained intact as well. The fixed backlight had disintegrated during the rollover event.

Interior Damage

The Saturn sustained moderate severity interior damage that was attributed to passenger compartment intrusion, integrity loss, air bag deployment and occupant contacts. Longitudinal, lateral, and vertical intrusions within the front left seating position's front, left side, and floor areas occurred during the engagement with the driveway culvert. Vertical intrusion of the top plane occurred during the subsequent rollover sequence. Combined, these intrusions displaced the driver seat at an upward diagonal angle from the area of impact, rotating the seat rearward and right laterally as seen in **Figure 9**.

Figure 9: Interior view of the Saturn.

The following table provides the Saturn's intrusions as documented during the SCI inspection:

Seat Position	Component	Intrusion	Direction
Row 1, Left	Toe pan	64 cm (25 in)	Longitudinal
Row 1, Left	Floor	41 cm (16 in)	Vertical
Row 1, Left	Door panel	36 cm (14 in)	Lateral
Row 1, Left	Lower B-pillar	36 cm (14 in)	Lateral
Row 1, Left	Seat cushion (left aspect)	18 cm (20 in)	Vertical
Row 2, Left	Seatback of row 1, left	15 cm (6 in)	Longitudinal
Row 1, Left	Roof	9 cm (3.5 in)	Vertical
Row 1, Left	Windshield header	9 cm (3.5 in)	Vertical
Row 1, Left	Instrument panel	8 cm (3 in)	Longitudinal
Row 1, Left	A-pillar	5 cm (2 in)	Vertical
Row 1, Left	Roof side rail	5 cm (2 in)	Vertical

The driver engaged the steering wheel rim during the multiple event crash. The wheel rim was deformed in two directions indicative of initial frontal loading and subsequent contact during the ejection. During the rollover the driver loaded and deformed the front row left side seatback. A large area of bodily fluid was noted on the second row right door panel and window glazing.

Frontal Air Bag System

The Saturn was equipped with a 1st generation frontal air bag system for the driver and front right passenger positions. This air bag system consisted of a single point Sensing and Diagnostic Module (SDM) that was located in the aft aspect of the center tunnel under the console, a steering wheel hub-mounted driver's air bag, and a mid-instrument panel-mounted front right passenger air bag. Both frontal air bags deployed as a result of the initial impact event.

The driver's air bag module consisted of I-configuration cover flaps that were 8 cm (3 in) in width and 14 cm (5.5 in) in height. The internally tethered air bag had a diameter of 61 cm (24 in) in its deflated state. Two 3 cm (1 in) diameter vent ports were located on the back side of the air bag at the 11 and 1 o'clock sectors. Although the undamaged air bag was soiled, the SCI team was unable to identify any direct evidence of contact attributable to the driver. The driver air bag is depicted in **Figure 10**.

The front right air bag module was concealed by a single top-hinged cover that measured 30 cm (12 in) in width and 11 cm (4.5 in) in height. A mid-mount cover flap was positioned under an integrated brow in the upper instrument panel that limited the upward rotation of the flap. The front right air bag was not tethered or directly vented into the passenger compartment. There was no occupant contact evidence or damage to the front right air bag. The deployed front right air bag is depicted in **Figure 11**.

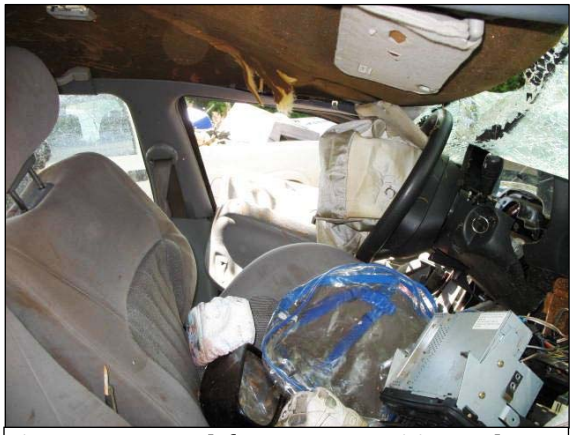

Figure 10: Front left occupant position and deployed driver air bag.

Figure 11: Overhead view of the deployed front right air bag.

Event Data Recorder

The 1995 Saturn was equipped with an Event Data Recorder (EDR) that was integrated in the SDM. This EDR was capable of being imaged through the use of the Bosch Crash Data Retrieval tool via the vehicle's Diagnostic Link Connector (DLC). The electrical system in this vehicle was compromised by the separation of the drive train and damage to the engine and passenger compartments; therefore the EDR could not be imaged. This vehicle platform was not

supported by a standalone cable for the SDM and remote 12-volt power could not be supplied to the DLC.

Manual Safety Belt Systems

The Saturn was equipped with 3-point, continuous loop lap and shoulder safety belts for all four outboard seating positions and a lap belt for the second row center position. The front safety belt systems utilized a dual Emergency Locking Retractor (ELR) system for the lap belt and the shoulder belt, with a sewn-on latch plate. Both front belt systems were equipped with fixed D-rings. The driver's belt system contained indications of historical use on the latch plate and the edges of the belt webbing. A lack of loading evidence to the driver's safety belt system supported a lack of manual restraint use by the driver during the crash.

The second row outboard 3-point safety belt systems utilized continuous loop webbing with ELR retractors and locking latch plates. The second row center position lap belt system used a locking latch plate. The locking latch plates did not require the use of a locking clip to secure child safety seats.

The Fire Chief cut the belt webbing in two places to remove the child and the CRS from the vehicle. The lap belt webbing was cut 15 cm (6 in) above the floor anchor. The webbing was gathered at the belt guide outboard of the retractor; a 13 cm (5 in) length of webbing was extended from the retractor at the time of the SCI inspection. A segment of belt webbing was routed through the latch plate that measured 65 cm (25.5 in) in length. The cut portion of the shoulder belt webbing measured 70 cm (27.75 in). There were vertically oriented striations extending the length of the cut webbing from interaction with the CRS.

Child Restraint System

The 2-year-old male passenger was restrained in a Cosco Alpha Omega child seat, depicted in **Figure 12**. This model CRS was a convertible seat that could be used in the rear-facing or forward-facing mode. The CRS was found in the second row seat of the Saturn and was in a worn and well-used condition at the time of the inspection. The labeling on the seat was deteriorated, and the portions of the labels that contained the Model Number and Date of Manufacturer were missing. A single clock face molded into the back-side of the CRS shell contained an arrow pointing to the number 4. The remaining labeling listed the CRS for use by children with weights of 10-18 kg (22-40 lbs) in the forward-facing mode and 2-10 kg (5-22 lbs) in the rear-facing position. The CRS was equipped with a 5-point safety belt harness system that consisted of two straps with separate latch plates, a

Figure 12: Second row left child safety seat.

common center buckle and a chest retainer clip. At the time of SCI inspection, the straps were twisted and creased. Due to the expulsion of body fluid by the child following the crash, the harness straps were stiff. The left half of the chest clip was missing. The harness straps were routed through the second slot from the top of five positioning slots.

At the time of the crash, the CRS was used in a forward-facing mode with the child restrained by the internal harness. The CRS was secured to the second row left position by the vehicle's lap and shoulder belt. The lap belt was routed through the rear-facing belt path at the forward aspect of the CRS. The rear facing belt path should not be used when the CRS is in a forward facing position. **Figure 13** is a view of the CRS placed into the second row left position of the Saturn.

Figure 13: CRS placed into the second row left position.

Damage to the CRS consisted of abrasions to the lateral surfaces of the rear-facing belt path from frictional engagement with the vehicle's lap belt webbing. The lower left corner of the CRS shell was scuffed and deformed from possible contact with the driver seat back. This damage was primarily attributed to ground contact outside the vehicle during the handling of the CRS.

OCCUPANT DATA

Driver Demographics

Age / Sex:	25-year-old / Female
Height:	Unknown
Weight:	Unknown
Seat Track Position:	Mid-track position
Safety Belt Usage:	Unrestrained
Usage Source:	SCI vehicle inspection
Egress From Vehicle:	Fully ejected during the crash sequence
Type of Medical Treatment:	Transported by ground ambulance to a local hospital where she was pronounced deceased on-arrival

Driver Injury

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Fatal head injury, NFS No further evaluation	Unknown (115999.7,0)	Ground

Source: First responder

Driver Kinematics

The 25-year-old female driver of the Saturn was seated in a mid-track position with the seat back slightly reclined and the adjustable head restraint adjusted 5 cm (2 in) above the seat back. She was not restrained by the manual safety belt system. Belt usage was determined from the lack of loading evidence and/or damage to the belt system, the post-crash stowed position of the belt system, and the full-ejection status of the driver.

At impact with the culvert, the frontal air bag system deployed as the driver initiated a forward trajectory in response to the 12 o'clock direction of force. She engaged the deployed driver's air bag and compressed the air bag against the steering assembly. Her loading force deformed the upper aspect of the steering wheel rim forward approximately 2 cm (0.75 in). Her lower extremities were engaged by the severe intrusion of the toe and floor pans of the Saturn. The driver's seat was displaced vertically and laterally by the floor intrusion resultant to the culvert impact.

Based on the rapid CCW rotation of the Saturn following the initial culvert impact, the driver initiated a lateral trajectory to her left with respect to the vehicle. During the rollover event, the unrestrained driver moved about the interior of the vehicle and was subsequently displaced rearward between the left B-pillar and the deformed driver seat back. Her head probably impacted the face/head of the 2-year-old child who was restrained in the forward facing CSS in the second row left position of the vehicle during her ejection. The injuries to the driver from this occupant-to-occupant interaction are unknown. She was completely ejected through the backlight of the vehicle onto the asphalt road surface where she came to rest.

The driver was found unconscious at the scene with faint vital signs. She was placed on a backboard and transported by ground ambulance to a local hospital, but expired en route and was pronounced deceased upon arrival at the facility. There was no autopsy performed on her body. The SCI team was unable to obtain medical records as an authorization was required. Due to the lack of medical data, the injuries to the driver are unknown.

Second Row Left Child Passenger

Age / Sex:	2-year-old / Male
Height:	Unknown
Weight:	Unknown
Child Restraint Use:	Restrained in a forward facing Cosco Alpha Omega CRS by the integral harness system
Vehicle Safety Belt Usage:	3-point lap and shoulder belt system routed through the rear-facing belt path
Egress From Vehicle:	Removed from the vehicle in the CRS by the first responder to the scene
Type of Medical Treatment:	Transported via helicopter to a regional trauma center where he was admitted for treatment of unknown injuries

Second Row Left Passenger Injury

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Head/face injury, NFS	Unknown (115099.7,0)	Occupant to occupant contact

Source: First responder

Second Row Left Passenger Kinematics

The 2-year-old male passenger was restrained in a forward-facing Cosco Alpha Omega CRS by the integral 5-point harness system. The CRS was positioned in the second row left of the Saturn and was secured to the bench seat by the routing of the Saturn's 3-point lap and shoulder safety belt. The safety belt system was routed through the rear-facing belt path at the forward aspect of the CRS.

At impact the second row left safety belt retractor locked. The child passenger responded to the frontal impact force by initiating a forward trajectory within the CRS and loaded the integral harness system. In turn, the CRS and the child moved forward and loaded the vehicle's belt system. During the subsequent rotation of the vehicle and the rollover event, the driver was displaced rearward and ejected through the backlight of the vehicle. The driver probably contacted/interacted with the child passenger's face/head as she was displaced rearward along her ejection path within the vehicle. The child sustained multiple head/facial injuries from the probable occupant-to-occupant interaction. The child's injuries were reported by the Fire Chief.

As the Saturn came to rest on its right side in the roadway, the child passenger remained within the CRS in the second row left position of the vehicle. The child and the CRS were suspended by the vehicle's locked belt system. The child bled profusely onto the right rear door glazing.

The Fire Chief removed the child passenger and the CRS as a unit through the backlight of the vehicle. The child was subsequently removed from the CRS and was transported by helicopter to a regional pediatric trauma center where he was admitted for treatment of his injuries. The hospital would not release the child's medical records without authorization and the SCI team was unable to obtain authorization from surviving family.

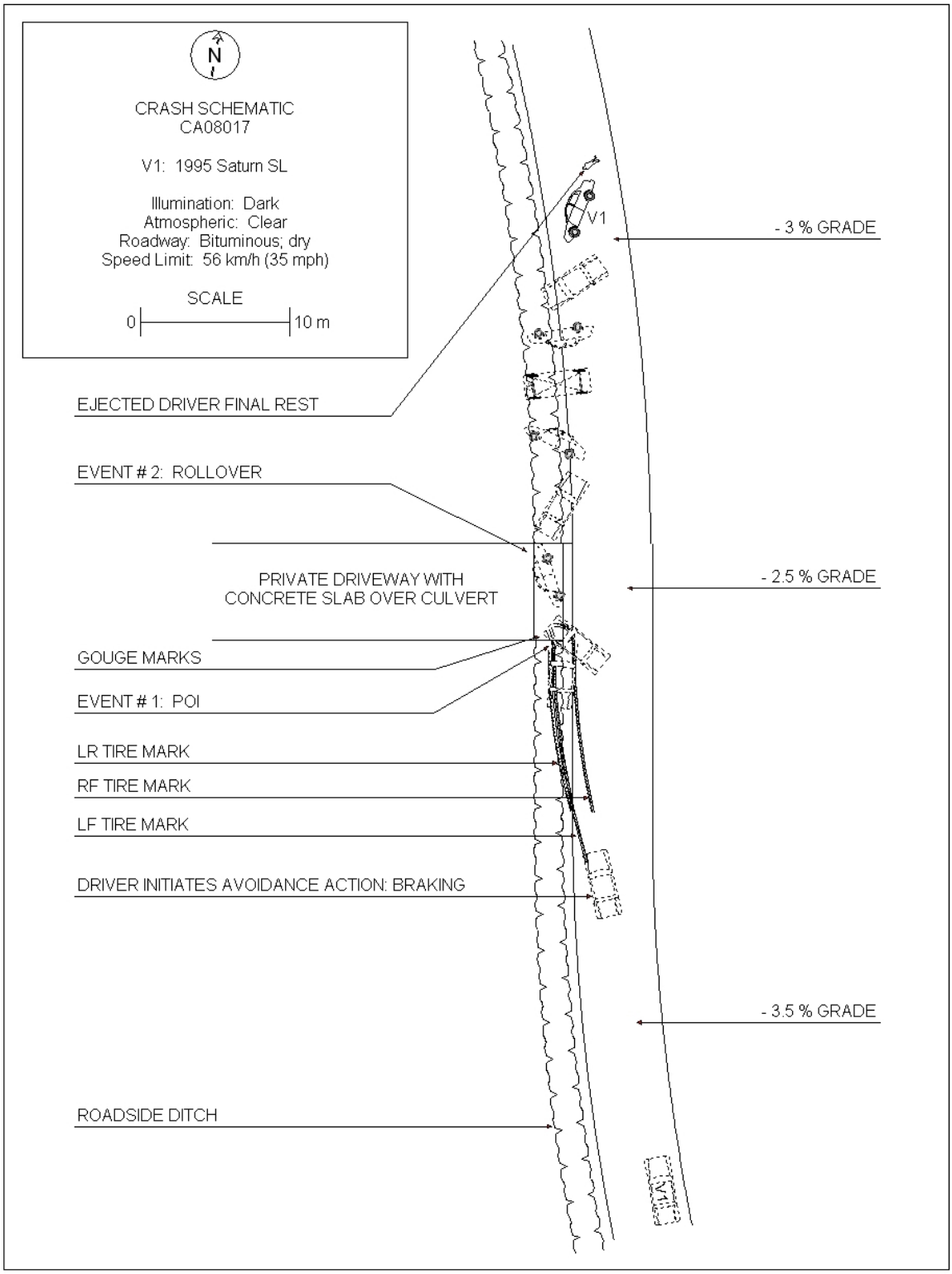

Figure 14: Crash schematic.