

CRASH DATA RESEARCH CENTER

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**CALSPAN ON-SITE CHILD AIR BAG RELATED FATALITY CRASH
INVESTIGATION**

CALSPAN CASE NO: CA06-001

VEHICLE: 1995 FORD MUSTANG

LOCATION: GEORGIA

CRASH DATE: JANUARY 2006

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.

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**CALSPAN ON-SITE CHILD AIR BAG RELATED FATALITY
INVESTIGATION
CASE NO.: CA06-001
VEHICLE: 1995 FORD MUSTANG
LOCATION: GEORGIA
DATE OF CRASH: JANUARY 2006**

BACKGROUND

This on-site investigation focused on the severity of the crash and the source of injury that caused the death of a 4-month old female, restrained in a rear-facing child safety seat (RFCSS) in the front right position of a 1995 Ford Mustang (**Figure 1**). The Mustang was involved in a minor severity front-to-rear crash sequence with a 2000 Toyota Camry Solara. The Ford was equipped with frontal air bags for the driver and front right positions that deployed as a result of the crash. The 22-year old female driver of the Mustang was descending a long grade on a straight segment of road during daylight hours. The Toyota was stopped behind several cars as the lead vehicle was waiting for traffic to clear prior to initiating a left turn at a three-leg intersection. The driver of the Mustang did not detect the stopped Toyota in sufficient time to avoid the crash. She steered right and braked in a locked front wheel skid pattern. The Mustang skidded 43 m (141 feet) to impact. The mid-mount front right air bag expanded against the leading edge of the RFCSS, fracturing the shell of the safety seat and displacing the seat rearward into the seat back. The infant sustained skull fractures with closed head injuries. She was transported by ambulance to a local hospital where she expired. The driver and a 3-year old male positioned in the rear right of the Mustang were not injured. The driver was not belted; however, the 3-year-old child passenger was restrained in a high-back belt positioning booster seat.



Figure 1. 1995 Ford Mustang subject vehicle.

The crash was identified through an Internet news search by NHTSA and assigned to the Calspan Special Crash Investigations team for on-site investigation on January 17, 2006. Cooperation was established with the investigating officer and the driver of the vehicle. The Mustang was released to the possession of the driver and was inspected at her residence. The Toyota was driven from the scene of the crash and was inspected at the driver's residence.

SUMMARY

Crash Site

The crash occurred on a two-lane north/south road in a rural, undeveloped area. The travel lanes were 3.3 meters (11 feet) in width and delineated by solid white edge lines and a double yellow centerline. In the vicinity of the crash site, the roadway was straight with a negative grade of 2 percent in the southbound direction. Paved shoulders that measured 1m (3.3 feet) in width bordered the travel lanes. Cut grass that transitioned into drainage ditches paralleled both shoulders. A two-lane asphalt roadway intersected the north/south roadway at the left side (west). An incomplete driveway intersected the roadway opposite of the T-intersection. The posted speed limit was 89 km/h (55 mph). The scene schematic is included as **Figure 15** of this report.

Vehicle Data

1995 Ford Mustang

The subject vehicle in this crash was a 1995 Ford Mustang. The vehicle was purchased used by the driver and her partner from a family member. The history of the vehicle included high mileage and two previous crashes that involved the rear and right front fender. These crashes did not result in deployment of the frontal air bag system. In addition, the front left (drivers) seat was loose within the vehicle. It appeared that the seat track mounts had fractured, or were damaged as a result of seat removal by the previous owner. The seat mounting bolts and the track anchors remained secure to the floor of the vehicle; however, the seat assembly was resting on the carpeted floor without attachment to the vehicle. The power seat wire leads were cut and not reinstalled. The driver verified the previous condition of this seat.

The 1995 Ford Mustang was manufactured on January 1995 and was identified by Vehicle Identification Number (VIN) 1FALP40435F (production number deleted). The odometer reading at the time of the SCI inspection was 349,103 kilometers (216,922 miles). The vehicle was a two-door coupe equipped with a conventionally mounted 3.8 liter V-6 engine linked to a five-speed manual transmission with a console mounted transmission shifter. The service brakes were four-wheel disc without anti-lock. The vehicle was equipped with OEM five-spoke alloy wheels with P225/60R16 all season tires. The vehicle manufacturer recommended tire pressure was unknown. The specific tire data at the time of the SCI inspection was as follows:

Position	Measured Tire Pressure	Measured Tread Depth	Damage
Left Front	131 kPa (19 PSI)	4 mm (5/32")	None
Left Rear	221 kPa (32 PSI)	2 mm (3/32")	None
Right Front	228 kPa (33 PSI)	3 mm (4/32")	None
Right Rear	165 kPa (24 PSI)	2 mm (2/32")	None

The interior of the Mustang was configured with cloth surfaced front bucket seats and a fixed rear bench seat. The front head restraints were height-adjustable with both adjusted to the full down positions. The vehicle was equipped with a tilt steering wheel that was adjusted to the second lowest position at the time of the SCI inspection. The Mustang

was equipped with power windows, power door locks, and a power driver's seat, which was inoperative prior to the crash.

2000 Toyota Camry Solara

The struck vehicle in this crash was a 2000 Toyota Solara two-door coupe. The Toyota was manufactured in August 2000 and was identified by VIN: 2T1CG22P0YC (production number omitted). The Solara was powered by a 2.2 liter, transverse mounted 4-cylinder engine linked to a 4-speed automatic transmission with a console-mounted shifter. The vehicle was driven from the scene of the crash. At the time of the SCI inspection, the Solara's odometer reading was 394,105 kilometers (244,885 miles). The Solara was equipped with Goodyear Eagle P205/65R16 tires mounted on OEM multi-spoke alloy wheels. The manufacturer recommended tire pressure for this vehicle was 199 kPa (29 PSI). The specific tire data at the time of the SCI inspection was as follows:

Position	Measured Tire Pressure	Tread Depth	Damage
Left Front	124 kPa (18 PSI)	5 mm (6/32")	None
Left Rear	179 kPa (26 PSI)	2 mm (3/32")	None
Right Front	145 kPa (21 PSI)	6 mm (7/32")	None
Right Rear	152 kPa (22 PSI)	2 mm (2/32")	None

***Crash Sequence
Pre-Crash***

The crash occurred on a straight segment of road with a long downgrade for southbound travel. Located at the bottom of the grade was a sag with an incomplete driveway and an intersecting roadway. A non-contact southbound vehicle stopped on the roadway, waiting for northbound traffic to clear prior to turning left onto the west roadway. A second non-contact vehicle stopped behind this vehicle. The Toyota Camry Solara approached the stopped vehicles and stopped forming a line of traffic that involved three vehicles in the southbound lane. The 22-year old female driver of the Ford Mustang crested the hill that was located approximately 0.4 kilometers (0.25 mile) north of the crash site and traveled southbound on the downgrade. The roadway and daylight conditions afforded the driver of the Mustang a clear line of sight of the stopped vehicles. This driver was apparently distracted as she approached the stopped vehicles at a driver-estimated speed of 105 km/h (65 mph). Based on the roadway and the daylight conditions, the driver was apparently distracted by the children in the vehicle. The driver gave the SCI investigator the indication that she was holding a bottle in the infant's mouth prior to the crash. Further probing by the investigator yielded no definitive information regarding this possibility.



Figure 2. Ford's pre-crash skid marks.

The driver detected the stopped vehicles prior to impact. She steered right and applied full braking force to lock the front wheels of the vehicle. As the Mustang skidded in a tracking mode, the right side tires crossed the right side white edge line. Two locked front wheel skid marks were present and documented at the scene (**Figure 2**). The skid marks measured 34.2 m (112') and 42.5 m (139.4') for the left and right front tires respectively. The equivalent velocity loss due to braking was calculated at approximately 87 km/h (54 mph). At impact, the Mustang was straddling the right (east) edge line.

The driver of the non-contact vehicle that was stopped ahead of the Toyota heard the skidding of the Mustang and noted the smoke coming from the tires as it approached the line of stopped traffic. This driver accelerated forward onto the right shoulder and drove his vehicle forward of the intersection.

Crash

The front left area of the Ford Mustang impacted the back right area of the stopped Toyota Camry Solara. Due to the pre-crash braking, the front suspension of the Mustang compressed downward which resulted in the bumper and left headlamp engaging the rear bumper of the Toyota. Resultant directions of force were 12 o'clock for the striking Ford and 6 o'clock for the struck Toyota. Vehicle crush was minimal and was limited to the bumper beams of both vehicles. The damage algorithm of the WinSMASH program computed total velocity changes of 14 km/h (8.7 mph) for the Ford and 13 km/h (8.1 mph) for the Toyota. The specific longitudinal and lateral components were -14 km/h (-8.7 mph) and 0 km/h for the Ford and 13 km/h (8.1 mph) and 0 km/h for the Toyota. As a result of the crash, the frontal air bag system in the Ford Mustang deployed.

The impact displaced the Toyota forward. The Toyota driver brought the vehicle to a controlled stop on the right road edge, approximately 23 m (75 feet) forward of the point of impact (POI). The Mustang came to rest at, or near the POI.

Post-Crash

Immediately following the crash, the driver of the non-contact vehicle exited his vehicle and ran to check on the condition of the involved parties. As he approached the Ford Mustang, he noted the infant in the rear-facing child safety seat. He removed the integral harness straps and removed the infant from the vehicle. The driver of the Toyota exited her vehicle unassisted and approached the Mustang. She was handed the infant as the witness assisted the child passenger from the rear right position of the Mustang. The driver of the Mustang exited the vehicle through the left door. The driver of the Toyota transferred the infant to the driver of the Ford who held the infant until rescue personnel arrived on scene. The infant was transported by ambulance to a local hospital where she expired.

Vehicle Damage

Exterior – 1995 Ford Mustang

The Ford Mustang sustained minor severity frontal damage as a result of its impact sequence with the Toyota (**Figure 3**). Maximum crush was 13 cm (5.1”), located at the left corner of the front bumper beam. The direct contact damage consisted of abrasions and a fracture site to the bumper fascia. The direct damage began 31 cm (12.2”) left of the vehicle’s centerline and extended 46 cm (18.1”) to the left bumper corner. The damage also extended vertically, involving the headlamp assembly and the leading edge of the left front fender (**Figure 4**). The impact deformed the full width of the bumper beam resulting in a combined induced and direct damage length (Field L) of 140 cm (55.1”). Six equidistant crush measurements were documented at this level and were as follows: C1 = 13 cm (5.1”), C2 = 10 cm (3.9”), C3 = 0 cm, C4 = 0 cm, C5 = 0 cm, C6 = 0 cm. Damage components included the hood, front bumper fascia and reinforcement beam, left headlamp and turn signal assembly, and the left front fender. The Collision Deformation Classification (CDC) for this impact was 12-FLEW-1.



Figure 3. Overall view of the frontal damage.



Figure 4. Lateral view of the crush profile

Interior – 1995 Ford Mustang

The interior of the Ford Mustang sustained minor interior damage that was attributed to air bag deployment. Both air bags deployed as designed from the respective modules. The minor severity crash did not produce intrusion to the passenger compartment.

The front right air bag expanded against the shell of the rear-facing child safety seat, fracturing the seat. Transfers from this interaction were prevalent on the air bag membrane. The expanding air bag contacted the rear view mirror and deflected the mirror to the left, into the laminated windshield. The mirror glass was fractured on both sides of center, and the left aspect of the mirror frame fractured the windshield glazing in a star-like pattern. There were no interior contact points or damage attributed to driver motion.

Exterior – 2000 Toyota Camry Solara

The Toyota was struck in the rear by the front left area of the Ford. This impact resulted in minor damage to the rear right area of the Toyota (**Figure 5**) with a maximum crush of 25 cm (9.8”) located at the right corner of the back bumper beam. The direct contact damage began 15 cm (5.9”) right of center and extended 60 cm (23.6”) to the right rear corner. The impact produced a large dent to the bumper fascia and displaced the entire width of the bumper beam forward, resulting in a combined induced and direct contact damage length of 135 cm (53.1”). A crush profile was documented at the level of the bumper beam and was as follows: C1 = 0 cm, C2 = 0 cm, C3 = 0 cm, C4 = 1 cm (0.4”), C5 = 7 cm (2.8”), C6 = 13 cm (5.2”). Induced damage extended onto the right rear quarter panel with two isolated dents noted forward of the tail lamp assembly and at the leading edge of the wheel opening (**Figure 6**). The CDC for this impact was 06-BZLW-1.



Figure 5. Resultant damage to the rear of the Toyota.



Figure 6. Lateral of the resultant crush.

Frontal Air Bag System – 1995 Ford Mustang

The Mustang was equipped with first generation air bags for the driver and front right occupant positions. The system deployed as a result of the front-to-rear impact sequence with the Toyota.

The driver’s air bag was contained within the four-spoke steering wheel rim and concealed by two H-configuration cover flaps. Both flaps were 15 cm (6”) wide at the horizontal tear seam. The upper and lower flaps were measured at 10 cm (4”) and 6 cm (2.5”) in height respectively. The air bag membrane (**Figure 7**) measured 62 cm (24.5”) in diameter in its deflated stated and was tethered by four internal tethers at the 12/6 and 3/9 o’clock sectors. Two vent ports located on the backside of the bag at the 11 and 1 o’clock



Figure 7. Driver's frontal air bag.

sectors vented the bag into the passenger compartment. The maximum rearward excursion of this bag at the tether locations was 32 cm (12.5"). There was no damage or evidence of driver contact on the face of the deployed air bag.

The front right passenger air bag was a mid-mount design, incorporated into the right instrument panel. Two symmetrical H-configuration cover flaps concealed the bag. Both flaps were 41 cm (16") wide at the horizontal tear seam and 8 cm (3") in height. There was no damage or contact evidence to the cover flaps. The air bag (**Figure 8**) measured 74 cm (29") in width and 64 cm (25") in height. The bag was not tethered; however, it was vented by a single port on the left side panel at the 9 o'clock position. The maximum rearward excursion of this bag at the midpoint measured 81 cm (32").



Figure 8. Overall view of the front right air bag membrane.

The front right passenger air bag deployed against the backside of the shell of the rear-facing child safety seat. This interaction fractured the shell of the CSS and was evidenced by blue plastic transfers to the face, top, and side surfaces of the bag membrane. The top panel of the air bag contained a blue transfer that extended 24 cm (9.25") aft of the forward seam and 18-53 cm (7-21") left of the right seam (**Figure 9**). A 5x17cm (2x6.5") transfer was noted to the extension panel that was affixed to the inflator housing and the top panel of the air bag. The face of the air bag was marked by a blue plastic transfer that extended 25-31 cm (10-12") below the top panel and 22-33 cm (8.75-13") inboard of the right seam.



Figure 9. Blue plastic transfer on the top panel of the air bag membrane.

Both side panels evidenced expansion contact with the CSS. An 8x8 cm (3x3") transfer was noted to the upper aspect of the right side panel and a 10x13 cm (4x5") transfer was located near the midline of the panel. The left side panel had a 2x5 cm (0.75x2") transfer located near the midline and a 3x3 cm (1x1.25") transfer located below the upper mark. All transfers occurred as the bag initially deployed and expanded against the CSS.

The sun visors of the Mustang were equipped with Air Bag warning labels on the exposed side.

This vehicle was not equipped with safety belt pretensioners or an Event Data Recorder.

Manual Safety Belt Systems – 1995 Ford Mustang

The Ford Mustang was equipped with three-point lap and shoulder belt systems for the four outboard-seated positions. This vehicle was manufacturer designed as a four-passenger vehicle; therefore there was no center rear belt system.

All four positions consisted of continuous loop webbing with sliding latch plates and fixed D-rings. The driver's belt retracted onto an Emergency Locking Retractor (ELR). The remaining three belt systems utilized switchable ELR/Automatic Locking Retractors (ALR).

Although the vehicle was high-mileage, the belt systems yielded historical usage marks that were not consistent with frequent use over the life of the vehicle, given its high mileage. This driver recently purchased the Mustang used; therefore, these indicators were not consistent with her safety belt use habits. There was no evidence of loading on the driver's belt system associated with this low-severity crash.

The rear-facing CSS was secured to the vehicle by the front right three-point lap and shoulder belt system. During the SCI inspection of the vehicle, the investigator asked the driver to reinstall the CSS and demonstrate the techniques she used to secure the CSS prior to the crash. The belt was routed through the proper belt path on the CSS base; however, she failed to set and tension the belt with the ALR mode of the retractor. The belt system did not exhibit loading evidence from this crash. The belt path of the CSS was void of loading evidence.

The rear right position was occupied by a 3-year old male, seated in a high-back booster seat and restrained by the manual belt system. A subtle frictional abrasion was noted to the corner of the latch plate cross bar from loading during this crash. There were no other points of interest on this belt system.

Child Safety Seats – 1995 Ford Mustang Evenflo Rear-Facing Infant Seat

The Ford Mustang was occupied by two child passengers, both restrained in child safety seats. The 4-month old infant female was positioned in an Evenflo infant child restraint. This unit was designed exclusively and installed as a rear-facing child safety seat (RFCSS). The unit consisted of a child safety seat with an integral three-point harness system, a pivoting carrying handle, and a detachable base. Additionally, the driver used an aftermarket head cushion to position the head of the child. The unit was identified by Model Number 558-356 with a



Figure 10. RFCSS installed in the front right position.

Manufacture Date of 22JAN04. The RFCSS was placarded with manufacturer specified size limits of 2.3-10 kg (5-22 lb) and less than 66 cm (26") in height.

The RFCSS (safety seat and base) was installed in the front right position of the Mustang (**Figure 10**). The driver stated during the SCI interview that she was not aware of the risks associated by placing the RFCSS in the front right position of a vehicle that was equipped with a front right air bag system. Although the vehicle and the RFCSS were equipped with warning labels advising against this placement, she failed to observe these warnings.

The driver reinstalled the RFCSS for the SCI investigator during this on-site investigation. Her installation involved the placement of the base on the front right seat cushion. The adjustable foot was extended approximately 1 cm (0.5") from the base. She routed the manual three-point lap and shoulder belt through the appropriate belt path and pulled the shoulder belt webbing to remove slack from the vehicle restraint system. The driver did not extend the belt webbing to activate the Automatic Locking Retractor. She then placed the safety seat in the base and clicked it into position. In this position, the leading edge of the RFCSS was located 20 cm (8") aft of the mid mount air bag module flaps.

The child was positioned in the RFCSS and restrained with the integral three-point harness. The position of the harness straps had been altered prior to the SCI inspection. The driver noted that the straps were positioned in the middle of three slots and were adjusted snug on the infant. Additionally, an aftermarket head cushion was used to maintain the position of child's head within the CSS. The cushion was manufactured by Gold Bug with an unknown date of manufacture or model number. The retainer (chest) clip was positioned at the mid chest level. The carrying handle was left in the up-position, the position used when carrying the seat and infant to/from the vehicle.



Figure 11. Expansion of the air bag membrane against the RFCSS.

At impact, the frontal air bag system deployed. The front right air bag membrane expanded against the leading edge and backside of the shell of the RFCSS (**Figure 11**). The top surface of the shell was stressed from bag contact.

The shell of the CSS was extensively fractured. As a point of reference, when viewed from the backside of the RFCSS, a fracture line extended vertically 21 cm (8.25") from the forward edge of the shell to the left vertical reinforcement, terminating at the top harness strap slot. A near matching fracture line extended along the right side of the

shell, ending at the top slot. **Figure 12** is an overall view of the fractures at top aspect and harness strap slots.

Numerous stress points were noted to the lower portion of the shell, forward of the buckle assembly. These resulted from loading against the locking mechanism of the base unit. The shell of the CSS did not separate from the base unit during the deployment event.

The continued expansion of the air bag accelerated the RFCSS rearward. The carrying handle loaded the front right seat back. This loading force fractured the outboard aspect of the shell, beginning at the outboard pivot point and extending 17 cm (6.75”) toward the back of the seat (**Figure 13**). The pivot point of the carrying handle separated; however, the handle remained intact.



Figure 12. Fractures at the top of the RFCSS.



Figure 13. Fracture at the carry handle.

Evenflo High-back Booster Seat

The 3-year old male was restrained in the rear right position of the Mustang. He was seated in an Evenflo Comfort Touch high-back belt positioning booster seat (**Figure 14**) and restrained by the manual three-point lap and shoulder belt system. The booster seat model number and date of manufacturer was unknown. The booster seat was placarded with a label that advised against usage after year 2010.



Figure 14. Evenflo high-back booster seat.

The booster seat was labeled for use under the following guidelines:

Five-Point Harness - 9-18 kg (20-40 lb)

74-109 cm (29-43”)

Without Five-Point
Harness - 13.6-36 kg (30-80 lb)
<137 cm (<54")

This booster seat was used at the time of the crash as a belt positioning booster. The 3-year old child was restrained by the manual 3-point lap and shoulder belt system. The integral five-point harness was threaded through the shell of the CSS, but was not used by this child. There was no loading evidence or damage to the booster seat.

Occupant Demographics/Data

Driver

Age/Sex: 22 year old/Female
Height: 163 cm (64")
Weight: 61 kg (135 lb)
Seat Track Position: Rear track position
Eyewear: None
Manual Safety Belt Usage: None
Usage Source: Vehicle inspection
Egress from Vehicle: Unassisted through left door
Mode of Transport from Scene: Transported by ambulance to a hospital with child passengers
Type of Medical Treatment: None

Driver Injuries

Injury	Injury AIS90/Update 98	Severity	Injury Source
Not injured	N/A		N/A

Source – Driver interview

Driver Kinematics

The 22-year old female driver of the 1995 Ford Mustang was seated in an upright driving posture with her left hand positioned on the steering wheel rim and her right hand on the console mounted shifter. She was depressing the brake pedal with her right foot as the vehicle skidded to impact. The driver's seat was set in a position that was equal to a rear track position. The adjustable head restraint was adjusted to the lowest position on top of the seat back. She was not restrained by the manual safety belt system. The lack of belt usage was determined by the inspection of the belt system.

At impact, the frontal air bag system deployed. The driver initiated a slight forward trajectory and loaded the deployed air bag. There were no contact points within the interior to support driver motion and loading. She was not injured.

Front Right Infant Passenger

Age/Sex: 4-month-old/Female
 Height: 64 cm (25")
 Weight: 7 kg (15 lb)
 Seat Track Position: Rear track position
 Child Restraint Use: Restrained in a rear-facing child safety seat, secured by the integral three-point harness
 Usage Source: Vehicle inspection
 Egress from Vehicle: Removed from CSS by a witness to the crash
 Mode of Transport from Scene: Transported by ambulance
 Type of Medical Treatment: Expired in the emergency room of a local hospital

Front Right Infant Injuries

Injury	Injury Severity (AIS 90, Update 98)	Injury Source
Diffuse epidural hemorrhages to underlying brain	Critical (140634.5,3)	Expanding air bag against the shell of the CSS
Subdural hemorrhage over the bilateral cerebral hemispheres and the basilar skull with the left side greater than right	Critical (140654.5,3)	Expanding air bag against the shell of the CSS
Left parietal dura mater is extensively lacerated	Severe (140688.4,2)	Expanding air bag against the shell of the CSS
Extensive comminuted fracture of the skull (crushing type injury) impact site is located on the left parietal/temporal region and radiates out above the calvarial suture on the left	Severe (150406.4,2)	Expanding air bag against the shell of the CSS
Fractures of the left anterior fossa, right petrous ridge and across the entirety of the inferior occipital plate	Severe (150206.4,8)	Expanding air bag against the shell of the CSS
Subarachnoid hemorrhage over the right cerebral hemisphere	Serious (140684.3,1)	Expanding air bag against the shell of the CSS
Subarachnoid hemorrhage over the left cerebral hemisphere	Serious (140684.3,2)	Expanding air bag against the shell of the CSS
Diffuse contusions of the underlying brain	Serious (140620.3,3)	Expanding air bag against the shell of the CSS

Injury	Injury Severity (AIS 90, Update 98)	Injury Source
Linear fracture in the right occipital/parietal region	Moderate (150402.2,1)	Expanding air bag against the shell of the CSS
Triangular shaped abrasion of the superior left temple, 1.7 cm x 1.2 cm (0.7 x 0.5")	Minor (190202.1,2)	Expanding air bag against the shell of the CSS
Full thickness scalp hemorrhages over the vertex, left parietal, left temporal, and occipital areas	Minor (190402.1,2)	Expanding air bag against the shell of the CSS

Source – Autopsy

Front Right Infant Kinematics

The front right infant passenger was positioned in a rear-facing child safety seat (RFCSS) and restrained by the integral three-point harness system. Additionally, an aftermarket head cushion was used to maintain the position of the child’s head within the CSS. The RFCSS was fastened to the base, which was secured to the vehicle with the manual three-point lap and shoulder belt system. During this on-site investigation, the driver reinstalled the RFCSS for the SCI investigator. Her installation, which mirrored the installation at the time of the crash, involved the proper routing of the vehicle’s safety belt through the belt path of the base. She pulled the shoulder belt webbing to spool the belt slack through the latch plate and engaged the RFCSS into the base. The driver did not set the ALR mode of the retractor, therefore the base was not secured firm within the vehicle. The carrying handle was in the up position, left in the position required to carry the seat.

The front right seat was adjusted to a rear track position, measured at 13 cm (5”) aft of full forward and 3 cm (1”) forward of the full rear position. In this position, the leading edge of the RFCSS was located 17 cm (6.5”) rearward of the mid instrument panel and 20 cm (8.0”) aft of the mid-mount front right passenger air bag module cover flaps. The child was restrained in the seat and secured by the integral three-point harness. At the time of inspection, the harness straps were removed from the seat and the specific at-crash adjustment could not be replicated.

At impact, the frontal air bag system deployed. Early in the deployment, as the front right passenger air bag membrane expanded from the mid mount module, the bag impacted the back of the RFCSS in the area of the child’s head. The expanding air bag fractured the shell of the RFCSS and as the bag continued to inflate it accelerated the RFCSS in a rearward direction. The RFCSS pivoted at the belt path as the ELR locked due to the crash forces. The carrying handle impacted the front right seat back. The forces exerted on the handle exceeded the designed strength of the shell. A fracture line extended through the shell at the outboard aspect of the handle pivot and the pivot mount separated.

The leading edge of the shell revealed stress from the air bag expansion. Two fracture lines extended along the inboard aspects of the molded vertical reinforcements of the shell. These extended to the area of the upper harness strap slots. Blue plastic transfers were evident on the top, face, and both side panels of the front right air bag, indicative of full bag expansion against the RFCSS.

All documented injuries resulted from air bag expansion against the back of the RFCSS shell. The injuries are detailed in the above table.

The RFCSS rebounded from the seat back contact and returned to its original position on the front right seat cushion. The infant was removed from the RFCSS and the vehicle by a witness to the crash. She appeared to remain conscious for a brief period of time at the scene; however, the child’s condition rapidly declined. The witness handed the child to the female driver of the struck Toyota Solara. The child vomited while held by this driver and was transferred to its mother, the driver of the Mustang. The driver held the infant until rescue personnel arrived on scene. The infant was transported by ambulance to a local hospital where she expired approximately 40 minutes post-crash.

Rear Right Child Passenger

Age/Sex: 3-year old/Male
 Height: 91 cm (36”)
 Weight: 14 kg (31 lb)
 Seat Track Position: Not adjustable
 Eyewear: None
 Child Restraint Use: High-back booster seat; restrained by the vehicle’s three-point safety belt system
 Usage Source: Vehicle inspection
 Egress from Vehicle: Assisted by a witness from the right door
 Mode of Transport from Scene: Ambulance to hospital with driver and sibling
 Type of Medical Treatment: None

Rear Right Child Injuries

Injury	Injury Severity AIS90/Update 98	Injury Source
Not injured	N/A	N/A

Rear Right Child Kinematics

The three-year old child passenger was seated in a Cosco high-back belt positioning booster seat and restrained by the manual three-point safety belt system in the rear right position of the Mustang. The child responded to the frontal crash forces by initiating a forward trajectory and loading the manual belt system. There was no damage to the CSS and no distinct loading evidence on the manual belt system. This child was not injured in the crash.

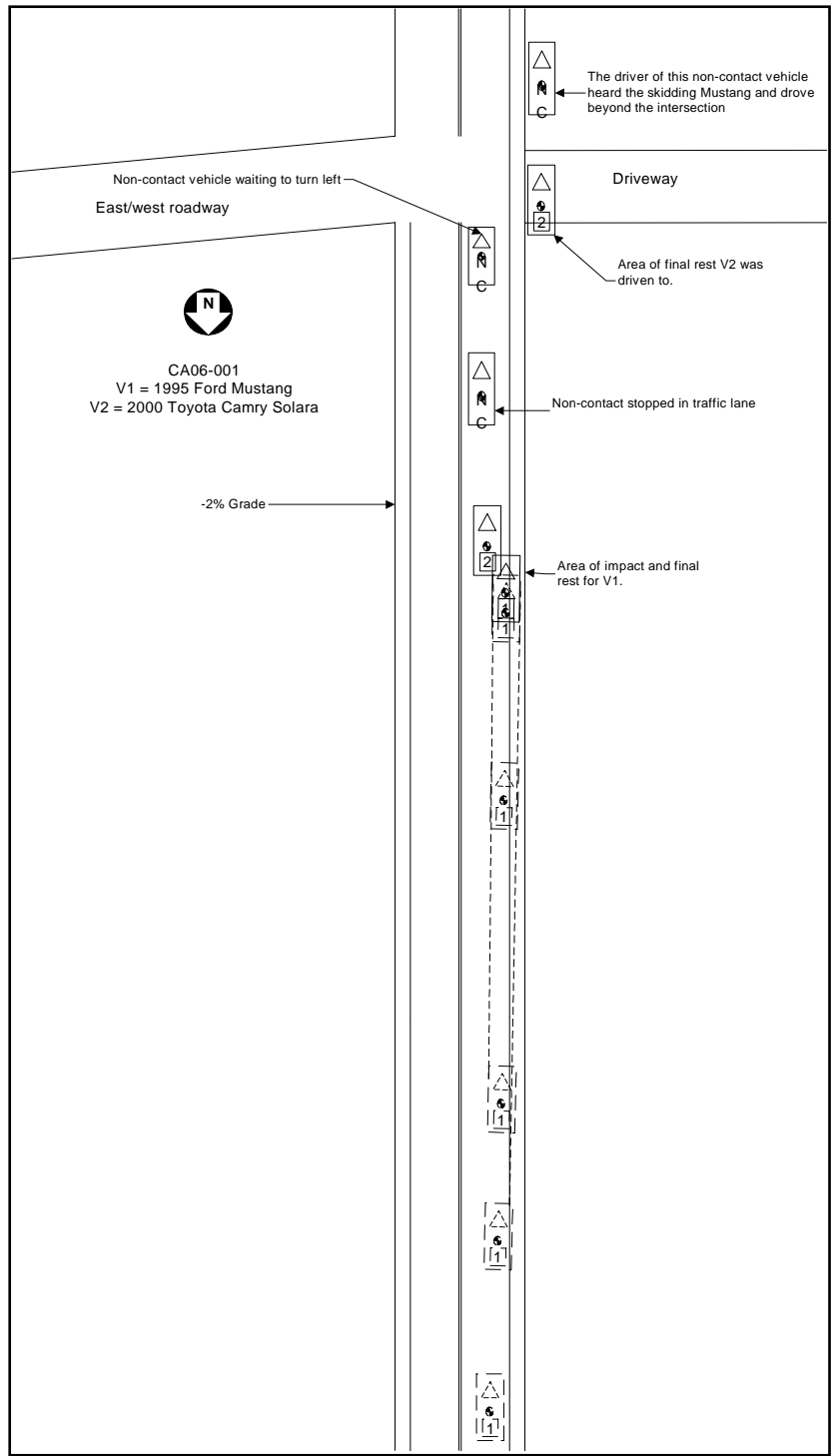


Figure 15: Scene Schematic