Child Restraint System Investigation
Dynamic Science, Inc. (DSI), Case Number DS09003
2002 Mitsubishi Montero
California
January 2009

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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

1. Report No.	2. Government Accession No.	3. Recipient Catalog No.
DS09003		

4. Title and Subtitle	5. Report Date
Child Restraint System Investigation	February 5, 2010
	6. Performing Organization Report No.

7. Author(s)	8. Performing Organization Report No.
Dynamic Science, Inc.	

9. Performing Organization name and Address	10. Work Unit No. (TRAIS)
Dynamic Science, Inc. 299 West Cerritos Avenue Anaheim, CA 92805	11. Contract or Grant no. DTNH22-07-00045

12. Sponsoring Agency Name and Address	13. Type of report and period Covered [Report Month, Year]
U.S. Dept. of Transportation (NVS-411) National Highway Traffic Safety Administration 1200 New Jersey Ave, SE Washington, DC 20590	14. Sponsoring Agency Code

15. Supplemental Notes

16. Abstract

This on-site investigation focused on the child restraint systems that were installed in the second row of a 2002 Mitsubishi Montero. The Mitsubishi was occupied by a 32-year-old male driver, a 27-year-old female front row right occupant, a 3-year-old female second row left occupant who was restrained in a backless booster seat, an 8-year-old second row middle occupant, and a 4-year-old male second row right occupant who was restrained in a backless booster seat. This two-vehicle crash occurred in January 2009 at 0255 hours. The Mitsubishi was traveling southbound on an interstate highway. The other vehicle was a 2004 Mazda RX8 that was being driven by a 25-year-old male. The Mazda was traveling southbound, and initiated a lane change prior to the impact. The front end of the Mazda impacted the rear end of the Mitsubishi. After the initial impact, the Mitsubishi initiated a rollover, struck a guardrail, and then impacted a utility pole. The driver of the Mitsubishi sustained multiple fractures and lacerations and was transported by ambulance to a local trauma center. The first row right occupant sustained a spinal fracture with paralysis and was transported to a local trauma center. The second row left occupant sustained multiple abrasions and contusions and was transported to a local trauma center for treatment. The second row middle occupant sustained minor abrasions and was transported to a local trauma center for treatment. The second row right occupant was partially ejected and fatally injured.

17. Key Words	18. Distribution Statement
Child safety seat, infant seat, fatality	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No of pages	22. Price

Form DOT F 1700.7 (8_72) Reproduction of this form and completed page is authorized

Dynamic Science, Inc.
Crash Investigation
Case Number: DS09003

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BACKGROUND

This on-site investigation focused on two child seats that were installed in the second row of a 2002 Mitsubishi Montero (**Figure 1**). The Mitsubishi was occupied by a 32-year-old male driver, a 27-year-old female front row right occupant, a 3-year-old female second row left occupant who was restrained in a backless booster safety seat (BSS), an 8-year-old second row middle occupant in a lap belt, and a 4-year-old male second row right occupant who was restrained in a backless BSS. This two-vehicle crash occurred in January 2009 at 0255 hours. The Mitsubishi was traveling southbound on an interstate highway. The other vehicle was a 2004 Mazda RX8 that was being driven by a 25-year-old male. The Mazda was traveling southbound, and initiated a lane change prior to the impact. The front end of the Mazda impacted the rear end of the Mitsubishi. After the initial impact, the Mitsubishi initiated a rollover, struck a guardrail, and then impacted a utility pole. The driver of the Mitsubishi sustained multiple fractures and lacerations and was transported by ambulance to a local trauma center. The first row right occupant sustained a spinal fracture with paralysis and was transported to a local trauma center. The second row left occupant sustained multiple abrasions and contusions and was transported to a local trauma center for treatment. The second row middle occupant sustained minor abrasions and was transported to a local trauma center for treatment. The second row right occupant was partially ejected and fatally injured. Both vehicles were towed due to damage and the vehicles and the child safety seats were impounded by police.

Figure 1. 2002 Mitsubishi Montero Sport

This child restraint system (CRS) investigation was initiated by an SCI investigator during a review of an internet news article. The article reported that a 4-year-old male, who was properly restrained in a BSS, died as a result of injuries he sustained in a two-vehicle crash. On January 3, 2009, DSI forwarded the news article to the National Highway Traffic Safety Administration (NHTSA). On January 6, 2009, DSI was notified by NHTSA with a request to obtain cooperation. On January 6, 2009, the investigating police agency was contacted and the police report was requested. The two vehicles and the BSSs involved in the crash were being held in evidence by the police. DSI obtained permission to inspect the vehicles and the seats and the inspections took place on January 29, 2009. Five members of the Multi Disciplinary Accident Investigation Team were present during the vehicle inspections. The police report was obtained at a later date and the scene was inspected at that time.

SUMMARY

Crash Site

The crash occurred on a northbound/southbound freeway in southern California. The northbound traffic was separated from the southbound traffic by a wide dirt embankment. The southbound roadway consisted of five travel lanes (**Figure 2**). The roadway was primarily straight, had a

descending grade of negative 2%, and was of concrete composition. The roadway was bordered to the west by a metal guardrail and a downhill embankment. A 45 cm (17.7 in) diameter metal support pole was located 1.2 m (4 ft) to the right of the guardrail. The roadway was dry and the weather clear. The crash occurred at 0255 hours; conditions were dark with no streetlights illuminated. The posted speed limit was 113 km/h (70 mph).

Figure 2. Southbound approach

Pre-Crash

The Mitsubishi was occupied by a restrained 32-year-old male driver, a restrained 27-year-old female front row right occupant, a 3-year-old female second row left occupant, who was seated in a Dorel belt positioning booster seat, a restrained 8-year-old second row middle occupant, and a 4-year-old male second row right occupant, who seated in a Cosco belt positioning booster seat. The Mitsubishi was traveling southbound in the fifth lane of an interstate highway. The Mazda was being driven by a restrained 25-year-old male. The Mazda was traveling southbound at a driver reported speed of 113 km/h (70 mph) in the fourth lane. The driver of the Mazda was driving while under the influence of alcohol. For unknown reasons, the Mazda shifted from the fourth lane into the fifth lane.

Crash

The front end of the Mazda impacted and underrode the rear end of the Mitsubishi. The Damage Only algorithm of the WinSMASH program computed a Total Delta-V of 11.0 km/h (6.8 mph) for the Mitsubishi. The longitudinal and lateral components were 11.0 km/h (6.8 mph) and 0 km/h, respectively. The program computed a Total Delta-V of 31.0 km/h (19.3 mph) for the Mazda. The longitudinal and lateral components were -31.0 km/h (-19.3 mph) and 0 km/h, respectively. After the initial impact, the Mazda began a clockwise rotation while traveling in a southwest direction. The Mazda traveled approximately 149 m (489 ft) while rotating and came to rest in the second lane from right facing southeast. The Mitsubishi began a clockwise rotation while traveling in a southwest direction. The Mitsubishi traveled across the adjacent travel lanes at a diagonal to the right roadside. After rotating approximately 90 degrees, the vehicle's front tires departed the roadway (**Figure 3**). The vehicle tripped in the shoulder area and began a left side leading rollover (Event 2). After rolling four quarter turns, the vehicle mounted the metal guardrail (Event 3). The most significant area of

Figure 3. Area of rollover, guardrail contact, and pole impact (skid on shoulder not related to this crash)

contact from this impact was to the left side of the vehicle. The Montero rolled two more quarter turns during this event while straddling the guardrail, until the vehicle impacted the metal pole with its right side (Event 4). The Mitsubishi came to rest on its roof facing west with its right side against the freeway sign post.

Post-Crash

The driver of the Mitsubishi exited the vehicle with some assistance. He was transported to a local trauma center where he arrived with a Glasgow Coma Score (GCS) of 15 and was hospitalized overnight.

The front right occupant was removed from the vehicle with serious injuries. She sustained a spinal fracture with paraplegia, was transported to a local trauma center, and was hospitalized for an unknown period of time.

The second row left occupant was extricated from the vehicle by rescue personnel. She sustained mostly minor injuries, and was transported to a local hospital for treatment.

After the vehicle came to rest, the second row middle occupant unlatched his seat belt and fell down and hit the top of his head on the roof. He was able to extricate himself from the vehicle under his own power. He sustained mostly minor injuries, and was transported to a local trauma center where he was treated and released.

The second row right occupant was partially ejected and located posteriorly with his upper body positioned between the B-pillar and the sign post, with his head outside the vehicle. He sustained multiple blunt force injuries and was pronounced deceased at the scene at 0318 hours.

The driver of the Mazda exited the vehicle under his own power. He sustained a laceration to the right eyebrow. He was transported to a local hospital by the investigating police agency. He was later arrested for driving under the influence of alcohol.

Both vehicles were towed from the scene due to damage and were placed on a police hold.

Vehicle Data - 2002 Mitsubishi Montero Sport

The 2002 Mitsubishi Montero Sport 4-door sport utility vehicle was identified by the Vehicle Identification Number (VIN): JA4LS41R72Jxxxxxx. The vehicle's date of manufacture was not visible due to the jammed left front door. The Mitsubishi was equipped a 3.5-liter, 6-cylinder engine, 4-speed automatic transmission, front disc/rear drum brakes, and rear-wheel drive. The vehicle was configured with Goodyear Wrangler RT/S 255/70R16 tires. The tire manufacturer's recommended maximum pressure was 303 kPa (44 psi). The vehicle manufacturer's recommended tire size was P255/70R16. The specific tire information was as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	Tire Flat	11 mm (14/32 in)	No	Debeaded

LR	221 kPa (32 psi)	10 mm (13/32 in)	No	Sidewall abrasions
RR	207 kPa (30 psi)	10 mm (13/32 in)	No	Sidewall abrasions
RF	Tire Flat	10 mm (13/32 in)	No	Debeaded

The seating in the Mitsubishi was configured with front bucket seats with adjustable head restraints and a 60/40 split bench second row seat with adjustable head restraints for the outboard seating positions.

Vehicle Damage

Exterior Damage

The Mitsubishi sustained moderate rear-end damage from the impact with the Mazda (**Figure 4**). The direct damage began at the left rear bumper corner and extended 82 cm (32.3 in) to the right. Six crush measurements were documented at the bumper level as follows: C_1 = 14 cm (5.5 in), C_2 = 18 cm (7.0 in), C_3 = 14 cm (5.5 in), C_4 = 8 cm (3.1 in), C_5 = 5 cm (1.9 in), C_6 = 3 cm (1.2 in). The Mazda underrode the Mitsubishi and impacted the rear axle stabilizer bar (**Figure 5**). The distance from the reference line to the stabilizer bar measured 94 cm (37 in). The distance from the reference line to the differential measured 101 cm (39.8 in). There was 93 cm (36.6 in) of direct contact to the bar. The Collision Deformation Classification (CDC) for the impact with Mazda was 06BYEW1.

Figure 5. Rear end damage

Figure 4. Rear axle stabilizer contact

The vehicle sustained moderate top damage as a result of vehicle rollover. The direct damage began at the hood and extended 393 cm (154.7 in) longitudinally. The lateral damage was distributed from roof side rail to roof side rail and measured 158 cm (62.2 in). The maximum crush was located on the left roof side rail at 2 cm (0.8 in) forward of the rear axle. The vertical measurement was 17 cm (6.7 in) and the lateral measurement was 23 cm (9 in). The CDC for the rollover was 00TDDO3.

The vehicle sustained moderate non-horizontal left side damage as a result of the contact to the top

of the guardrail (**Figure 6**). The direct damage began 115 cm (45.3 in) forward of the rear axle and extended 60 cm (23.6 in) forward. The direct and induced damage began 28 cm (11 in) forward of the rear axle and extended 190 cm (74.8 in) forward. Six crush measurements were documented at the upper door level as follows: C_1 = 0 cm, C_2 = 2 cm (0.8 in), C_3 = 11 cm (4.3 in), C_4 = 22 cm (8.7 in), C_5 = 10 cm (3.9 in), C_6 = 0 cm. The CDC for impact with the guardrail was 00LPAW3.

Figure 6. Left side damage from guardrail

The vehicle sustained severe non-horizontal damage to the right as a result of the impact with the metal pole (**Figure 7**). The direct damage began 82 cm (32.2 in) aft of the front axle. The damage measured 39 cm (15.3 in) along the right front door. There was a 29 cm (11.4 in) gap between the aft edge of the door panel to the B-pillar. The direct damage continued rearward for an additional 40 cm (15.7 in). The vertical damage extended from the sill to the roof side rail. The maximum lateral crush was located at the mid door area and measured 28 cm (11 in). The CDC for the pole impact was 00RPAW3.

Figure 7. Right side damage from pole

Interior Damage

The Mitsubishi sustained major interior damage from passenger compartment intrusion and occupant contacts. The left front, right front and right rear doors and the tailgate were jammed shut. The windshield glazing was cracked and out of place. The glazing at all positions except the fixed glazing aft of the second row window was disintegrated. The passenger compartment sustained vertical and lateral intrusions to the front and second rows.

Manual Restraint Systems

The Mitsubishi was configured with manual 3-point lap and shoulder belts for the outboard seating positions and a lap belt for the second row middle seat position. The front seat belts were configured with retractor pretensioners that did not actuate. The driver's safety belt was equipped with an anchorage adjustment that was in the mid-position. The front right safety belt was equipped with an anchorage adjustment that was in the full-up position. The driver's safety belt was configured with a sliding latch plate and an Emergency Locking Retractor (ELR). The remaining outboard safety belts were configured with sliding latch plates and switchable ELR/Automatic Locking Retractors (ALR). The driver's belt exhibited loading marks located 60 cm (23.6 in) from the anchor that measured 19 cm (7.5 in) in length (**Figure 8**).

Figure 8. Loading to driver's seat belt webbing

The front right latch plate was in the buckle at the time of the inspection. The belt webbing had been cut at a point 136 cm (53.5 in) from the lower anchor (**Figure 9**).

Figure 9. Front right safety belt

The second row left seat belt was being used in combination with a backless BSS (**Figure 10**). The belt had been cut by emergency personnel at a point 43 cm (16.9 in) from the anchor. The remaining segment of the webbing remained attached to the retractor and measured 79 cm (31.1 in) in length. An area of loading/bending was located 29 cm (11.4 in) from the D-ring. At the time the inspection, the cover over the C-pillar had been pulled away from the D-ring assembly.

Figure 10. Left rear safety belt

The second row middle lap belt was equipped with a locking/cinching latch plate. There were indications of historical usage on the latch plate.

The second row right seat belt was being used in combination with a backless BSS (**Figure 11**). The belt webbing had been cut by emergency personnel. One segment of the webbing was attached to the retractor and the other to its corresponding anchor. The webbing segment was fully

wound within the retractor and would not unspool. The latch plate was found inserted into its corresponding buckle. The non-adjustable D-ring assembly was located in place; however, the cover over the C-pillar was missing. The segment of the belt webbing that was attached to the anchor measured 112 cm (44 in). The distance from the anchor to the plastic stop button measured 30 cm (11.8 in). Abrasions were observed on the side of the belt webbing that was in contact with the D-ring. The 21 cm (8.3 in) long abrasion began 11 cm (4.3 in) from the cut end of the belt and ended 80 cm (31.5 in) from the anchor.

Figure 11. Right rear safety belt

Supplemental Restraint Systems

The Mitsubishi Montero Sport was equipped with Second Generation redesigned frontal air bags for the driver and front right passenger seat positions. The frontal air bags did not deploy. The module cover for the passenger air bag was displaced during the crash and the air bag was visible.

Child Restraint Systems

Second Row Left

The second row left occupant was a 3-year-old female seated in a Dorel Eddie Bauer Auto Booster backless BSS (**Figure 12**). The model number was 22828-ENJ and the date of manufacture was 10/26/07. The seat was designed to be used by children whose weight was between 18.1-45.4 kg (40-100 lbs), whose height was between 110.1-144.8 cm (43-57 in), and whose age was greater than 1 year. The height and weight of the child using this seat is not known. The BSS was being used in combination with the vehicle's 3-point manual lap and shoulder belt.

Figure 12. Booster seat, second row left

Second Row Right

The 4-year-old male seated in second row right in a Cosco Ambassador backless BSS (**Figure 13**). The model number was 22-293-BVL and the date of manufacture was 7/19/2007. The seat was designed to be used by children whose weight was between 13.6-45.4 kg (30-100 lbs), whose height was between 85.1-144.8 cm (34-57 in), and whose age was greater than 1 year. The right rear occupant was within the recommended parameters for this child seat. The seat was being used in combination with the vehicle's manual 3-point lap and shoulder belt. It was indeterminate if the lap and shoulder belt was in the ELR or ALR mode at time of the crash. The outboard base of the seat sustained a V-shaped fracture (**Figure 14**). The 6 x 5 cm (2.4 x 1.9 in) fracture was oriented with

the bottom of the V pointed toward the front of the BSS. The damage was caused by the intrusion of the right interior door surface. The seat pad exhibited regular usage and was soiled.

Figure 13. BSS, second row right

Figure 14. Right side BSS damage

Rollover Dynamics

The Mitsubishi was equipped with an automatic transmission, front disc/rear drum brakes, and rear wheel drive. The vehicle had a Static Stability Factor (SSF) of 1.07[1]. The SSF of a vehicle is an at-rest calculation of its rollover resistance, based on geometric properties. Basically, SSF is a measure of the top-heavy characteristics of a vehicle. The Montero was a three star rated vehicle, indicating that the vehicle has a risk of rollover between 20% and 30%. After the impact with the Mazda, the Montero began a clockwise rotation. The vehicle traveled across the adjacent travel lanes at a diagonal. After rotating approximately 90 degrees, the front tires departed the roadway. The front tires were traveling across dirt/grass and the rear tires were traveling across the asphalt shoulder. At this point, the roadway's opposing lateral forces against the left side tires induced a trip rollover, left side leading. After rolling four quarter turns, the vehicle mounted the metal guardrail. The most significant area of contact was to the left side of the vehicle. The Montero rolled two more quarter turns during this event while straddling guardrail, until the vehicle impacted the metal pole with its right side. The Mitsubishi came to rest on its roof facing west with its right side against the freeway sign post. The vehicle rolled a total of six quarter turns. The distance from the tripping point to the interrupted rollover and final rest was approximately 48 m (157 ft).

Vehicle Data - 2004 Mazda RX-8

The 2004 Mazda RX-8 4-door coupe was identified by the Vehicle Identification Number (VIN): JM1FE173740xxxxxx. The Mazda was equipped with a 1.3-liter twin-rotor rotary piston engine, 6-speed manual transmission, 4-wheel disc brakes with ABS, power-assisted rack and pinion steering, and rear wheel drive. The vehicle mileage was 74,834 km (46,500 miles), and the vehicle

[1]www.safercar.gov

was equipped with Kumho Ecsta SPT 225/45R18 tires. The vehicle manufacturer's recommended cold tire pressure was 221 kPa (32 psi); the tire manufacturer's recommended maximum pressure was 352 kPa (51 psi). The specific tire information was as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	221 kPa (32 psi)	4 mm (5/32 in)	No	None
LR	193 kPa (28 psi)	5 mm (6/32 in)	No	None
RR	200 kPa (29 psi)	5 mm (6/32 in)	No	None
RF	214 kPa (31 psi)	3 mm (4/32 in)	No	None

Vehicle Damage - 2004 Mazda RX-8

Exterior Damage

The Mazda sustained moderate front end damage as a result of the impact with the Mitsubishi **(Figure 15**). The direct damage began 55 cm (21.2 in) to the right of the left front bumper corner and extended 82 cm (32.2 in) to the right. The bumper fascia was fractured and displaced. The bumper backing bar had separated from the bumper mount, and had been pulled forward as the vehicles disengaged. Crush measurements were taken at the bumper level and at the upper radiator support level. The crush measurements were averaged and the resultant crush profile was as follows: C_1 = 0 cm, C_2 = 0 cm, C_3 = 8 cm (3.1 in), C_4 = 18 cm (7.0 in), C_5 = 23 cm (9.0 in), and C_6 = 19 cm (7.5 in). The CDC for the impact with Mitsubishi was 12FZEW2.

Figure 15. Other vehicle, 2004 Mazda RX-8

OCCUPANT DEMOGRAPHICS

	Driver	Front Row Right Occupant (02)
Age/Sex:	32/Male	27/Female
Seated Position:	Front left	Front right
Seat Type:	Bucket	Bucket
Seat track position:	Mid-track, 30 cm (11.8 in) from instrument panel	Mid-track, 32 cm (12.6 in) from instrument panel

	Driver	Front Row Right Occupant (02)
Height:	157 cm (62 in)	Unknown
Weight:	64 kg (140 lbs)	Unknown
Alcohol/Drug Involvement:	None	None
Body Posture:	Unknown	Unknown
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	Lap and shoulder belt	Lap and shoulder belt
Air bags:	Driver frontal air bag available, did not deploy	Front right passenger air bag available, did not deploy

	Second Row Left Occupant (03)	Second Row Middle Occupant (04)	Second Row Right Occupant (05)
Age/Sex:	3/Female	8/Male	4/Male
Seated Position:	Second row left	Second row middle	Second row right
Seat Type:	Split bench with folding backs	Split bench with folding backs	Split bench with folding backs
Seat track position:	N/A	N/A	N/A
Height:	Unknown	Unknown	109 cm (43 in)
Weight:	Unknown	40 kg (88 lbs)	20 kg (44 lbs)
Alcohol/Drug Involvement:	None	None	None
Body Posture:	Unknown	Unknown	Unknown
Hand Position:	Unknown	Unknown	Unknown
Foot Position:	Unknown	Unknown	Unknown
Restraint Usage:	Lap and shoulder belt used with booster CSS	Lap belt	Lap and shoulder belt with booster CSS

OCCUPANT INJURIES

Driver Injuries: Injuries obtained from emergency room records and radiology reports.

Injury	OIC Code	Injury Mechanism	Confidence Level
Bilateral scattered lung contusions (upper)	441410.4,3	Door panel, rear upper quadrant	Possible
Lacerations to the right parietal scalp (9 cm/3.5 in, 7 cm/2.8 in)	190602.1,1	Unknown	Unknown
Left humerus supracondylar avulsion fracture	752602.2,2	Door panel, rear upper quadrant	Probable
Laceration between left thumb and index finger	790600.1,2	Flying glass	Possible
Right side periorbital ecchymoses	297402.1,1	Unknown	Unknown

Front Right Occupant Injuries (02): Injuries obtained from police report.

Injury	OIC Code	Injury Mechanism	Confidence Level
Spinal fracture with paralysis from waist down	650616.2,8	Unknown	Unknown
Multiple open fractures, right leg	852002.2,1	Side door panel, forward upper quadrant	Probable
Multiple right side rib fractures	450210.2,1	Side door panel, forward upper quadrant	Probable
Blunt traumatic lumbar spine injury NFS	617099.7,9	Unknown	Unknown

Second Row Left Occupant Injuries (03): Injuries obtained from police report.

Injury	OIC Code	Injury Mechanism	Confidence Level
Contusion, right side of face surrounding right eye	290402.1,1	Occupant 04	Possible
Multiple lacerations, head Laceration, left ear	190600.1,0	Flying glass	Possible

Abrasion, left arm	790201.12	Flying glass	Possible
Contusion/laceration, anterior right hip	890402.1,1 890600.1,1	Seat belt webbing	Probable

Second Row Middle Occupant Injuries (04): Injuries obtained from emergency room and radiological reports.

Injury	OIC Code	Injury Mechanism	Confidence Level
Bilateral hand contusions	Not codeable - post-crash		
Bilateral hand abrasions	Not codeable - post-crash		
Abrasion, right elbow	790202.1,1	Unknown	Unknown
Small laceration, above right patella	890600.1,1	Unknown	Unknown

Second Row Right Occupant Injuries (05): Injuries obtained from autopsy report.

Injury	OIC Code	Injury Mechanism	Confidence Level
Basilar skull fractures, both occipital bones and squamous part of the inferior right temporal bone	150200.3,8	Pole	Probable
Separation between 1st and 2nd cervical vertebrae	650204.2,6	Pole	Probable
Blunt trauma cervical spine injury NFS	615099.7,6	Pole	Probable
Subarachnoid hemorrhage, right temporal lobe and base of the brain, 3cc of subdural hemorrhage over right cerebral convexities	140684.3,1	Pole	Probable
Diffuse subcutaneous hemorrhage, mid frontal and parietal scalp and left occipital scalp	190402.1,0	Pole	Probable
Linear diagonal indentation across left chest. Avulsion of underlying soft tissue underneath the indentation	490800.1,2	B-pillar	Certain
Fracture, left clavicle	752200.2,2	B-pillar	Certain

Fractures, lateral left ribs 1-3	450220.2,2	B-pillar	Certain
Abrasions, forehead and right side of face	290202.1,7 290202.1,1	Exterior of vehicle	Probable
Contusions, forehead and right side of face	290402.1,7 290402.1,1	Exterior of vehicle	Probable
Lacerations (3), right side of chin	290600.1,8	Exterior of vehicle	Probable
Laceration, upper frenula	243400.1,8	Exterior of vehicle	Probable
Laceration, right lower oral/buccal mucosa	243099.1,8	Exterior of vehicle	Probable
Abrasions, right shoulder	790202.1,1	Seat belt webbing	Probable
Abrasion, right anterior hip	890202.1,1	Seat belt webbing	Certain
Contusions, right shoulder	790402.1,1	Seat belt webbing	Possible
Contusion/abrasion, right lower chest	490402.1,1 490202.1,1	Door panel, right forward upper quadrant	Probable
Contusion/abrasion, left back	690402.1,2 690202.1,2	Pole	Probable
Contusion, anterior right hip	890402.1,1	Seat belt webbing	Possible
Contusions, right thigh and anterior right lower leg	890402.1,1	Door side panel, forward lower quadrant	Probable

OCCUPANT KINEMATICS

Driver Kinematics

The male driver of the Mitsubishi was seated in an unknown posture in the bucket seat and he was wearing the manual lap and shoulder belt. At impact with the Mazda, he was displaced rearward in response to the 6 o'clock direction of force. This was a moderate impact and there were no indications that he was injured during this initial impact. Post-impact, the vehicle initiated a clockwise rotation while crossing the adjacent travel lanes. The driver was displaced to the left during rotation. After the vehicle rotated approximately 90 degrees, it tripped and began a left side leading rollover. The driver pitched to the left and right during the rollover sequence. He sustained a fractured left humerus that was probably due to contact with interior door surface. He sustained bilateral lung contusions that were also possibly due to contact with the door surface. While the vehicle was upside down, it struck the pole with its right side. The driver was displaced to his right but remained belted. He sustained lacerations to the scalp and hand, and a contusion near the right

eye. He was able to exit the vehicle with some assistance and was transported to a local trauma center for treatment. He arrived with a GCS of 15 and was hospitalized overnight.

Front Row Right Occupant Kinematics (02)

The front right female occupant was seated in an unknown posture in the bucket seat. She was wearing the manual lap and shoulder belt. At impact with the Mazda, she was displaced rearward in response to the 6 o'clock direction of force. This was a moderate impact and there were no indications that she was injured during this initial impact. During the subsequent rotation, she was displaced to the left. As the vehicle overturned, she pitched to the left and right but remained belted in the vehicle. While the vehicle was upside down, it struck the pole with its right side. The front right occupant engaged the intruding door with the right side of her body. She sustained a spinal fracture with paraplegia, multiple open fractures of the right leg, and multiple right side rib fractures. She was transported to a local trauma center and was hospitalized.

Second Row Left Occupant Kinematics (03)

The 3-year-old second row left female occupant was seated in a BSS and was using the manual lap and shoulder belt. She was displaced rearward during the impact with the Mazda. This was a moderate impact and there were no resultant injuries. As the vehicle rolled, this occupant was displaced to the left and right. At impact with the pole, she was displaced sharply to the right. The occupant sustained a contusion and laceration to the right anterior hip due to loading with the seat belt webbing during these impacts. She also sustained a large contusion to the right side of her face and eye, possibly due to intra-occupant contact. She came to rest in the vehicle, still restrained, and was extricated by rescue personnel.

Second Row Center Occupant Kinematics (04)

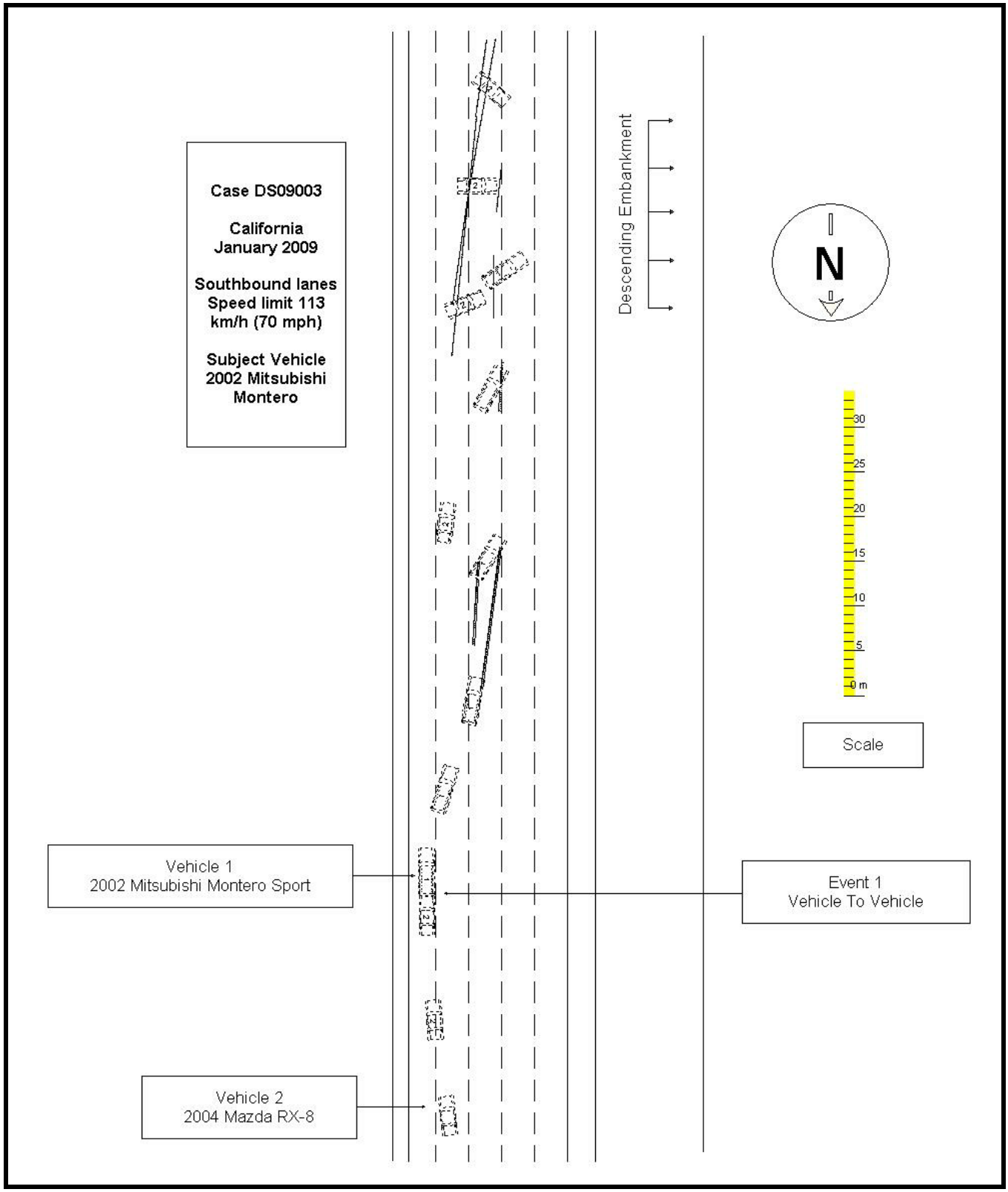
The 8-year-old male second row middle occupant was seated on the split bench seat and was wearing the manual lap belt. At impact with the Mazda, this occupant was displaced rearward but did not sustain any injuries during this impact. As the vehicle rolled, this occupant was displaced to the left and right. The top of his head may have contacted the interior roof at some point. He remained belted throughout the rollover. At impact with the pole, he was displaced sharply to the right. He sustained bilateral abrasions/contusions to his hands, an abrasion to the right elbow, and a small laceration above the right patella. This occupant unlatched his safety belt and fell to the roof and struck his head. He was able to exit the vehicle under his own power through a side window. The injuries to his hands were likely a result of his extrication activities. The injury mechanism for the other injuries was not known. He was transported from the scene to a local trauma center where he arrived with a GCS of 15. He was treated and released.

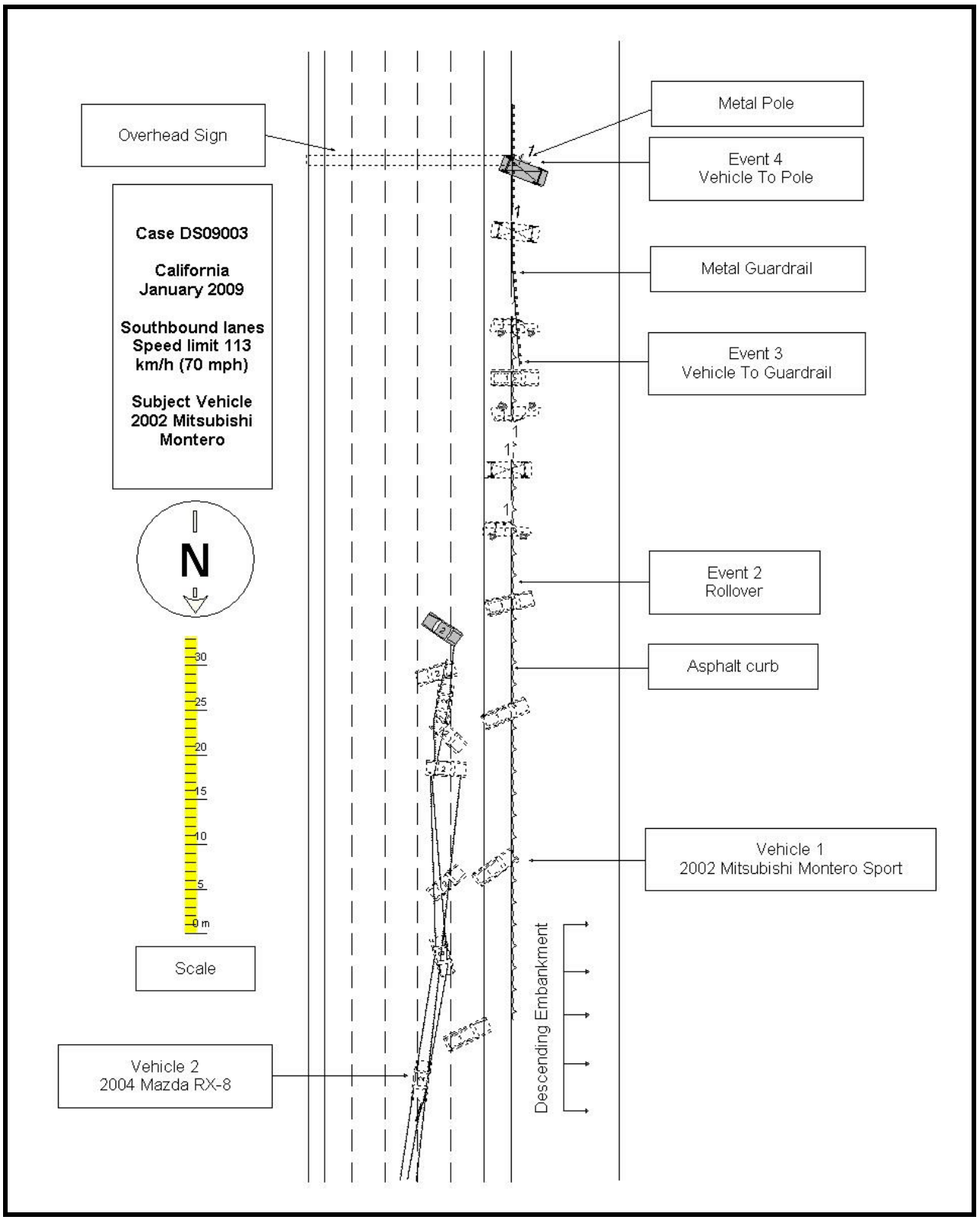
Second Row Right Occupant Kinematics (05)

Figure 16. Right rear occupant seating position

The second row right 4-year-old male occupant was in a BSS and was using the manual lap and shoulder belt. This occupant was displaced rearward during the impact with the Mazda, and as the vehicle rolled, he was displaced to the left and right. The seat belt webbing showed evidence of loading. The BSS did not exhibit any signs of occupant loading, but was cracked from the intruding right rear door. Due to the extended rollover sequence, this occupant was moving about his seating position, which resulted in the webbing being spooled out just prior to the impact with the pole. This occupant was partially ejected through the second row right side window during the rollover, and his torso was positioned between the right B-pillar and the pole at impact. There was an indentation across his left chest due to the body's positioning between the B-pillar and pole. He sustained multiple blunt force injuries, including: separation between 1st and 2nd cervical vertebrae, a basilar skull fracture, subdural and subarachnoid hemorrage, subcutaneous hemorrhages of scalp, left clavicle fracture, left 1st through 3rd rib fractures, and multiple contusions, abrasions, and lacerations. According to the coroner, the presence of petechiae around both eyes and lower eyelids in conjunction with the positioning of the body indicated the there may have been a component of mechanical asphyxia. He was pronounced deceased at the scene.

Attachment 1. Scene Diagram




Overhead Sign
Case DS09003
California
January 2009
Southbound lanes
Speed limit 113
km/h (70 mph)
Subject Vehicle
2002 Mitsubishi
Montero
N
30
25
20
15
10
5
0 m
Scale
Vehicle 2
2004 Mazda RX-8
Metal Pole
Event 4
Vehicle To Pole
Metal Guardrail
Event 3
Vehicle To Guardrail
Event 2
Rollover
Asphalt curb
Vehicle 1
2002 Mitsubishi Montero Sport
Descending Embankment