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REMOTE CHILD SAFETY SEAT INVESTIGATION

CASE NUMBER - IN-04-039
LOCATION - Texas
VEHICLE - 1999 Toyota Camry
CRASH DATE - November 2004

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

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

Technical Report Documentation Page

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| 15. <i>Supplementary Notes</i> Remote child safety seat investigation involving a 1999 Toyota Camry that was hit in the back by a 2001 Ford F150 and subsequently sustained a front impact with the back of a 2001 Chrysler Sebring | | | | | |
| 16. <i>Abstract</i> The report covers a remote child safety seat investigation of a crash involving a 1999 Toyota Camry four-door sedan (case vehicle), a 2001 Ford F-150 Supercrew four-door pickup truck (first other vehicle) and a 2001 Chrysler Sebring four-door sedan (second other vehicle). This crash is of special interest because the case vehicle's back center passenger (2-year-old female) was seated in a forward-facing child safety seat and did not sustain any injuries as a result of this crash. The case vehicle had been traveling eastward in the eastbound left turn lane of a six-lane roadway and was stopped, heading eastward, in congested traffic, under an overpass. The Chrysler was also stopped heading eastward in the same lane, immediately in front of the case vehicle, with other vehicles further ahead. The Ford was traveling eastward in the same lane, approaching the case vehicle from behind. There is no evidence that any of the involved drivers attempted any avoidance actions. The crash occurred in the eastbound left turn lane. The back of the case vehicle was impacted by the front of the Ford. This impact pushed the case vehicle forward, and the case vehicle's front impacted the back of the Chrysler. No air bags deployed in any of the vehicles. All of the vehicles came to rest close to the point of impact. The case vehicle and the Ford were towed due to damage while the Chrysler was driven from the scene. The first impact was centered on the case vehicle's back surface and the case vehicle was propelled straight forward, causing the occupants to move rearward. Almost immediately, the case vehicle's front impacted the Chrysler's back and the occupants moved forward. The child safety seat was tightly secured by the vehicle's safety belt system, the child was restrained by the seat's five-point harness with a retainer clip in use and the child did not sustain any injuries. The driver (34-year-old female) and the back right passenger (36-year-old male) were both restrained by their available, three-point manual safety belts and both sustained minor soft tissue injuries. No one involved in the crash was transported via ambulance. The case vehicle's three occupants went to their family physician later. | | | | | |
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TABLE OF CONTENTS

IN-04-039

| | <u>Page No.</u> |
|--|-----------------|
| BACKGROUND | 1 |
| CRASH CIRCUMSTANCES | 1 |
| CASE VEHICLE: 1999 TOYOTA CAMRY LE | 1 |
| CHILD SAFETY SEAT | 3 |
| CASE VEHICLE BACK CENTER PASSENGER'S KINEMATICS | 4 |
| CASE VEHICLE DRIVER'S KINEMATICS | 4 |
| DRIVER'S INJURIES | 5 |
| CASE VEHICLE BACK RIGHT PASSENGER'S KINEMATICS | 5 |
| BACK RIGHT PASSENGER'S INJURIES | 6 |
| FIRST OTHER VEHICLE: 2001 FORD F150 SUPERCREW PICKUP | 6 |
| SECOND OTHER VEHICLE: 2001 CHRYSLER SEBRING LX | 6 |
| SCENE DIAGRAM | 8 |
| SELECTED PHOTOGRAPHS | |
| Figure 1: Case vehicle's left side | 2 |
| Figure 2: Case vehicle's back, view from left | 2 |
| Figure 3: Case vehicle's front, view from right | 2 |
| Figure 4: Case vehicle's front, straight-on view | 2 |
| Figure 5: Child safety seat, view through back left window | 3 |
| Figure 6: Child safety seat, view through back left door opening | 3 |

This remote investigation was brought to the NHTSA's attention in December 2004 by a newspaper clipping service. This crash involved a 1999 Toyota Camry LE (case vehicle), a 2001 Ford F150 (first other vehicle), and a 2001 Chrysler Sebring LX (second other vehicle). The crash occurred in November 2004, at 5:32 p.m., in Texas, and was investigated by the applicable municipal police department. This crash is of special interest because the case vehicle's back center passenger (2-year-old female, white, non-Hispanic) was seated in a child safety seat and did not sustain any injuries as a result of this crash. The case vehicle was not available to be inspected and this investigation is based on the police crash report, photographs provided by the case vehicle driver, an interview with the case vehicle driver, occupant kinematic principles, and this contractor's evaluation of the available evidence.

CRASH CIRCUMSTANCES

The case vehicle had been traveling eastward in the eastbound left turn lane of a six-lane roadway (two through lanes and a left turn lane in each direction, separated by double solid yellow lines), and was stopped, heading eastward, in congested traffic, under an overpass. The Chrysler was also stopped heading eastward in the same lane, immediately in front of the case vehicle, with other vehicles further ahead. The weather was clear, it was dark but the roadway was illuminated by overhead lights, the bituminous surface was dry and free of defects, and the speed limit was 64 km.p.h. [40 m.p.h.]. The Ford was traveling eastward in the same lane, approaching the case vehicle from behind. There is no evidence that any of the involved drivers attempted any avoidance actions. The crash occurred in the eastbound left turn lane.

The back of the case vehicle was impacted by the front of the Ford. This impact propelled the case vehicle forward, and the case vehicle's front impacted the back of the Chrysler. No air bags deployed in any of the vehicles. All of the vehicles came to rest close to the point of impact. (There are no scene photographs available.)

CASE VEHICLE

The case vehicle was a 1999 Toyota Camry LE front wheel drive, four-door, five-passenger sedan (VIN: JT2BF22K1X0-----), equipped with a 3.0 liter V6 gasoline engine and an unknown type of transmission. Anti-lock brakes and traction control were options for this model, but it is not known if the case vehicle was so equipped. It was equipped with manual, three-point, lap-and-shoulder safety belts at all five seat positions, and with driver and front right passenger frontal air bags. Side impact air bags for the two front seats were an option for this model, but the case vehicle did not have this option. The driver estimated that the odometer reading was approximately 149,665 kilometers [93,000 miles]. Its specification wheelbase was 267 centimeters [105.2 inches]. The case vehicle was towed due to disabling rear end damage.

The case vehicle sustained direct contact damage across its entire back from the first impact (**Figures 1 and 2**). The bumper cover was torn and the steel bumper was crushed forward. The trunk lid was originally shaped such that it extended downward to form a vertical panel on the back plane and this was crushed inward, with the horizontal portion of the trunk lid folded nearly

double and bent upward. The trailing edge of both quarter panels was crushed forward, more so on the left, with the left tail light/turn signal assembly shattered and the right assembly displaced but intact. The left quarter panel was bent outward and sustained induced damaged that extended forward to the C-pillar, including the fuel port cover. There was no glazing damage and none of the tires were deflated or restricted.



Figure 1: Case vehicle's left side (case photo #03)



Figure 2: Case vehicle's rear plane (case photo #04)

The CDC for the case vehicle's first impact was estimated from the available photographs as **06-BDEW-3 (180 degrees)**. The WinSMASH reconstruction program, missing vehicle algorithm based on the case vehicle's photo-estimated CDC, was used on the case vehicle's first impact. The total, longitudinal and lateral delta-Vs are, respectively: 35.0 km.p.h. [21.7 m.p.h.], + 35.0 km.p.h. [+ 21.7 m.p.h.], and 0 km.p.h. [0 m.p.h.]. This is a borderline reconstruction, but the results appear reasonable. The first (most severe) impact was of moderate severity (24-40 km.p.h. [15-25 m.p.h.]) for the case vehicle.

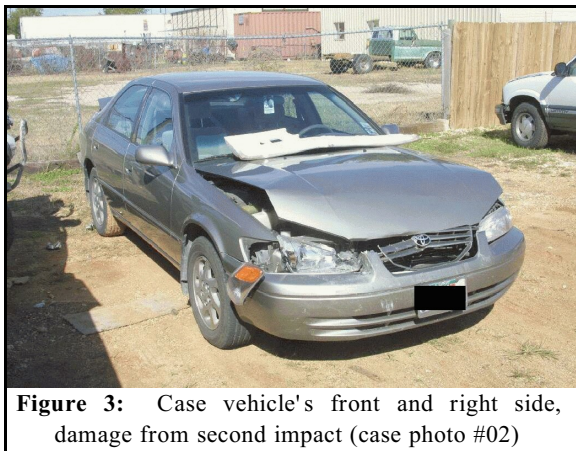


Figure 3: Case vehicle's front and right side, damage from second impact (case photo #02)

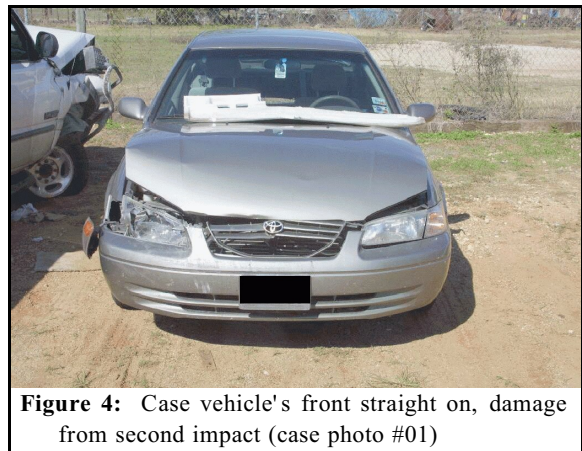


Figure 4: Case vehicle's front straight on, damage from second impact (case photo #01)

The case vehicle also sustained frontal damage from the second impact (**Figures 3 and 4**). Direct contact extended from slightly left of center to the front right bumper corner. There was abrading on the bumper cover and the plastic skin was slightly displaced, and the leading edge of the hood was folded down slightly. The grille was damaged and the right headlamp lens was shattered but neither was broken away. The right front turn signal assembly was intact, but was

knocked loose and was dangling by its wires. The hood was folded upward and was slightly displaced.

The CDC for the case vehicle's second impact was estimated from the available photographs as **12-FZEW-1 (0 degrees)**. The WinSMASH reconstruction program, missing vehicle algorithm based on the case vehicle's photo-estimated CDC, was used on the case vehicle's second impact. The total, longitudinal and lateral delta-Vs are, respectively: 21.0 km.p.h. [13.0 m.p.h.], -21.0 km.p.h. [-13.0 m.p.h.], and 0 km.p.h. [0 m.p.h.]. This is a borderline reconstruction, but the results appear reasonable. The second impact was of low severity (14-23 km.p.h. [9-14 m.p.h.]) for the case vehicle.

CHILD SAFETY SEAT

The back row center occupant was seated in an Evenflo Titan 5 convertible child safety seat (CSS), model #3672098P1, manufacture date September 25, 2002 (**Figures 5 and 6**). The CSS was configured in the forward-facing, upright mode, and was secured by the vehicle's available, manual, three-point, lap-and-shoulder safety belt system, with the webbing routed through the studs on the back of the CSS. The interviewee (driver; child's mother) stated that the switchable retractor was in automatic locking mode with the belt pulled tight such that the CSS could not move either forward-rearward or side-to-side. The interviewee further stated that the entire family had been to a child restraint checkpoint and the technicians confirmed that the CSS was correctly installed. The CSS was manufactured after the date when the Lower Anchors and Tethers for Children (LATCH) system components are expected to be present, but the interviewee stated that there was no tether strap. The case vehicle did not have LATCH system features.

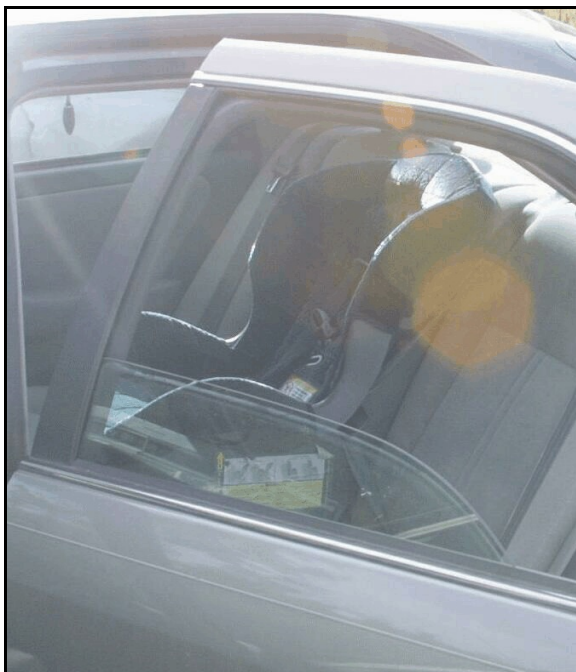


Figure 5: Child safety seat, viewed through back left window (case photo #06)



Figure 6: Child safety seat, viewed through back left door opening (case photo #05)

The CSS had a five-point harness with a retainer clip. The interviewee did not know where the retainer clip was situated with respect to the child's body. The harness straps were routed through the top slots. The seat portion of the CSS assembly was a one-piece rigid plastic shell, lined with padded upholstery. The child was seated in an upright posture and the interviewee stated that the harness straps held the child snugly. During the crash, the CSS stayed in position and the child was restrained by the harness. The interviewee stated there was no evidence that the CSS had been damaged in the crash.

CASE VEHICLE BACK CENTER PASSENGER'S KINEMATICS

The back center passenger (2-year-old female, white, non-Hispanic, 86 centimeters, 12 kilograms [34 inches, 26 pounds]) was positioned in a forward-facing convertible child safety seat (CSS). The CSS was secured by the case vehicle's available manual, three-point, lap-and-shoulder safety belt system and the child was restrained by the CSS's five-point harness with a retainer clip in use. The child was seated in an upright posture, with her back against the child safety seat's seat back, her legs dangling forward and downward, and her hands in her lap. The vehicle's seat back incline and seat track were not adjustable. There was no head restraint for the back center seat position.

The case vehicle was stopped, the driver did not attempt any avoidance maneuvers and the child's posture did not change immediately prior to the first impact. The back of the case vehicle was struck by the Ford's front. This impact was centered on the case vehicle's back plane and the case vehicle was propelled straight forward. The child moved rearward in response to the rear impact acceleration, with her back and the back of her head loading against the CSS's padded seat back. Almost immediately, the case vehicle's front impacted the Chrysler's back. The child moved forward in response to the front impact deceleration, with her chest, shoulders and hips loading against the CSS harness straps. The harness straps held the child in position and the case vehicle's safety belt held the CSS in position. The child's exact position at final rest is not known, but she probably rebounded into the CSS.

The child had no apparent injuries and was not transported via ambulance. She was taken to the family's private physician later, where it was confirmed that she had no injuries as a result of this crash.

CASE VEHICLE DRIVER'S KINEMATICS

The case vehicle's driver (34-year-old female, white, non-Hispanic, 157 centimeters, 82 kilograms [62 inches, 180 pounds]) was restrained by her available manual, three-point, lap-and-shoulder safety belt system. She was seated in a forward-facing, upright driving posture, with her back against the seat back, her feet on the floor or foot controls and both hands on the steering wheel. The tilt steering wheel was set at the center position. Her seat track was adjusted between the middle and full-forward position and the seat back incline was full up. Her adjustable head restraint was set at approximately the middle position.

The case vehicle was stopped, the driver did not attempt any avoidance maneuvers and her posture did not change immediately prior to the first impact. The back of the case vehicle was struck by the Ford's front. This impact was centered on the case vehicle's back plane and the case vehicle was propelled straight forward. The driver moved rearward in response to the rear impact acceleration, with her back loading against the seat back and the back of her head loading against the adjustable head restraint. Almost immediately, the case vehicle's front impacted the Chrysler's back. The driver moved forward in response to the front impact deceleration, with her chest and hips loading against the safety belt webbing, and she sustained a contusion on her left shoulder from the torso portion of the safety belt system. The safety belt system held her in place. Her exact position at final rest is not known, but she probably rebounded into her seat.

DRIVER'S INJURIES

The driver was not transported via ambulance, but she went to her private physician later.

| Injury Number | Injury Description (including Aspect) | NASS Injury Code & AIS 90 | Injury Source (Mechanism) | Source Confidence | Source of Injury Data |
|---------------|---------------------------------------|---------------------------|---------------------------|-------------------|-----------------------|
| 1. | Contusion, left shoulder | minor 790202.1,2 | Safety belt webbing | certain | interviewee |

CASE VEHICLE BACK RIGHT PASSENGER'S KINEMATICS

The case vehicle's back right passenger (36-year-old male, white, non-Hispanic, 188 centimeters, 95 kilograms [74 inches, 210 pounds]) was restrained by his available manual, three-point, lap-and-shoulder safety belt system. He was seated in a forward facing posture, with his feet on the floor, his right hand/forearm on the right side arm rest and his left hand in his lap. His seat track and seat back incline were not adjustable. His adjustable head restraint was full down, against with the top of the seat back.

The case vehicle was stopped, the driver did not attempt any avoidance maneuvers and the back right passenger's posture did not change immediately prior to the first impact. The back of the case vehicle was struck by the Ford's front. This impact was centered on the case vehicle's back plane and the case vehicle was propelled straight forward. The back right passenger moved rearward in response to the rear impact acceleration, with his back loading against the seat back. Because of his tall height and the low adjustment of his head restraint, the back of his head impacted the back light and he sustained an abrasion on his scalp. Almost immediately, the case vehicle's front impacted the Chrysler's back. The back right passenger moved forward in response to the front impact deceleration, with his chest and hips loading against the safety belt webbing. The safety belt system held him in place. His exact position at final rest is not known, but he probably rebounded into his seat.

The back right passenger was not transported via ambulance, but he went to his private physician later.

| Injury Number | Injury Description (including Aspect) | NASS Injury Code & AIS 90 | Injury Source (Mechanism) | Source Confidence | Source of Injury Data |
|---------------|---------------------------------------|---------------------------|---------------------------|-------------------|-----------------------|
| 1. | Abrasion, scalp, top-back of head | minor 190202.1,6 | Back light glazing | certain | interviewee |

FIRST OTHER VEHICLE

The first other vehicle was a 2001 Ford F-150 rear wheel drive, Supercrew, four-door pickup truck (VIN: 1FTRW07L21K-----), equipped with a 5.4 liter V8 gasoline engine. Four wheel anti-lock brakes were standard equipment on this model. Its specification wheelbase was 352 centimeters [138.5 inches]. The Ford was towed due to disabling damage.

There are no available photographs showing the Ford. The WinSMASH reconstruction program, missing vehicle algorithm based on the case vehicle's photo-estimated CDC, was used on the Ford's single impact. The total, longitudinal and lateral delta-Vs are, respectively: 25.0 km.p.h. [15.5 m.p.h.], -25.0 km.p.h. [-15.5 m.p.h.], and 0 km.p.h. [0 m.p.h.]. This is a borderline reconstruction, but the results appear reasonable. The impact was of moderate severity (24-40 km.p.h. [15-25 m.p.h.]) for the Ford.

According to the police crash report, the Ford's driver (21-year-old male) and front right passenger (22-year-old female) were restrained by their available, manual, three-point, lap-and-shoulder safety belt systems and the air bags did not deploy. Neither occupant was transported by ambulance, and both were police-reported as not injured.

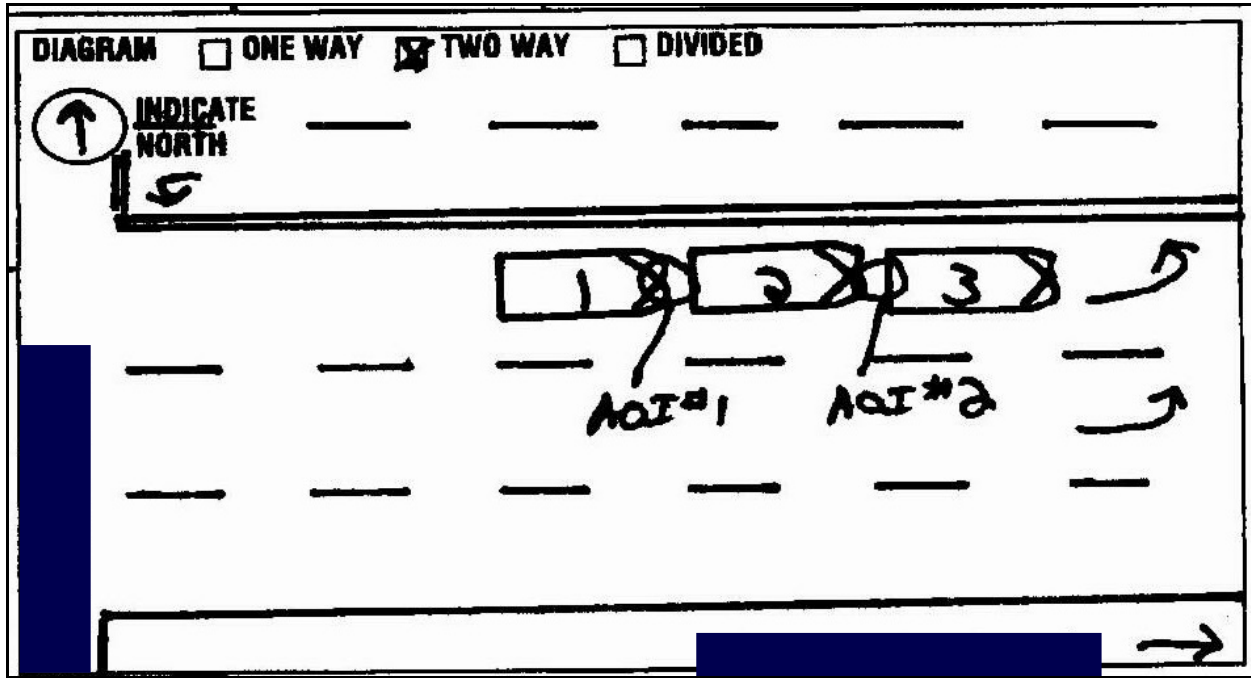
SECOND OTHER VEHICLE

The second other vehicle was a 2001 Chrysler Sebring LX front wheel drive, four-door, five-passenger sedan (VIN: 1C3EL46U51N-----), equipped with a 2.7 liter V6 gasoline engine. Four wheel anti-lock brakes are optional on this model but it is not known if this vehicle was so equipped. Its specification wheelbase was 274 centimeters [108.0 inches]. The Chrysler was driven away from the scene.

There are no available photographs of the Chrysler. The WinSMASH reconstruction program, missing vehicle algorithm based on the case vehicle's photo-estimated CDC, was used on the Chrysler's single impact, which was the second event in the crash sequence. The total, longitudinal and lateral delta-Vs are, respectively: 21.0 km.p.h. [13.0 m.p.h.], + 21.0 km.p.h.

[+ 13.0 m.p.h.], and 0 km.p.h. [0 m.p.h.]. This is a borderline reconstruction, but the results appear reasonable. The second event was of low severity (14-23 km.p.h. [9-14 m.p.h.]) for the Chrysler.

According to the police crash report, the Chrysler's driver (24-year-old female) was restrained by her available, active, three-point, lap-and-shoulder safety belt system and the air bags did not deploy. The driver was not transported by ambulance, but she was police-reported as sustaining a “ C” (possible) injury, based on her statement that she had head and neck pain.



Copied from police crash report.

Vehicle #2 in this diagram is the case vehicle (1999 Toyota Camry)

Vehicle #1 is the first other vehicle (2001 Ford F150)

Vehicle #3 is the second other vehicle (2001 Chrysler Sebring)