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Special Crash Investigations
Remote Vehicle Fire/
Child Restraint System Investigation
Vehicle: 2004 Chevrolet Silverado
Location: California
Crash Date: January 2014

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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 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 vehicles or their safety systems.

This report and associated case data are based on information available to the Special Crash Investigation team on the date this report was published.

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16. Abstract

The interest of this Remote Vehicle Fire/Child Restraint System (CRS) Investigation is the post-impact fire in a 2004 Chevrolet Silverado involved in a frontal crash with another vehicle, and the 3-year-old male occupant of the Chevrolet who was seated in a CRS in the second row. This two-vehicle crash occurred during daylight hours in January 2014 on a two-lane State highway in California. The driver of the Chevrolet was a belted 29-year-old female. The other occupant in the vehicle was a 3-year-old male seated in the left side of the second row in a booster safety seat and using the vehicle's seat belt. The other vehicle involved in the crash was a 2014 Ford F-250 towing a 2012 C&B two-axle flatbed trailer. The driver of the Ford was a belted 23-year-old male. The Chevrolet was traveling southbound and the Ford was traveling northbound. The Chevrolet crossed the center line and entered the northbound lane. After entering the northbound lane, the driver of the Chevrolet steered right to return to the southbound lane. The front plane of the Chevrolet struck the front plane of the Ford. The Ford jackknifed as it was displaced to the west and sustained intra-unit damage. The Chevrolet was displaced rearward and rotated clockwise coming to rest in the northbound lane facing north. The Ford continued west, striking a bridge rail with its front plane where it came to rest. Following the crash, a fire started in the Chevrolet and spread to the occupant compartment. A witness observed the driver who was unresponsive and the child who was seated in the CRS. He removed the child from the vehicle and determined due to the fire it was too dangerous to attempt rescue of the driver. The witness stated the fire quickly spread throughout the engine and occupant compartments. Emergency responders arrived after the Chevrolet was engulfed in flames. The driver of the Chevrolet was fatally injured. The 3-year-old sustained police-reported incapacitating "A" injuries and was transported to a local hospital for treatment.

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Special Crash Investigations
Remote Vehicle Fire/Child Restraint System
Investigation Case Number: DS16026
Vehicle: 2004 Chevrolet Silverado
Location: California
Incident Date: January 2014

BACKGROUND

Figure 1. 2004 Chevrolet Silverado (police image)

The interest of this Remote Vehicle Fire/Child Restraint System (CRS) Investigation is the post-impact fire in a 2004 Chevrolet Silverado (**Figure 1**) involved in a frontal crash with another vehicle, and the 3-year-old male occupant of the Chevrolet who was seated in a CRS in the second row. The investigation is intended to determine the events leading to the fire, how quickly the fire spread to the occupant compartment, the magnitude of the fire, how quickly EMS and other responders arrived on-scene, occupant restraint usage, demographics, injury data and CRS data. The crash was identified during a review of Fatality Analysis Reporting System (FARS) crash reports. The criteria for the crash type include a front plane impact, fire which spreads to the occupant compartment and at least one occupant seated in a CRS. The Special Crash Investigations (SCI) team obtained the police report and on-scene images for the case and it was initiated by the SCI group of the National Highway Traffic Safety Administration on December 19, 2016. Police inspected both vehicles during the investigation but did not image the event data recorder (EDR) from either vehicle.

This two-vehicle crash occurred during daylight hours in January 2014 on a two-lane State highway in California. The crash site was a State maintained north/south bridge consisting of one lane for each direction. The driver of the Chevrolet was a belted 29-year-old female. The other occupant in the vehicle was a 3-year-old male seated in the second row left in a booster safety seat and using the vehicle's seat belt. The other vehicle involved in the crash was a 2014 Ford F-250 towing a 2012 C&B Deck-Over Edition two-axle flatbed trailer. The driver of the Ford was a belted 23-year-old male. The Chevrolet was traveling southbound and the Ford was traveling northbound. The driver of the Chevrolet was under the influence of methamphetamine. The Chevrolet crossed the center line and entered the northbound lane. After entering the northbound lane, the driver of the Chevrolet steered right to return to the southbound lane. Before changing lanes the front plane of the Chevrolet struck the front plane of the Ford in a head-on configuration. The Ford jackknifed as it was displaced to the west and sustained intra-unit damage. The Ford continued west, striking a bridge rail with its front plane (Event 3) where it came to rest. The Chevrolet was displaced rearward and rotated clockwise coming to rest in the northbound lane facing north. Following the crash, a fire started in the Chevrolet and spread to the occupant compartment.

Following the crash, a witness traveling behind the Ford stopped his vehicle and ran to the Chevrolet. He observed the driver who was unresponsive and the child who was seated in the CRS. He removed the child from the vehicle and determined due to the fire it was too dangerous to attempt rescue of the driver. The witness stated the fire quickly spread throughout the engine and occupant compartments. Emergency responders arrived after the Chevrolet was engulfed in flames.

The driver of the Chevrolet sustained "K" (fatal) injuries, was declared deceased on-scene, and was transported to the local coroner's office. The 3-year-old male occupant of the Chevrolet sustained "A" (incapacitating) injuries including a thermal burn to the face and was transported to a local hospital. The driver of the Ford sustained "A" (incapacitating) injuries and was transported to a local hospital. Both vehicles were towed due to damage.

SUMMARY

Crash Site

The crash occurred on a bridge section of an undivided north/south county-maintained roadway in California (**Figure 2**). Crash site data including roadway measurements were obtained from the police report, police on-scene images and satellite images. The roadway was asphalt surfaced and was configured with two lanes each measuring 3.7 m (12.0 ft) wide. It was configured with paved shoulders on the east and west edges measuring 1.8 m (6.0 ft) wide. The shoulders were bordered by metal bridge railings of unknown height. The travel lanes were separated by a solid double yellow painted stripe, the left edge was bordered by a solid yellow painted stripe and the right edge was bordered by a solid white painted fog line. This roadway was straight for the full length of the bridge. In their respective travel approaches across the bridge, the northbound and southbound lanes had a slight ascending slope that crested at the center of the bridge. The posted speed limit was 89 km/h (55 mph). The investigating police officer noted no unusual conditions were present at the time of the crash.

Figure 2. Crash site looking south (police image

Conditions at the time of the crash as reported by the nearest weather station were as follows: temperature 21.1 degrees C (70.0 degrees F), 39 percent humidity, northeast winds at 14.8 km/h (9.2 mph), 16.0 km (10.0 mi) visibility and cloudy skies. A crash diagram is included in this report.

Pre-Crash

The Chevrolet was traveling southbound across the bridge at a police-reported speed of 89 km/h (55 mph). The driver of the Chevrolet steered left crossing the centerline and entering the northbound lane. A post-mortem toxicology report for the driver of the Chevrolet indicated she was operating the vehicle while under the influence of methamphetamine. After entering the north-

bound lane, the driver of the Chevrolet steered right to return to the southbound lane. The Ford was traveling northbound across the bridge at a police-reported speed of 80 km/h (50 mph). The driver of the Ford indicated later to police he had observed the Chevrolet traveling toward him in the southbound lane when it suddenly veered into the northbound lane. The driver of the Ford stated he braked hard and veered left before vehicles struck head-on. A witness driving a non-contact vehicle northbound and following directly behind the Ford confirmed the vehicle's travel speed of approximately 80 km/h (50 mph) and the sudden lane departure of the Chevrolet from the southbound lane to the northbound lane.

Crash

The front plane of the Chevrolet struck the front plane of the Ford in a head-on configuration (Event 1). The Ford jackknifed as it was displaced to the west and sustained intra-unit damage (Event 2). The Ford continued west impacting a bridge rail with its front plane (Event 3) where it came to rest facing west. The trailer being pulled by the Ford came to rest behind the Ford, facing north and straddling the centerline. The Chevrolet was displaced rearward and rotated clockwise approximately 180 degrees coming to rest in the northbound lane facing north (**Figure 3**). After the Chevrolet came to rest, the vehicle caught fire and soon thereafter was engulfed in flames (Event 4).

Figure 3. Final rest positions looking south, Chevrolet on left, Ford on right (police image)

Post-Crash

A witness traveling behind the Ford stopped his vehicle and ran to render aid to the occupants of the Chevrolet. The witness stated he first observed the driver of the Chevrolet was unconscious and unresponsive. He then saw the 3-year-old male occupant seated in his CRS in the second row left seat position. The witness observed a fire in the middle aspect of the occupant compartment. The witness unbuckled this occupant's seat belt and removed him from the vehicle and left the CRS in the vehicle. He then observed the fire spreading in the occupant compartment and also spreading in the engine compartment. He returned to his vehicle with the 3-year-old male occupant, left the occupant with another witness, and returned to the Chevrolet. At that time, he described the driver of the Chevrolet as lifeless and the vehicle fully engulfed in flames and too dangerous to continue rescue efforts. The witness tending to the 3-year-old male occupant then handed the child to another witness who then stayed with the child until emergency responders arrived on-scene.

Given the witness statements, the investigation determined the fire spread to the occupant compartment and engulfed the entire vehicle within five minutes after the initial impact. Emergency vehicles arrived seven minutes after the crash. At some point prior to the vehicle being engulfed in flames, someone removed the CRS from the Chevrolet. Police images of the CRS indicated it avoided significant visible thermal damage. Both vehicles were towed due to damage and inspected by police. Neither vehicle revealed evidence of prior damage and they were later released.

SCI obtained a copy of the police Incident Detail Report that documented alarm, dispatch, and arrival times for emergency responders including police, sheriffs, fire, and EMS units. Seventeen fire department personnel responded in seven fire service vehicles from two fire departments. The vehicles included three engines, two brush trucks, one quint unit and one privately owned vehicle. Two emergency medical technicians (EMTs) and four paramedics responded in three vehicles from two companies.

Thirteen police and sheriff officers responded from two agencies.

The Incident Detail Report indicated the elapsed time from call received to first assigned unit was 00:01:41 [hr:min:sec], and time en route to first arrival on-scene was 00:07:26. The report indicated the alarm was sent at 1453 hours in response from multiple phone calls to 911. The first police units were dispatched at 1453 hours and arrived at 1500 hours. Fire and EMS were dispatched with a 10-39 police code (Urgent - Use Light, Siren) at 1453 hours and paramedics were on-scene at 1457 hours. Additional fire and EMS were on-scene at 1500 hours. At 1505 it was reported the Chevrolet was fully engulfed in flames. At 1537 hours, responders were cutting the door from the Chevrolet to extricate the driver, suggesting the fire was extinguished. At 1539 hours the coroner was dispatched, suggesting the driver of the vehicle had been declared deceased.

SCI also obtained the ambulance transport record. The following table provide the times from notification to release back into service.

Events	Times
Call in to Public Safety Answering Point (PSAP)	1455
Unit Notified	1506
Unit en Route	1506
Unit Arrived on Scene	1513
Arrived at Patient	1514
Unit Left Scene	1523
Unit Arrived at Destination	1546
Transfer of EMS Patient	1548
Unit Back in Service	1610

Source: Ambulance Response Record

2004 CHEVROLET SILVERADO

Description

The 2004 Chevrolet Silverado was identified by police using the Vehicle Identification Number (VIN) 1GCHK23U44Fxxxxxx. The vehicle was configured with an electronic odometer and the mileage is unknown. The Chevrolet was a four-door crew cab light truck configured with an 8-cylinder 6.0-liter gasoline engine, four-speed automatic transmission, four-wheel drive, hydraulic brakes, antilock braking system, tilt steering and daytime running lights. The Chevrolet was equipped with Falken Wildpeak tires of an unknown size on the rear and tires of an unknown make and size on the front. No additional tire data was available.

The Chevrolet's interior was equipped with two rows of seating to accommodate five occupants. The front row was configured with two bucket seats with adjustable head restraints. The seat track setting for the front row occupant was unknown. The second row was configured with a bench seat and adjustable head restraints. This row was configured with Lower Anchors and Tethers for Children (LATCH). Lower anchors were present at the center and right seat positions and tether anchors were present at all three seat positions.

Exterior Damage

Exterior images of the Chevrolet taken by police were used to conduct a partial exterior vehicle inspection. The Chevrolet sustained direct contact damage to the front, left, right, and top planes. This damage was caused by direct contact damage during the vehicle-to-vehicle impact, and the subsequent fire and post-crash activities (**Figure 4**). The crush damage from the initial vehicle-to-vehicle event could not be separated to determine crush severity. The estimated Collision Deformation Classification for the Chevrolet in Event 1 was 11FDEW4. Thermal damage included burned paint on all planes, melted tail lamp assemblies, and melted front tires.

Figure 4. Exterior damage, 2004 Chevrolet Silverado (police image)

NHTSA Recalls and Investigations

A search using the vehicle's VIN revealed no active NHTSA recalls or investigations.

Interior Damage

The Chevrolet sustained catastrophic interior damage caused by the post-impact fire. All side glass was disintegrated. Both rows of seats were destroyed. Few components in the occupant compartment were recognizable aside from metal framework and exposed electrical wiring (**Figure 5**).

Figure 5. Interior damage front row, 2004 Chevrolet Silverado (police image)

Manual Restraint Systems
Chevrolet was equipped with seating for five occupants and all seats were configured with three-point lap and shoulder seat belts. The front row belts were equipped with retractor pretensioners, sliding latch plates and adjustable D-rings. The driver's belt was configured with an emergency locking retractor (ELR). Police indicated the driver of the Chevrolet was using the lap and shoulder seat belt at the time of the crash. The second row seat belts were configured ELR/automatic locking retractors (ALR) and sliding latch plates. Police indicated the second row seated in the CRS was using the lap and shoulder seat belt in the center seat position. A subsequent interview with the first responding witness by SCI revealed that the CRS and child were in the second row left position.

The second row was configured with Lower Anchors and Tethers for Children (LATCH). Lower anchors were present at the center and right seat positions and tether anchors were present at all three seat positions. LATCH is not designed to be used with booster seats and was not used in this crash.

Supplemental Restraint Systems
The Chevrolet's supplemental restraint systems (SRS) included frontal air bags with dual stage inflators for the front row. The driver's frontal air bag deployed at impact with the Ford. A portion of the driver's deployed frontal air bag appears in one police image to have remained intact during the fire (**Figure 6**).

Figure 6. Driver's deployed frontal air bag, 2004 Chevrolet Silverado (police image)

Child Restraint System
Harmony Juvenile Cruz Youth Booster Seat (grey/pink)
The Harmony Juvenile Cruz Youth Booster Seat was a belt-positioning booster safety seat. Data for this CRS and its usage was obtained from the police report and images. Specifications were obtained from the owner's manual. The Model Number was 0304007CRL and the date of manufacture was 3/5/2013. The history of this safety seat is not known.

According to the owner's manual, the Cruz Youth Booster Seat (**Figure 7-8**) is a forward-facing only belt positioning booster safety seat intended to be used in combination with the vehicle's lap and shoulder seat belt. It was configured with a molded plastic shell, fabric seat pad and pre- installed shoulder belt guide. It is unknown whether the shoulder belt guide was attached or in use at the time of the crash.

Figure 7. Harmony Juvenile Cruz Youth Booster Seat, top view, 2004 Chevrolet Silverado

The occupant parameters for using the seat with the harness system in a forward-facing orientation

are as follows:

Weight: 30.0 - 100.0 lb (13.6 - 50.0 kg)
Height: 34.0 - 57.0 in (86.4 - 144.8 cm

The occupant met the weight parameter (20 kg/9 lbs). It is unknown if the occupant met the height parameter. Police images show the seat to have sustained minor scuffs and dirt to the fabric seat pad. A bottom view reveals no visible damage to the shell (**Figure 8**).

Figure 8. Harmony Juvenile Cruz Youth Booster Seat, bottom view, 2004 Chevrolet Silverado

2004 CHEVROLET SILVERADO OCCUPANTS

Driver Demographics

Age/Sex:	29 years/female
Height:	157 cm (62 in)
Weight:	64 kg (141 lb)
Eyewear:	Unknown
Seat type:	Bucket seat with adjustable head restraint
Seat track position:	Unknown
Manual restraint usage:	Lap and shoulder seat belt used
Usage source:	Police report
Air bags:	Frontal air bag deployed
Alcohol/Drug data:	Positive for methamphetamine = 1.4 mg/L; amphetamine = 0.14 mg/L
Egress from vehicle:	Removed after being declared deceased
Transport from scene:	To coroner's office
Type of medical treatment:	None

Driver Injuries[1]

Inj. No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
1	Third-degree thermal burns to over 95% of body skin	912032.6	Fire	Certain
2	Hemopericardium with laceration, herniation of heart through pericardium	441606.5	Tandem IPC shoulder portion of belt restraint, left steering wheel hub air bag, and steering wheel rim/hub/spoke	Certain Possible Possible
3	Subdural hemorrhage, cerebrum	140652.4	A-pillar	Possible

[1]Additional injury detail is available in the SCI case viewer

4 5	Hemothorax NFS, bilateral lungs	442200.3 442200.3	Tandem IPC shoulder portion of belt restraint, left steering wheel hub air bag, and steering wheel rim/hub/spoke	Certain Possible Possible
6	Laceration, heart	441010.3	Tandem IPC shoulder portion of belt restraint, left steering wheel hub air bag, and steering wheel rim/hub/spoke	Certain Possible Possible
7	Contusions NFS, bilateral lungs	441410.3	Tandem IPC shoulder portion of belt restraint, left steering wheel hub air bag, and steering wheel rim/hub/spoke	Certain Possible Possible
8	Inhalation injury, bilateral lungs (minor carbonaceous deposits in bronchi)	419202.3	Fire	Certain
9	Subarachnoid hemorrhage NFS, cerebrum	140693.2	A-pillar	Probable
10	Fracture, sternum	450804.2	Tandem IPC shoulder portion of belt restraint, left steering wheel hub air bag, and steering wheel rim/hub/spoke	Certain Possible Possible
11 12	Multiple rib fractures NFS, bilateral	450210.2 450210.2	Tandem IPC shoulder portion of belt restraint, left steering wheel hub air bag, and steering wheel rim/hub/spoke	Certain Possible Possible

13	Laceration NFS, liver	541820.2	Lap portion of belt restraint	Probable
14	Hemorrhage, retroperitone-um	543800.2	Lap portion of belt restraint	Certain Possible Possible

Source: Autopsy report

Driver Kinematics

The belted 29-year-old female driver of the Chevrolet was seated in an unknown posture and was operating the vehicle at a police-estimated speed of 89 km/h (55 mph). She was reportedly operating the vehicle while under the influence of methamphetamine. For unknown reasons the driver steered left, entering the northbound lane and then began steering right according to a witness before striking the other vehicle head-on. At impact, the driver's frontal air bag deployed and most likely her seat belt pretensioner actuated. The driver was displaced forward in response to impact forces loading the seat belt with her chest and abdomen. Her head, neck, chest, and abdomen continued to be displaced forward contacting the deployed frontal air bag and steering wheel assembly. Following the crash, the Chevrolet was displaced to the left and initiated a clockwise rotation. The driver was held in place in her seated position by the lap and shoulder seat belt until the vehicle came to rest near the area of impact. At final rest, the driver was unconscious and unresponsive. A witness observed a fire in the middle aspect of the occupant compartment initially. Shortly afterward, he observed the fire spreading in the engine compartment and occupant compartment. Within a few minutes the vehicle was engulfed in flames and rescue efforts became too dangerous for on-scene passersby to continue. While remaining in the vehicle, the driver's body sustained thermal burns in all regions to varying degrees. She was pronounced deceased and removed after the fire was extinguished. Her body was taken to the county coroner's office and an autopsy was performed.

Second Row Left Occupant Demographics

Age/Sex:	3 years/male
Height:	Unknown
Weight:	20 kg (44 lb)
Eyewear:	Unknown
Seat type:	Bench with folding back
Seat track position:	NA
Manual restraint usage:	Forward-facing booster safety seat (BSS) in Combination with lap and shoulder seat belt
Usage source:	Police report and images
Air bags:	None available
Egress from vehicle:	Removed due to age by passerby
Transport from scene:	Ambulance to hospital
Type of medical treatment:	Treated and released

Second Row Left Occupant Injuries

Inj. No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Contusion, left lung	441402.3	Shoulder portion of belt restraint	Probable
2	Comminuted fracture, mid-shaft, left clavicle	750671.2	Shoulder portion of belt restraint	Certain
3	Cervical spine soft tissue injury	640278.1	Shoulder portion of belt restraint	Probable
4	Contusion, right forehead	210402.1	Front row seat back	Probable
5 6	Abrasions, face (nose, chin and frontal regions)	210202.1 210202.1	Front row seat back	Possible
7 8	Abrasion and contusion, left chest	410202.1 410402.1	Shoulder portion of belt restraint	Probable
9 10	Abrasion and contusion, left shoulder (clavicle)	710202.1 710402.1	Shoulder portion of belt restraint	Certain
11 12 13 14	Abrasions and contusions, bilateral arms	710202.1 710202.1 710402.1 710402.1	Unknown	Unknown
15 16 17 18	Abrasions and contusions, bilateral knees and lower legs	810202.1 810202.1 810402.1 810402.1	Front row seat back	Probable
19	Left side head contusion	110402.1	Door	Possible
20	Abrasion, left hip	810202.1	Lap portion of belt restraint	Probable

Source: Medical records

Second Row Left Occupant Kinematics

The 3-year-old male occupant was belted in a forward-facing orientation in a booster safety seat in the second row left seat position. At impact, he was displaced forward and his chest and abdomen loaded the seat belt. He sustained a fracture to the clavicle and a contusion to the left lung. It is likely the occupant's head and neck continued to be displaced forward. It was reported his face sustained abrasions/contusions, probably from contact to the driver's seat back. His lower legs also likely contacted the driver's seat back. The occupant remained belted in his seated position until the vehicle came to rest. Following the crash, this occupant was unbelted and removed from the vehicle through a side door by a passerby on-scene. He was cared for by witnesses until emergency responders arrived a few minutes later. The occupant was transported by ambulance to a local hospital where he arrived thirty-four minutes after the crash with a Glasgow Coma Score (GCS) of 15. The occupant was treated for approximately 4 hours then transferred by helicopter to a pediatric hospital for a higher level of treatment.

2014 FORD F-250 SUPER DUTY
2012 C&B DESK-OVER EDITION TWO-AXLE FLAT BED TRAILER

Description

The Ford F-250 Super Duty pickup was identified in the police report and images but the VIN was unknown. The vehicle was a four-door crew cab medium truck configured with four-wheel drive and seating for five occupants. It was towing a 2012 C&B Desk-Over Edition two-axle flat bed trailer. The trailer was loaded with metal boxes. The axle weight of the trailer was unknown.

Figure 9. Front end damage, 2014 Ford F-250 (police image)

Exterior Damage

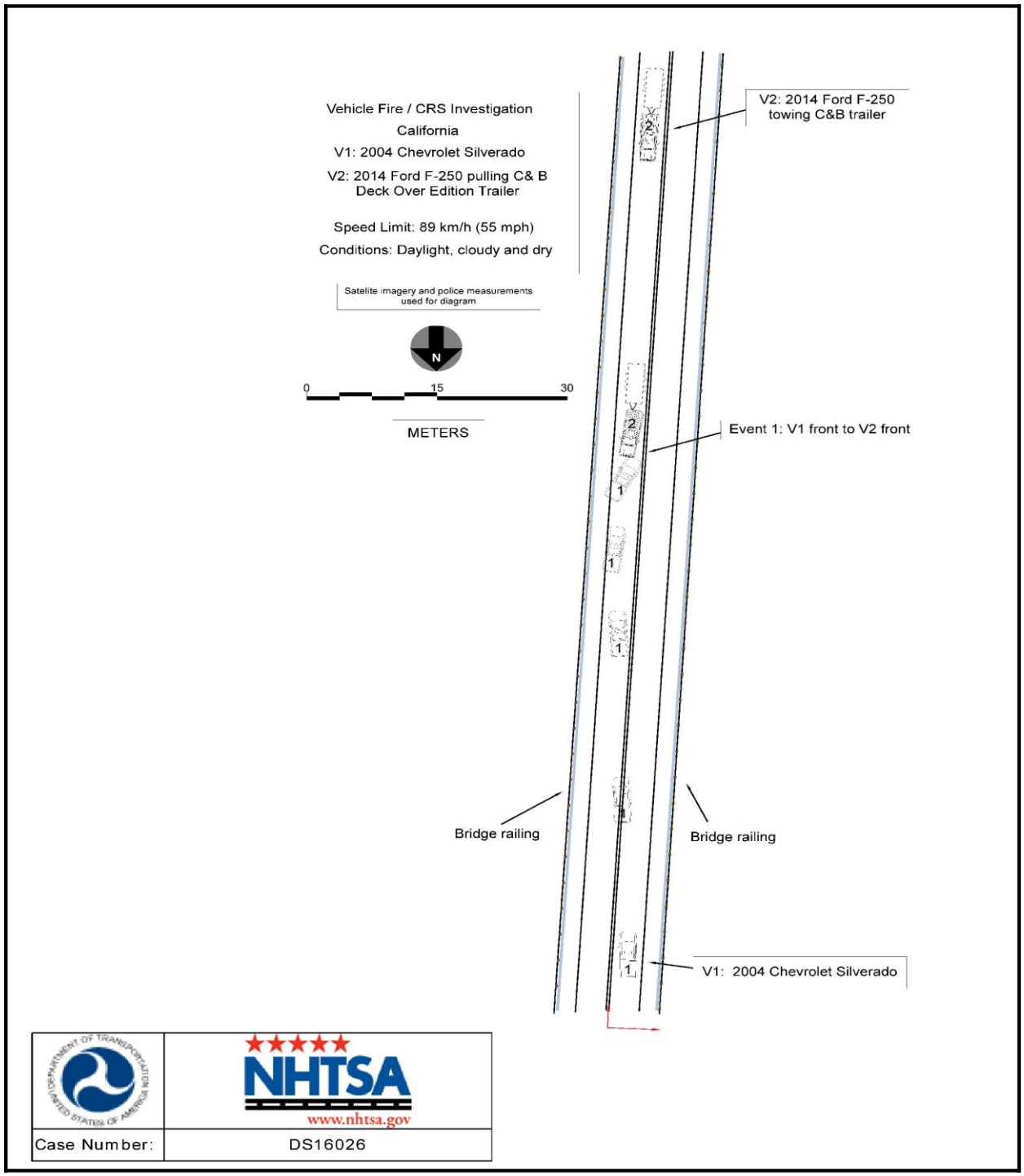
The Ford sustained direct contact damage to the front plane caused by the impact with the Chevrolet. The estimated CDC for the Ford in Event 1 was 12FDEW4 (**Figure 9**). It also sustained direct contact damage to the left plane caused by intra-unit contact with the trailer during the crash (**Figure 10**). There was a secondary impact with the metal bridge railing following the initial impact.

Figure 10. Intra-unit damage, 2014 Ford F250

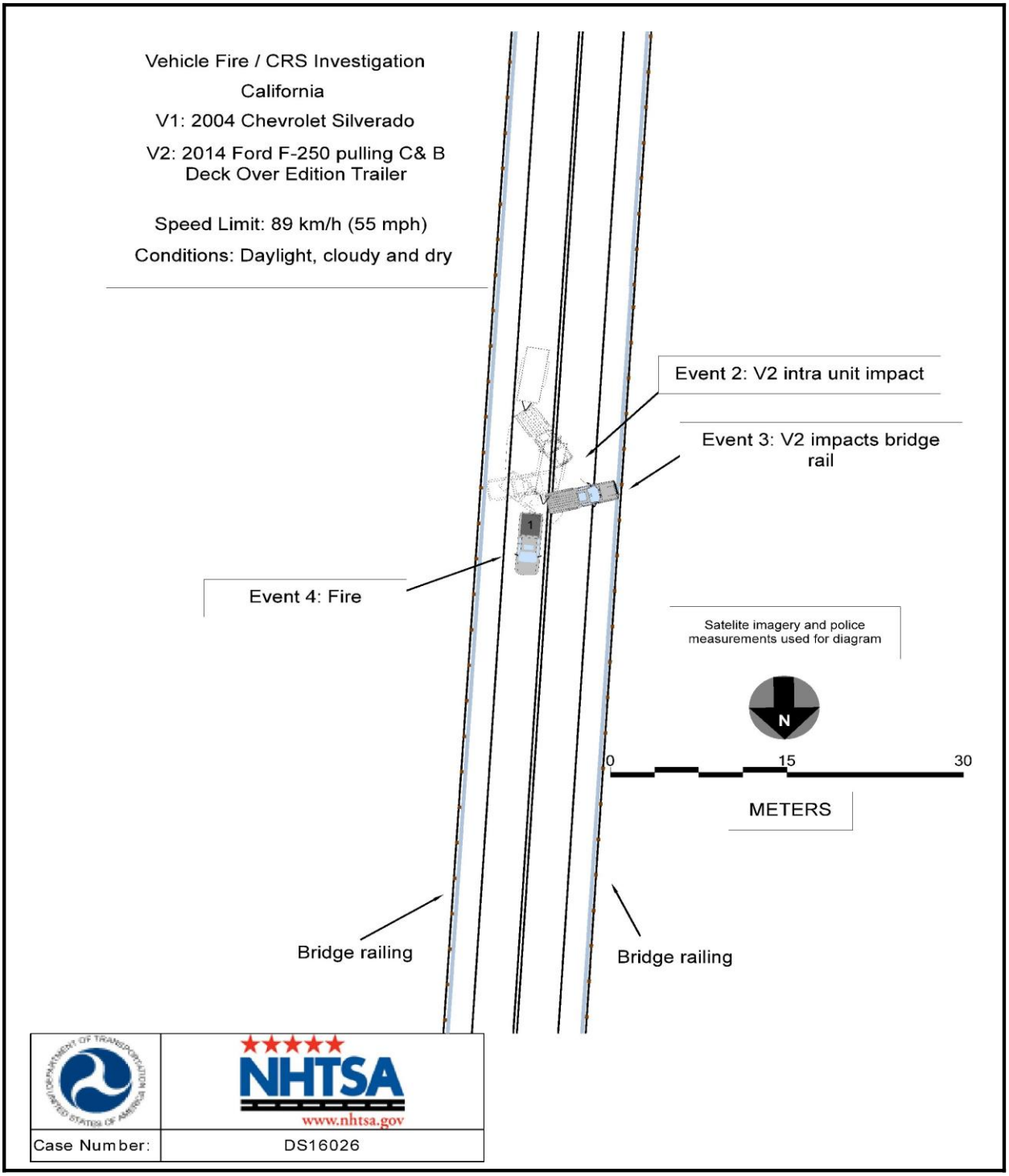
Occupant Data

The 23-year-old male was employed by the owner of the Ford. He sustained police-reported incapacitating injuries including a fracture to the right femur. He was transported by ambulance to a local hospital where his level of treatment is not known.

CRASH DIAGRAM



CRASH DIAGRAM



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