TRANSPORTATION SCIENCES
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VERIDIAN ON-SITE AIR BAG RELATED CHILD SERIOUS INJURY INVESTIGATION
VERIDIAN CASE NO. CA98-065
VEHICLE: 1996 TOYOTA COROLLA
LOCATION: FLORIDA
CRASH DATE: NOVEMBER 1998

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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 injury mechanisms that resulted in serious injury to a 6 year old female front right passenger of a 1996 Toyota Corolla. The Toyota was equipped with frontal air bags for the driver and front right passenger that deployed as a result of a moderate severity front-to-rear crash sequence with a 1978 Chevrolet Impala. The improperly restrained child passenger of the Toyota was displaced forward by pre-crash braking, into the path of the deploying front right air bag. The child's involvement with the deploying air bag membrane resulted in a closed head injury with brief loss of consciousness, cervical strain, abrasions of the scalp, face, chin, anterior neck, and a right brachial plexus injury. Her loading of the improperly placed shoulder belt webbing resulted in soft tissue injuries of the chest, and a right pulmonary contusion. She was transported by helicopter to a regional pediatric trauma center where she was admitted for treatment for a period of six days. Her parents discharged her from the hospital against the directives of the attending physicians.			
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BACKGROUND

This on-site investigation focused on the injury mechanisms that resulted in serious injury to a 6 year old female front right passenger of a 1996 Toyota Corolla. The Toyota was equipped with frontal air bags for the driver and front right passenger that deployed as a result of a moderate severity front-to-rear crash sequence with a 1978 Chevrolet Impala. **Figure 1** is an on-scene view of the crash site. The improperly restrained child passenger of the Toyota was displaced forward by pre-crash braking, into the path of the deploying front right air bag. The child's involvement with the deploying air bag membrane resulted in a closed head injury with brief loss of consciousness, cervical strain, abrasions of the scalp, face, chin, anterior neck, and a right brachial plexus injury. Her loading of the improperly placed shoulder belt webbing resulted in soft tissue injuries of the chest, and a right pulmonary contusion. She was transported by helicopter to a regional pediatric trauma center where she was admitted for treatment for a period of six days. Her parents discharged her from the hospital against the directives of the attending physicians.

Figure 1. On-scene view of the involved vehicles at final rest.

The Veridian Special Crash Investigation (SCI) Team was notified by the National Highway Traffic Safety Administration (NHTSA) of the two vehicle crash on November 16, 1998. NHTSA identified the crash through a news article which appeared in the local press. The crash was assigned to the Veridian SCI Team as an on-site investigation to determine the relationship between the deployment event of the air bag system and the injuries sustained by the child seated in the right front seat of the Toyota. The on-site investigation was initiated on November 17th.

SUMMARY

Crash Site

The crash occurred on a two lane, north/south state route near a three-leg T intersection **(Figure 2)**. In the vicinity of the crash site, the asphalt road surface was level and curved to the right, with respect to the involved vehicle's direction of travel. The radius of curvature was calculated at 136.2 m (446.8'). The travel lanes were 3.8 m (12.5') and 3.6 m (11.8') in width for the south and northbound lanes respectively. The travel lanes were bordered by asphalt shoulders that were 1.2 m (3.9') in width with grass bordering both shoulders. At the

Figure 2. Crash site in the area of impact.

time of the crash, the conditions were daylight and dry. The posted speed limit was 72 km/h (45 mph).

Crash Sequence

Pre-Crash

The driver of the 1996 Toyota Corolla had just left a relative's residence and made a right turn onto the two-lane state route. After completing the turn, the driver noted that her 6 year old daughter seated in the front right position was not restrained by the manual 3-point lap and shoulder belt system. While driving in a southerly direction and negotiating the right curve, the driver reached with her right hand to restrain her child by engaging the latch plate of the belt system into the center mounted buckle. During this activity, the driver's attention was diverted away from the roadway. As she redirected her attention forward, the driver of the Toyota observed the southbound Chevrolet Impala slowing to a stop in preparation for a left turn at the 3-leg intersection.

The driver of the Toyota Corolla steered to the right, while applying full brakes in an attempt to avoid the crash. The Toyota skidded 8 m (26') in a tracking mode **(Figure 3)** on the dry asphalt road surface to impact with the rear of the Chevrolet. It should be noted that the crash occurred to the right of the southbound travel lane, therefore it was unknown if the driver of the Chevrolet attempted to steer right to avoid the impending crash or if she was driving to the right of the travel lane. The crash schematic is attached as **Figure 15**, Page 13.

Figure 3. Pre-crash skid marks of the Toyota.

Crash

The full frontal area of the Toyota impacted the rear of the Chevrolet Impala in a 12/6 o'clock impact configuration. The damage and trajectory algorithm of the WinSMASH program computed impact speeds of 32.5 km/h (20.2 mph) for the Toyota Corolla and 2.1 km/h (1.3 mph) for the Chevrolet. The Chevrolet was accelerated to match the speed of the striking Toyota. As the Toyota crushed and decelerated due to continuous braking by the driver, the vehicles separated. The damage output from the WinSMASH reconstruction program indicated that the Toyota Corolla sustained a total delta V of 21.3 km/h (13.2 mph) while the Chevrolet Impala experienced a 11.5 km/h (7.1 mph). The longitudinal components were -21.3 km/h (-13.2 mph) and 11.5 km/h (7.1 mph) respectively. The delta V values were consistent with the crush profiles of both vehicles. The Impala was displaced forward and came to rest approximately 15 m (49') south of the point of impact, straddling the right asphalt shoulder and the adjacent grassy area**(Figure 4)**. The position of the Impala indicated that the driver may have steered to the right after the impact, or had the wheels turned to the right prior to impact. The Toyota Corolla continued approximately 3 m (10') forward before coming to rest straddling the west (right) edgeline.

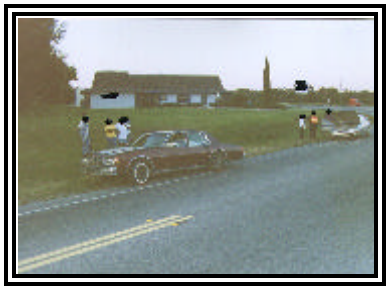

Figure 4. Final rest of the involved vehicles.

Post-Crash

The front right child passenger of the Toyota Corolla rebounded and came to final rest with her hips forward on the seat cushion and her head leaning against the seat back support. She was reported by the mother as unconscious for a period of 8-10 minutes. The driver unbuckled the child from the manual 3-point lap and shoulder belt system and held the child upright in the front right seat until rescue personnel arrive on-scene.

The local police department received notification of the crash and dispatched an officer to the scene. This officer arrived on-scene within five minutes of the time of the crash. Rescue personnel responded to the call and arrived on-scene at approximately the same time as the police. The paramedics assessed the child's condition and requested helicopter transport. A life flight helicopter arrived within 15 minutes of the request and remained on the ground for approximately ten minutes before transporting the six year old child to a regional pediatric trauma center. She arrived at the trauma unit in an obtunded condition approximately one hour after the reported time of the crash with a Glascow Coma Score GCS of 12. She was admitted for treatment and discharged six days later against the advice of the attending physician.

Vehicle Data

The 1996 Toyota Corolla DX, 4-door sedan, was owned by the driver of the vehicle. She purchased the Toyota in June of 1996 from a local car rental company. At the time of purchase, the odometer reading was approximately 16K km (10K miles). The vehicle was manufactured in October 1995 and was identified by vehicle identification number 2T1BB02EXTC (production number deleted). The Toyota was equipped with a 1.6 liter engine linked to a 4-speed automatic transmission with a floor mounted shifter, power-assisted steering and power-assisted front disc/rear drum brakes without anti-lock. The interior was configured with front bucket seats with adjustable head restraints and reclining seat backs, and a rear bench seat with a split, forward folding seat back.

The safety systems included the frontal air bag system for the driver and right passenger positions and manual belts systems for the five designated seated positions. The air bag system is discussed later in this summary report. The four outboard seated positions were equipped with 3-point lap and shoulder belt systems while the center rear position was equipped with a lap belt. The front belt systems consisted of continuous loop webbings with sliding latchplates and dual mode locking retractors. The B-pillar mounted D-rings were adjustable with 9.8 cm (3.875") of vertical adjustment. Both D-rings were adjusted to the full-up positions. The front lap belts were equipped with energy management loops that were concealed by the vinyl sleeves at the outboard anchorage points. Although both front belts systems were in use at the time of the crash, the management loops remained intact.

Vehicle Damage

Exterior - 1996 Toyota Corolla

The Toyota Corolla sustained moderate frontal damage as a result of its impact with the rear of the 1978 Chevrolet Impala. Maximum crush was 6.4 cm (2.5") located 11.4 cm (4.5") left of the vehicle centerline. The direct contact damage length was 127 cm (50") that was distributed across the entire width of the front

bumper fascia. This damage involved abrasions to the bumper fascia. The underlying bumper reinforcement bar was minimally crushed, however, this damage was concealed by the bumper fascia. The fascia was removed and a crush profile was documented at the level of the reinforcement bar. The crush profile is documented in the following table:

Crush measurements along the front bumper reinforcement beam	C_1 = 2.9 cm (1.125")	C_2 = 4.8 cm (1.875")	C_3 = 6.4 cm (2.5")
	C_4 = 4.1 cm (1.625")	C_5 = 3.2 cm (1.25")	C_6 = 2.2 cm (0.875")

The Collision Deformation Classification (CDC) for the frontal damage to the 1996 Toyota Corolla was 12-FDEW-1. **Figures 5 and 6** are exterior views of the Toyota Corolla.

Figure 5. Front left view of the exterior damage to the Toyota.

Figure 6. Profile view documenting the extent of frontal crush.

Interior

The interior damage to the Toyota Corolla was attributed to occupant contact points and the deployment of the frontal air bag system. The mid-mount front right air bag module cover flap exhibited a series of four parallel scratch type marks along the lower left surface which were attribute to post-impact module removal. Both frontal air bags deployed from the respective module assemblies as designed.

The front left driver air bag exhibited a red lip stick transfer mark in the upper right quadrant which measured 1.9 cm (0.75"). There was a 7.6 cm (3.0") black vinyl transfer located on the upper right quadrant of the bag that was attributed to expansion within the inside surface of the air bag module cover. Although the driver loaded the front left driver air bag, there was no damage to the steering wheel rim or compression of the energy absorbing steering column.

Figure 7. Tissue transfer to the right door armrest.

There was a circular pattern of air bag generant residue on the left side of the windshield that resulted from the exhaust gases from the front left

driver air bag. The pattern measured 8.9 cm (3.5") in diameter and was located 15.2 cm (6.0") left of the vehicle centerline and 12.7 cm (5.0") above the instrument panel.

The right door armrest exhibited a tissue transfer along the upper edge that was attributed to contact by the front right child passenger during the crash event. The tissue transfer measured 8.9 cm (3.5") in length and was located 20.3 cm (8.0") rearward of the instrument panel **(Figure 7)**.

The front right passenger air bag exhibited tissue transfers along the inboard surface of the air bag. The transfer measured 19.7 cm (7.75") in length and 6.4 cm (2.5") in width. It was located 22.9 cm (9.0") rearward of the inflator unit. These transfers were attributed to contact with the right front occupant's face and neck during the expansion of the air bag. There was an air bag membrane transfer on the right instrument panel located immediately below the module location. The transfer measured 8.9 cm (3.5") laterally and 1.9 cm (0.75") vertically and began 35.6 cm (14.0") right of the vehicle centerline.

The right sunvisor was not present at the time of the inspection. The owner indicated that it had been removed prior to the crash. The glovebox door had been removed post-crash and there was no evidence of contact or damage to the component.

Exterior - 1978 Chevrolet Impala

The 1978 Chevrolet Impala was a four-door sedan. This vehicle could not be located during this on-site investigation, therefore it was not inspected. The Impala sustained moderate damage to the full rear area of the vehicle. Based on the on-scene police photographs, the rear bumper was crushed minimally by the impact sequence. The energy was transmitted into the frame of the vehicle as evidenced by the downward deflection of the rear quarter panels. Induced deformation was noted to the quarter panels at the rear third of the rear wheel opening. The damage was not disabling as it was driven from the scene following the police investigation.

Frontal Air Bag System

The 1996 Toyota Corolla was equipped with front air bags for the driver and right passenger positions that deployed during the crash sequence **(Figure 8)**. The front left driver air bag was mounted in a typical configuration within the four-spoke steering wheel with H-configuration module cover flaps. The cover flaps opened at the designated tear points. The upper flap measured 7.6 cm (3.0") vertically while the lower flap measured 7.0 cm (2.75"). The width of the flaps measured 15.2 cm (6.0") at the horizontal tear seam. There were no apparent occupant contact points or damage to the cover flaps.

Figure 8. On-scene image of the deployed frontal air bag system

Figure 9. Driver position with air bag generant on windshield.

Figure 10. Cover flap and vent ports of the driver air bag.

The front left air bag was removed from the steering wheel by the body shop prior to this on-site investigation. The air bag membrane was constructed of a woven nylon-type fabric and measured 67.9 cm (26.5") in diameter in its deflated state. The bag was tethered internally by four tethers that were stitched to the face of the bag with a 19.7 cm (7.75") tether reinforcement. The bag was vented by two vent ports that measured 3.2 cm (1.25") in diameter and were located 15.9 cm (6.25") apart **(Figure 10)**.

There was a 1.9 cm (0.75") red lipstick mark on the surface of the air bag at the right upper quadrant. The transfer was located 7.6 cm (3.0") right of the air bag vertical centerline and 7.6 cm (3.0") below the peripheral seam. The pattern of this transfer indicated that the air bag was fully expanded at the time of contact by the driver's face.

Adjacent to the red transfer was a black color transfer mark which was attributed to contact by the underside of the air bag module flap during air bag expansion. The transfer measured 7.6 cm (3.0") in length and was located 1.3 cm (0.5") right of the air bag centerline. An air bag identification number of 9580912B1134 was printed on the rear lower surface of the air bag.

The front right air bag was a mid mount design **(Figure 11)** which had a single air bag module cover flap that opened in an upward motion. The module cover measured 34.3 cm (13.5") along the lateral seam line, 12.1 cm (4.75") along the left vertical seam, 10.8 cm (4.25") along the right seam, and 35.6 cm (14.0") along the hinged side. It measured 1.4 cm (9/16") thick and was comprised of a high density foam over a sheet metal backing plate. The cover was deformed in a curved shape. The cover flap was deformed with the left leading edge 7.6 cm (3.0") below the right leading edge and the center located 8.9 cm (3.5") below the right leading edge **(Figure 12)**. This deflection was not attributed to child passenger contact. It probably resulted from bag expansion as the forward positioned child passenger interacted with the expansion of the bag, thus altering its deployment path. There were a series of four light vertical scrapes on the cover surface in the area of the lower left corner which measured 11.4 cm (4.5") laterally and 3.8 cm (1.5") vertically. These marks were not attributed to any occupant injuries and were considered the result of module removal from the instrument panel during collision repair**.**

Figure 11. Deployed front right air bag.

Figure 12. Deformed module cover flap.

The front right air bag was non-tethered and was vented by two 6.0 cm (2.375") diameter vent ports on both the inboard and outboard side surfaces of the bag. These ports were located 32.4 cm (12.75") below the inflated horizontal top plane of the air bag. The air bag material was a white color nylon and constructed of a fine fabric weave. There was a reddish nylon overwrap panel located at the inflator unit which measured 21.6 cm (8.5") laterally at the top and 25.4 cm (10.0") laterally at the bottom. The bottom edge of the panel was frayed due to the designed separation of the panel during air bag expansion. There was no discernable occupant contact on this panel.

The front right passenger air bag exhibited tissue transfers along the inboard surface of the air bag. The transfer measured 19.7 cm (7.75") in length and 6.4 cm (2.5") in width. It was located 22.9 cm (9.0") rearward of the inflator unit. These transfers were attributed to contact with the right front occupant's face and neck during the expansion of the air bag. There was an air bag membrane transfer on the right instrument panel located immediately below the module location. The transfer measured 8.9 cm (3.5") laterally and 1.9 cm (0.75") vertically and began 35.6 cm (14.0") right of the vehicle centerline **(Figure 13)**.

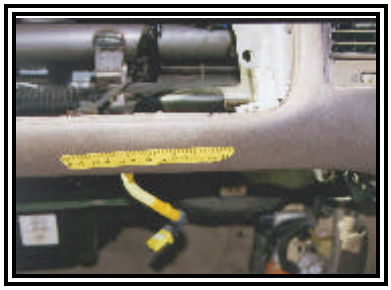

Figure 13. Membrane transfer to the mid instrument panel.

An inked print identification number was visible on the rear surface of the air bag. The identification number was as follows:

13907-02010.B.
403U392U402
C102
10/16/95
L025152113

The longitudinal excursion of the front right air bag measured 54.6 cm (21.5") from the air bag inflator unit **(Figure 12)**.

Driver Demographics - 1996 Toyota Corolla

Age/Sex:	30 year old female
Height:	168.9 cm (66.5 in)
Weight:	90.7 kg (200.0 lb)
Manual Restraint Usage:	3-point lap and shoulder belt
Usage Source:	Vehicle inspection, driver interview
Eyeware:	None
Seat Track Position:	Rearward
Mode of Transport From Scene:	Private vehicle
Type of Medical Treatment:	Not medically treated

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98	Injury Mechanism
Contusion of left upper chest	Minor (490402.1,2)	Shoulder belt webbing
Contusion of the bottom of the left foot	Minor (890402.1,2)	Toe pan contact
Soreness of the left shoulder and left arm	N/A	Shoulder belt webbing

Driver Kinematics

The driver's seat of the Toyota Corolla was in the full back adjusted position over an adjusted range of 21.6 cm (8.5"). In this position, the seat back support measured 63.5 cm (25.0") rearward from the driver air bag module cover at a height of 50.8 cm (20.0") above the junction with the seat cushion. The seat back support was reclined to a measured angle of 20 degrees. She was properly restrained by the manual 3-point lap and shoulder belt system as evidenced by a minor injury of the chest and the lack of contact points to the forward positioned components.

Immediately prior to the crash, she attempted to buckle the front right child passenger's 3-point lap and shoulder belt system. At this point, she was out-of-position to her right with her right arm extended to the right. As the driver redirected her attention forward, she observed the Chevrolet Impala and repositioned both hands on the steering wheel rim at the 10 and 2 o'clock positions. She subsequently steered to the right and braked with her right foot in an attempt to avoid the impending impact. The driver also braced against the steering wheel rim with both hands and against the floor/toe pan with her left foot.

At impact, she initiated a forward trajectory in response to the 12 o'clock impact force and loaded the

manual belt system. The loading force of the shoulder belt webbing resulted in a contusion over the left upper chest and soreness of the left shoulder and arm. She further noted that this soreness resulted in brief numbness of the left thumb. The driver also sustained a contusion of the bottom of the left foot from loading against the left floor/toe pan. She refused medical treatment at the scene and did not seek follow-up treatment.

Child Passenger Demographics

Age/Sex:	6 year old female
Height:	123.8 cm (48.75")
Weight:	23.6 kg (52.0 lb)
Manual Restraint Usage:	Improper usage of the 3-point lap and shoulder belt system
Usage Source:	Vehicle inspection, injury data
Seat Track Position:	Mid track position
Mode of Transport From Scene:	Transported by helicopter to a regional pediatric trauma center
Type of Medical Treatment:	Admitted for treatment for a period of six days and released against the advise of the attending physician

Child Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Closed head injury, concussion with brief loss of consciousness, 1-3 minutes	Serious (160612.3,0)	Expanding front right air bag
Supplemental discussion: Patient was obtunded , groggy upon awakening, did not converse and seemed disoriented, responded to verbal stimuli, left conjugate gaze palsy, remains with right side gaze-difficulty tracking to the left side.		
Right brachial plexus injury	Moderate (630299.2,6)	Rotational injury from expansion of the front right air bag
Cervical sprain	Minor (640278.1,6)	Expanding front right air bag
Diffuse abrasions of the anterior neck	Minor (390202.1,5)	Expanding front right air bag
Abrasions of the chin	Minor (290202.1,8)	Expanding front right air bag

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Abrasions of the upper right chest wall (near axilla)	Minor (490202.1,1)	Shoulder belt webbing
Abrasions of the right elbow with tenderness and swelling	Minor (790202.1,1)	Right door armrest
1 cm laceration of the right temple	Minor (190602.1,1)	Expanding front right air bag
Small abrasion of the tongue	Not codeable	Self-inflicted from the expanding front right air bag
Contusions of the gingiva	Minor (243202.1,8)	Expanding front right air bag
Small laceration of the tongue	Minor (243402.1,8)	Self-inflicted from the expanding front right air bag
Abrasions of the right clavicle (shoulder)	Minor (790202.1,1)	Expanding front right air bag
Abrasions of the right cheek and ear	Minor (290202.1,1)	Expanding front right air bag
Contusion of the anterior basal segment of the right lower pulmonary lobe without pneumothorax or effusion	Serious (441406.3,1)	Shoulder belt webbing
Abrasions of the scalp surrounding the right ear	Minor (190202.1,1)	Expanding front right air bag
Right glenohumeral joint separation	Minor (751030.2,1)	Rotational injury from expansion of the front right air bag
Abrasions of the anterior right forearm	Minor (790202.1,1)	Expanding front right air bag

** Source of Injuries - Hospital Medical Records*

Child Passenger Kinematics

At the on-set of this trip, the front right child passenger was reportedly sitting on the seat holding a plastic soda bottle between her legs. The mother was very specific that the bottle cap was secured in place and that the child was instructed not to drink the soda until she arrived home. The child's height dimensions measured during the on-site investigation were: 26.8 cm (14.5") knee height; 61.0 cm (24.0") hip height: 97.8 cm (38.5") shoulder height; and 123.8 cm (48.75") to the top of her head. Given the seat cushion height of 27.9 cm (11.0") at the leading edge, the child was probably sitting forward on the seat cushion so that her feet would be in contact with the floor pan.

Prior to impact, the driver of the Toyota observed that the front right child passenger was unrestrained. While negotiating the right curve, the driver assisted the child in an attempt to latch the 3-point lap and shoulder belt system. Both the police report and medical records indicated that the child was not restrained. The driver stated during the SCI interview that the events of the crash occurred so fast that she was not sure whether she had actually latched the manual belt system prior to impact. She further noted that she was struggling to insert the latch plate into the buckle. Injury patterns to the child's right chest indicated that the child was improperly restrained at the time of the crash with the shoulder belt positioned under her right arm.

The right front seat was adjusted to a mid track position. In this position, the front right seat back rest measured 76.2 cm (30.0") rearward from the leading edge of the front right air bag module cover flap at a height of 38.1 cm (15.0") above the junction with the seat cushion. The leading edge of the seat cushion measured 27.9 cm (11.0") above the floor and 17.8 cm (7.0") rearward from the projected vertical plane of the instrument panel. The seat cushion was inclined 13 degrees while the seat back support was 28 degrees rearward from vertical.

Figure 14. Excursion of the front right air bag.

The six year old female child was wearing the manual belt system with the lap belt across her lap and the shoulder belt incorrectly positioned under her right arm. During pre-impact braking, the child probably extended her right arm in an attempt to brace as she moved forward and began to load the manual belt system. She continued to load the belt webbing when the front right air bag deployed.

The expanding right front **(Figure 14)** air bag initially contacted the child's right arm resulting in an abrasion of the anterior aspect of the forearm. The expanding air bag displaced the arm rapidly in an upward, rotational motion that resulted in a right glenohumeral joint separation and a right brachial plexus injury. The front right air bag contacted her upper chest, facial, neck, and scalp regions which resulted in multiple soft tissue abrasions and a closed head injury with concussion and brief loss of consciousness. It should be noted that these abrasions wrapped beyond the right ear which indicated the child‘s head was probably turned to the left at impact. Air bag expansion deflected the child’s head in a rearward direction that resulted in cervical strain. The face/head contact by the expanding air bag, in combination with the head

deflection, induced a self-inflicted abrasion and laceration of the child's tongue. She also sustained contusions of the gingiva from the compression of her face against her teeth and gums.

The child's torso continued forward as she loaded the improperly worn shoulder belt webbing. The belt webbing abraded her chest area in the vicinity of the axilla. Due to the path of the shoulder belt positioned under her arm, the child sustained a contusion of the right lower pulmonary lobe.

The child's right arm subsequently contacted the top surface of the right door armrest which produced a tissue transfer to the armrest and an abrasion over the elbow area. She then rebounded rearward against the seat back support and came to rest with her hips forward on the seat cushion and her back leaning rearward with her head and shoulder against the seat back support. The driver initially held the child upright on the seat cushion and unbuckled the manual belt system.

The driver exited her vehicle and was described as very emotional. Bystanders came to her assistance and observed the child in the right front seat. The child's face was bleeding especially around the nose and mouth. Initially, there was indication of respiration without responses to stimuli. The rescue arrived on-scene within minutes of the crash and requested helicopter transport. The driver said she was informed by one of the rescue personnel that it did not look like the child was going to make it. Shortly thereafter, however, the child began to move her head and cry. She was taken to a pediatric trauma unit via helicopter located in a neighboring city where she was admitted for treatment.

Medical Treatment

The child was removed from the vehicle by rescue personnel and transported via helicopter to a pediatric trauma unit in a nearby city. She arrived at the emergency room in an obtunded condition with a GCS of 12. She was admitted for treatment and discharged six days later against the advice of her physician. The parents indicated during the time of the on-site investigation that the personality of the child had changed from one of an active child to one of a passive behavior. From visual observation, the child's gait was somewhat erratic and lethargic and she appeared to favor one leg while walking.

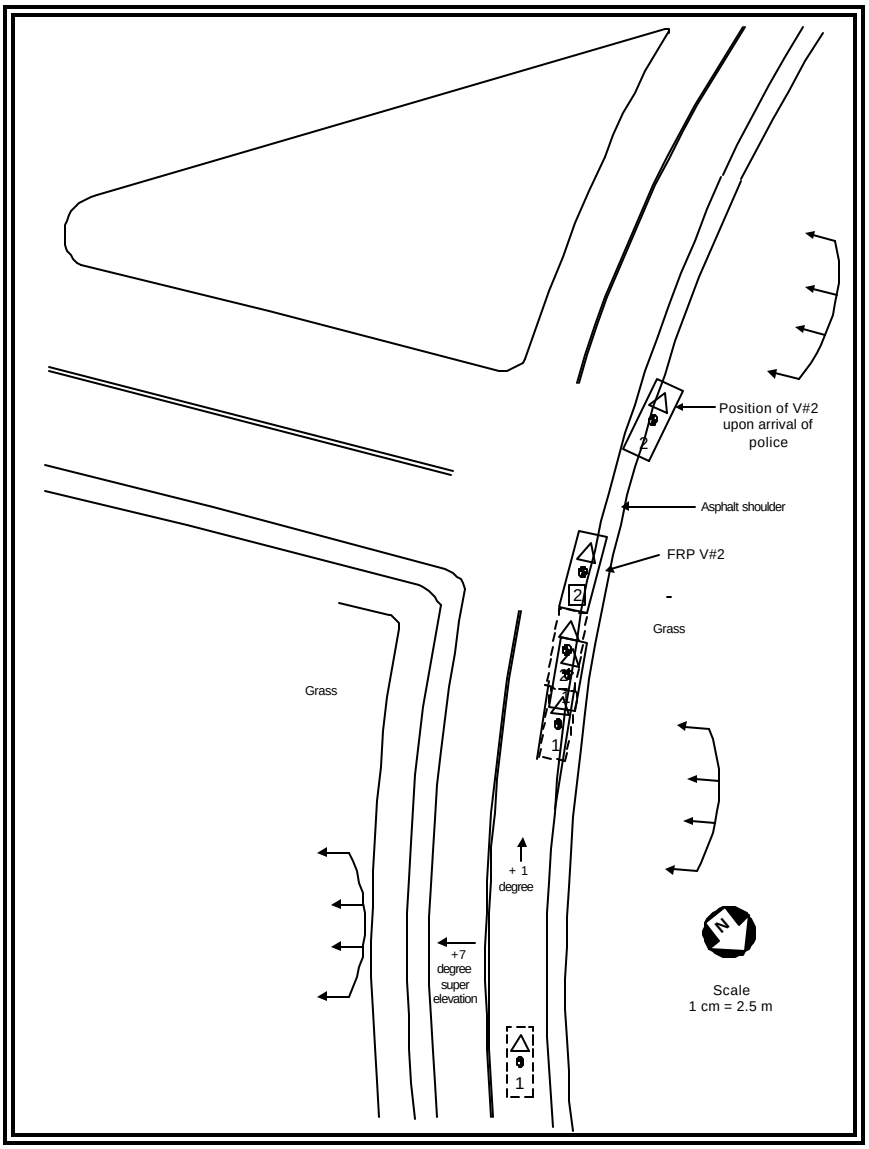

Figure 15. Crash Schematic