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**Special Crash Investigations:  
On-Site Passenger's Frontal Air  
Bag Inflator Rupture Crash and  
Fire Investigation;  
Vehicle: 2006 Nissan Sentra;  
Location: Florida;  
Crash Date: March 2018**

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<b>16. Abstract</b>  This report documents the on-site investigation of the multiple-event crash of a 2006 Nissan Sentra, the rupture of the passenger's frontal air bag inflator, and the post-crash fire that consumed the interior of the vehicle. An unbelted 17-year-old female driver of the 2006 Nissan Sentra was attempting to negotiate a right curve when the Nissan departed the left travel lane and struck the median curb with its left tires. After this impact, the Nissan reentered the westbound lanes where the driver then over-corrected back to the left, causing the Nissan to rotate (yaw) counterclockwise. The Nissan rotated to a right-side-leading orientation, struck the median a second time with its right tires, and then struck a tree with its right plane. At impact with the tree, both frontal air bags deployed. During its deployment sequence, the passenger's frontal air bag inflator ruptured. The Nissan rapidly rotated around the tree, separated from the tree, and came to rest straddling the south curb edge facing northwest. A post-impact fire ensued that consumed the interior of the vehicle. The driver sustained fatal injuries and was pronounced deceased at the scene. Through the course of the investigation, it was determined that the fire originated in the occupant compartment of the Nissan; however, it was not possible to define its root cause and/or source.			
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**Special Crash Investigations**  
**On-Site Passenger's Frontal Air Bag Inflator Rupture**  
**Crash and Fire Investigation**  
**Office of Defects Investigations**  
**Case Number: CR18025**  
**Vehicle: 2006 Nissan Sentra**  
**Location: Florida**  
**Crash Date: March 2018**

**BACKGROUND**

This report documents the on-site investigation of the multiple-event crash of a 2006 Nissan Sentra (**Figure 1**), the rupture of its passenger frontal air bag inflator, and the post-crash fire that consumed the interior of the vehicle. The unbelted 17-year-old female driver sustained fatal injuries and was pronounced deceased at the crash site. The National Highway Traffic Safety Administration was notified of the crash in August 2018 by Nissan North America. The notification was identified for further research and was subsequently forwarded to NHTSA's Crash Investigation Division, and an on-site investigation was assigned to the Special Crash Investigations (SCI) team at Crash Research & Analysis, Inc., in the same month. An inspection of the Nissan occurred in August 2018 and was attended by technical representatives of Nissan and NHTSA, and by legal entities for the driver.



**Figure 1.** Right side view of the Nissan Sentra.

The Nissan's safety equipment included frontal air bags and front safety belt pretensioners. A query of the NHTSA web site [www.safercar.gov](http://www.safercar.gov) using the Nissan's Vehicle Identification Number (VIN) indicated that there was one open recall pertaining to this specific vehicle. This recall (NHTSA campaign number 15V-287) referenced the need to replace the front passenger air bag inflator due to the risk of the potential rupture of the inflator during a crash that required air bag deployment.

Immediately prior to the crash, the Nissan was traveling west on a multi-lane roadway. Along the Nissan's intended path of travel, the roadway curved to the right and transitioned into a divided two-lane roadway with a median. As the roadway curved to the right, the Nissan departed the left travel lane and struck the median curb with its left tires. After this impact, the Nissan reentered the westbound lanes where the driver then over-corrected back to the left, causing the Nissan to rotate (yaw) counterclockwise. The Nissan rotated to a right-side-leading orientation, struck the median a second time with its right tires, and then struck a tree with its right plane. The vehicle's frontal air bags deployed at impact with the tree. During its deployment sequence, the passenger's frontal air bag inflator ruptured. The Nissan rapidly rotated around the tree, separated from the tree, and came to rest straddling the south curb edge facing northwest. A post-

impact fire ensued that consumed the interior of the vehicle. The driver sustained fatal injuries and was pronounced deceased at the scene.

The on-site activities of the investigation included exterior and interior inspections of the Nissan to measure the deformation and intrusion, document evidence of interior occupant contact, examine the manual restraint systems for use, assess the air bag systems for rupture, and attempt to determine the origin and cause of the vehicle fire. Due to the date of the Nissan's manufacture, the vehicle was not equipped with an air bag control module that had Event Data Recorder (EDR) capabilities compatible with the Bosch Crash Data Retrieval tool. Although consumed by the fire, the air bag control module was removed and retained by the legal entities representing the driver for possible examination at a later date. The SCI team also photographed and mapped the crash scene by Total Station for causative factors.

Through the course of the investigation, it was determined that the fire originated in the occupant compartment of the Nissan; however, it was not possible to define its root cause and/or source.

## SUMMARY

### *Crash Site*

The crash occurred during the dark morning hours of March 2018 on an east/west multi-lane roadway located in a suburban setting. The environmental conditions reported by the National Weather Service at the time of the crash included clear skies with a temperature of 16 °C (61 °F), a north-northwest wind of 11 km/h (7 mph), and relative humidity of 72 percent.

The multi-lane roadway consisted of two westbound lanes and three eastbound lanes in the pre-crash segment of the Nissan's travel and was posted with a 56 km/h (35 mph) speed limit. Proceeding west, this thoroughfare curved to the right and transitioned into a divided two-lane roadway with the origination of a grass median. The speed limit on the divided portion of the roadway transitioned to 72 km/h (45 mph). Each westbound lane measured 3.6 m (11.8 ft) wide. A solid white line separated these lanes. The right side of the right lane was delineated by a solid white line and was bordered by a concrete sidewalk. A solid yellow line adjacent to the median delineated the left edge of the left lane. The westbound radius of the right curve measured 667 m (2,188.3 ft). The grass median was bordered by a 15 cm (5.9 in) concrete curb and populated by deciduous trees. At its origination, the end of the median measured 1.9 m (6.2 ft) wide. The median's width expanded to 4.6 m (15.1 ft) in the area of the tree impact. The tree struck by the Nissan was fractured and partially uprooted during the crash. The fractured tree had been removed at the time of the SCI inspection. New growth identified the tree's original location, which measured 71.7 m (235.2 ft) from the end of the median. A series of scratches and gouge marks in the left eastbound lane of the roadway, adjacent to the median, identified the



**Figure 2.** West-facing trajectory view of the Nissan.

final rest location of the Nissan. **Figure 2** is a west trajectory view depicting the configuration of the roadway. **Figure 3** is an eastward lookback view depicting the point of impact (tree) and the Nissan's final rest location. A crash diagram is included at the end of this report.

### ***Pre-Crash***

The Nissan was traveling west in the left westbound lane of the roadway, driven by the unbelted 17-year-old female. She was the sole occupant of the vehicle. Her pre-crash activities remain unknown. The medical examiner reported that the driver's mother stated that the driver was a social drinker. The blood alcohol concentration (BAC) of the driver was determined to be .09 grams per deciliter (g/dL) as reported by the police. As the roadway curved to the right, the Nissan continued along a straight path (**Figure 4**). The left tires approached the median curb.

### ***Crash***

The left front and left rear tires of the Nissan struck and overrode the median curb (Events 1 and 2) as the vehicle continued west. Both left rims were deformed by these separate impacts. Based on the Total Station mapping, these impacts occurred approximately 16 m (53 ft) from the origination of the median. Any residual evidence of these impacts was masked by the multiple tire marks that were observed on the face of the curb throughout this area during the SCI scene inspection. The driver reacted to the curb strikes by steering right and redirecting the Nissan to the right toward the travel lane.

Based on the PAR, the vehicle reentered the westbound lanes, where the driver overcorrected (steered) back to the left. The abrupt steering maneuvers caused the Nissan to lose traction and initiate a counterclockwise rotation (yaw). Any evidence of this yawing trajectory had eroded due to the lapse in time between the dates of the crash and the SCI scene inspection.

As it approached the median a second time, the Nissan had rotated (yawed) roughly 50 degrees counterclockwise relative to the roadway heading into a right side-leading attitude. The inner surface of the right front wheel rim struck the median curb, followed by the inner surface of the right rear wheel (Event 3 and 4). The deformation to the inner surfaces of both wheel rims, which was observed during the SCI vehicle inspection, were attributed to these events. Black transfer marks from the Nissan's tires were observed on the face of the curb in an area consistent with the Nissan's errant trajectory leading to the tree impact. The right front and right rear tire



**Figure 3.** East-facing lookback view of the locations of the tree impact and final rest of the Nissan.



**Figure 4.** East-facing lookback view along the median depicting the roadway curvature.

marks (**Figure 5**) were located 67.0 m (219.8 ft) and 69.2 m (227.0 ft) from the end of the median, respectively.

The Nissan overrode the curb, entered the median, and struck and fractured the deciduous tree with its right plane (Event 5). The estimated diameter of the tree was 30 cm (11.8 in). The impact was located immediately forward of the right A-pillar and extended onto the forward aspect of the right front door. The sill crushed and deformed laterally, forming a small pocketing. The Nissan rapidly rotated approximately 180 degrees counterclockwise about the tree, separated and came to rest facing northwestward. At final rest, the Nissan was located 74.0 m (242.8 ft) west of the end of the median.



**Figure 5.** West-facing view depicting the locations of the curb strikes of the Nissan's right front and right rear tires.

Although unconfirmed, it is likely that the frontal air bags deployed as a result of the tree impact. The observations and evidence gathered at the SCI vehicle inspection, in conjunction with reconstruction of the crash, support this determination. The driver's frontal air bag appeared to have deployed as designed. During the deployment sequence of the passenger's frontal air bag, its inflator ruptured in the instrument panel. At an undetermined point in time, a post-crash fire ensued that consumed the vehicle's interior.

### ***Post-Crash***

Passers-by, police, and fire department personnel responded to the scene. It was reported that the vehicle became engulfed in flames and that passers-by were unable to assist the driver. Firefighters suppressed and extinguished the fire and then discovered the driver's body in the vehicle. She was pronounced deceased, and her remains were removed from the vehicle and transported to the medical examiner's office for autopsy. The vehicle was removed from the scene by a local tow service and transferred to a storage facility by the driver's legal representatives, where it was located for this inspection.

### **2006 NISSAN SENTRA**

#### ***Description***

The 2006 Nissan Sentra 4-door sedan (**Figure 6**), identified by the VIN 3N1CB51D96Lxxxxxx, had an unknown date of manufacture. The Nissan was equipped with the special edition trim package. The powertrain consisted of a 1.8-liter, transverse-mounted, 4-cylinder, gasoline engine that was linked to a 4-speed automatic transmission with front-wheel drive. Standard



**Figure 6.** Right front oblique view of the Nissan.

equipment included 4-wheel power-assisted disc brakes with electronic brake force distribution and power steering. The gross vehicle weight rating for this vehicle was 1,610 kg (3,550 lb) with gross axle weight ratings of 872 kg (1,923 lb) front and 764 kg (1,685 lb) rear. At the time of the crash, the Nissan was equipped with four matching Evergreen Dyna Comfort P195/55R16 tires. The tire identification number on each tire was 1KEBU ELHA 5016. All tires had adequate tread measuring 6 mm (7/32 in) or greater, and all were flat.

The interior of the Nissan was configured for the seating of up to five occupants with front row bucket seats and a three-passenger, split-bench rear seat. The driver's seat appeared to be adjusted in a mid-track position. The front row right seat was adjusted mid-track and deformed by intrusion and floor pan deformation. The interior was completely consumed by the fire. Manual restraint was provided by 3-point lap and shoulder seat belts for the five seat positions. The front seat belts were equipped with retractor pretensioners. Supplemental restraint consisted of single-stage frontal air bags for the driver and front row right positions. The Nissan was not equipped with the optional front-seat-mounted side impact air bags.

### ***Exterior Damage***

The exterior damage to the Nissan (**Figures 7 and 8**) consisted of damage to each wheel rim due to its individual impact to the median curb, right plane deformation due to the tree impact, and post-crash fire damage. Impacts to the median curb damaged the outer surfaces of the left front and left rear wheel rims (Events 1 and 2) and the inner surfaces of the right front and right rear rims (Events 3 and 4). The collision deformation classification (CDC) assigned to these wheel impacts were 12FLWN3, 12FLWN9, 12FRWN3 and 12FRWN9, respectively. The sidewall of the left front tire was cut with 50 percent of the tire burned. The left rear, right front, and right rear tires exhibited indicators of heat stress on approximately 10- to 20 percent of their tread surfaces. While the fire consumed the vehicle at its final rest location, these tire surfaces would have been at the top of their respective rotations. The minor involvement of the tires was one indicator of the extent of the fire's overall involvement and consumption.



**Figure 7.** Left view of the Nissan.



**Figure 8.** Right view of the Nissan.

The impact damage to the right plane was located along the sill (forward of the B-pillar), at the forward aspect of the right front door and on the right front fender (**Figures 9 and 10**). The direct

contact damage began on the fender 219 cm (86.2 in) forward of the right rear axle and extended rearward 78 cm (30.7 in). The combined length of the direct and induced damage (field L) measured 117 cm (46.1 in) and began 231 cm (90.9 in) forward of the rear axle reference. The maximum crush at the sill measured 27 cm (10.6 in) and was located 161 cm (63.4 in) forward of the rear axle. The vehicle's deformation was measured along the sill and the right fender, as the firefighters removed the right front door during the removal of the driver's body.

The residual crush profile was as follows: C1 = 0, C2 = 7 cm (2.8 in), C3 = 25 cm (9.8 in), C4 = 24 cm (9.4 in), C5 = 14 cm (5.5 in), and C6 = 2 cm (0.8 in). There was no noted direct contact to the right roof side rail. The right A-pillar appeared to be relatively undamaged, although it was cut and removed by the firefighters. The lack of contact to the A-pillar supported the probable fracture (yielding) of the tree at impact. The CDC assigned to this damage pattern was 02RYEW2. For comparison purposes, the severity (delta V) of this impact was calculated via a borderline analysis with the WinSMASH program. The total calculated delta V was 21 km/h (13 mph). The longitudinal and lateral components of the delta V were -14 km/h (-8 mph) and -16 km/h (-10 mph), respectively. The barrier equivalent speed (BES) was 21 km/h (13 mph). The results were low based on SCI field experience. The yielding properties of the impact (fracture), incompatibility in stiffness coefficients and borderline use of the program in pole-type impact analyses contributed to the low results.

### ***NHTSA Recalls and Investigations***

A query of the NHTSA web site, [www.nhtsa.gov/](http://www.nhtsa.gov/) recalls, using the Nissan's VIN at the time of this SCI investigation indicated that there was one open recall pertaining to this specific vehicle. The recall was released in May 2015. This recall

(NHTSA campaign number 15V-287) referenced the need to replace the passenger's frontal air bag inflator due to the risk of the potential rupture of the inflator during a crash that required air bag deployment.

### ***Interior Damage***

The post-crash fire consumed the interior of the Nissan (**Figures 11 and 12**) and destroyed any evidence of driver contact in the vehicle. The force of the impact caused 25 cm (9.8 in) of lateral intrusion at the right sill. The floor pan deformation resulted in 8 cm (3.1 in) rearward displacement of the right front seat pan, with 22 cm (8.7 in) upward displacement at its forward



**Figure 9.** Right view depicting the direct and induced impact damage of the Nissan.



**Figure 10.** Right view of the reconstructed position of the Nissan's front door.

right corner. The right kick panel (lower A-pillar) intruded laterally 10 cm (3.9 in). Firefighters removed a 50 cm (19.7 in) wide section of the right aspect of the instrument panel. This section was in the second row of the Nissan at the time of the SCI inspection. Refer to the *Supplemental Restraint Section* of this report for further detail regarding the cut section of the instrument panel. The fire completely consumed the upholstery of the driver seat. In comparison, there were some remnants of the upholstery at the forward half and inboard third of the right front seat. Through crash reconstruction, it was determined that the unbelted driver was displaced by the force of the impact across the front row and came to rest on the front passenger seat. The driver's body shielded the complete consumption of the materials at the inboard aspect of the right seat and center console.



**Figure 11.** Interior image looking forward depicting the front row of the Nissan.



**Figure 12.** Interior image looking rearward into the occupant compartment of the Nissan.

### ***Manual Restraint Systems***

The Nissan was equipped with continuous loop 3-point lap and shoulder seat belts for the five designated seat positions. The driver's seat belt retracted onto an emergency locking retractor (ELR) while the other four systems utilized switchable ELR/automatic locking retractors. Both front row positions were equipped with retractor pretensioners and adjustable D-rings. The fire consumed the seat belt webbing and the polymer components of the systems. The latch plates were found in the following locations.

- Driver: in the second row left floor pan adhered to a text book that was partially consumed by the fire.
- Front passenger: in the second row right floor pan immediately behind the front seat, lying in fire debris.
- Second row left: lying in fire debris at the base of the left C-pillar.
- Second row center: adhered in fire debris in the right center aspect of the second row seat pan.
- Second row right: lying on the second row right seat pan in fire debris.

The observed locations of the latch plates were consistent with each seat belt being stowed in its retractor as the fire consumed the vehicle's interior. Based on the location of the latch plate at the time of the inspection, the driver was unbelted at the time of the crash.

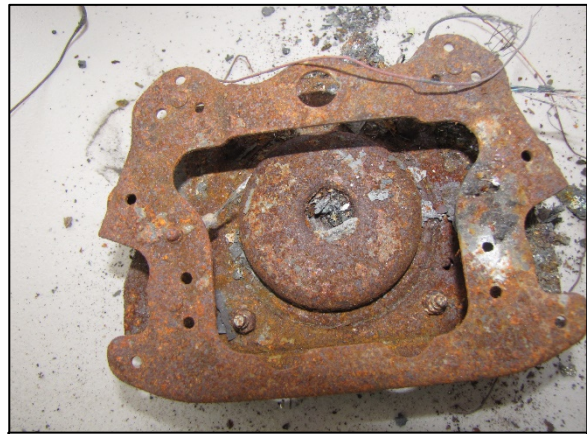
### ***Supplemental Restraint Systems***

The Nissan was equipped with single stage frontal air bags for the driver and passenger. The system was not equipped with a weight sensor or occupant presence detection system to suppress the passenger air bag in the event that the front right position was unoccupied. It was probable that the air bags were commanded to deploy as a result of the tree impact. Therefore, both frontal air bags would be expected to deploy if a command was given. Although the force of the impact was directed at the right plane, the time rate of change of the direction of force's longitudinal component was sufficient to warrant frontal air bag deployment. Air bag deployment in an angular side impact crash was supported by a review of NHTSA's crash test database. It was observed that the frontal air bags deployed in the side New Car Assessment Program (NCAP) testing of the 2002 Nissan Sentra (NHTSA Number M25203, test # 4199). In this test, the moving deformable barrier struck the side plane of the test vehicle at 62 km/h (38 mph). The direction of force was in the Nissan's 2 o'clock sector (60 degrees). The Nissan Sentra utilized the same body construction and equipment from model years 2000 to 2006.

The driver's frontal air bag module (**Figures 13 and 14**) was found beneath the steering column in the driver's floor pan. The components securing the module to the steering column had been consumed in the fire. It was observed that the module was a single stage design. The venting holes in the inflator appeared to be open, which indicated that the module had likely deployed. The fabric of the deployed air bag was completely consumed by the fire. It is likely that if the air bag deployed as a consequence of the fire, the air bag fabric would have started to burn while still packaged in the module, and the residual evidence of the air bag fabric may have partially survived.



**Figure 13.** Front side of the Nissan driver's frontal air bag module.



**Figure 14.** Backside of the Nissan driver's frontal air bag module.

The passenger's frontal air bag module remained attached to the cut section of the instrument panel that was removed from the second row of the Nissan during the SCI inspection (**Figure**

15). Based on its condition, it was observed that the passenger's frontal air bag module (**Figure 16**) had ruptured during its deployment sequence. Similar to the driver's frontal air bag, the passenger's frontal air bag fabric was also completely consumed. Numerous components of the inflator module were recovered from the interior of the vehicle through the course of its inspection. The inflator was found among fire debris in the front right floor pan. The inflator end cap was found behind the front right seat. The auto-ignition cap was located in the forward aspect of the driver's floor pan with wire mesh that may have been part of the module's filter media. A smaller portion of wire mesh was also located in the driver seat.



**Figure 15.** View of the instrument panel section that was cut and removed from the Nissan during the SCI inspection.



**Figure 16.** View of the Nissan's ruptured passenger's frontal air bag module which remained attached to the instrument panel.

The dispersed locations of the module components and the condition of the module assembly were supportive evidence that the inflator ruptured. However, the dispersed locations do not necessarily mean that these components were projected to these areas. Any loose fragments were most likely dispersed due to the high-pressure water spray during the suppression of the fire.

### ***Fire Patterns and Observations***

The following are observations of the fire damage to the Nissan:

- From an exterior perspective, the greatest area of visible fire damage was to the occupant compartment of the Nissan. The engine compartment and trunk space appeared largely undamaged, with the front and rear bumper areas unaffected by the fire.
- The undercarriage remained largely intact and was free of fire damage. There was no involvement of the fuel tank and/or fuel lines. There also was no involvement of the exhaust system or any of its components.
- Three tires only sustained minor heat stress across 10- to 20 percent of their surface areas, resultant from extension of the fire and its radiant heat into the wheel wells through seams in the vehicle structure.
- The asphalt roadway at the vehicle's final rest location sustained minimal fire damage.
- Combustible materials and fuel packages in the occupant compartment were nearly entirely consumed by the fire. However, those in the engine compartment and trunk space remained largely intact, with minor damage and/or consumption.

- Consumption of the interior's second row was complete and symmetrical, both left to right and top to bottom.

Based on the observations of the fire damage by the SCI team, the damage to the Nissan was consistent only with a fire that originated in the occupant compartment of the vehicle. The consumption of interior fuel packages and proliferation of the fire toward the trunk and engine compartment as observed could only result from a fire that originated in the vehicle's interior. There were numerous possible sources of ignition present that could have instigated the fire that ultimately ensued. Several of these possible sources were examined and eliminated.

- The vehicle's powertrain and its components remained largely intact, were not located in the area of the fire's origin, and were involved only as a result of fire progression.
- The vehicle's fuel system and its components were undamaged, and were not located in the area of the fire's origin or involved in the fire.
- The vehicle's exhaust system and its components were not damaged, and were not located in the area of the fire's origin or involved in the fire.
- The vehicle's fluid reservoirs and their components were intact and undamaged, were not located in the area of the fire's origin, and were not involved in the fire.

Several other possible sources of the fire were identified in the area of the fire's origin, and could not be eliminated. These included:

- Numerous low-voltage electrical systems and components in the Nissan's interior. These included the vehicle's controls, entertainment systems, lighting, and miscellaneous wiring.
- Supplemental restraint devices. There were multiple pyrotechnic devices in the Nissan as part of its supplemental restraint systems.
- Foreign object(s). Unlimited potential exists for a foreign object to have been brought into the Nissan at some point prior to the crash. Examples include lighters, electronic cigarettes/vaporizers, cellular telephone or other personal electronic devices, electric charging systems, lithium-ion batteries, flammable liquids, pyrotechnic devices, or any other of an infinite number of potential foreign object fire sources. Absent any interview information from the driver, involvement of potential foreign objects remains unknown.

## **2006 NISSAN SENTRA OCCUPANT DATA**

### ***Driver Demographics***

Age/sex:	17 years/female
Height:	155 cm (61 in)
Weight:	Autopsy weight of remains 28 kg (62 lb)
Eyewear:	None
Seat type:	Forward-facing bucket seat with adjustable head restraint
Seat track position:	Mid-track
Manual restraint usage:	None
Usage source:	SCI vehicle inspection
Air bags:	Driver's frontal air bag available; deployed
Alcohol/drug data:	BAC .09 g/dL, no drug involvement (source: PAR)

Egress from vehicle: Fatal prior to removal  
 Transport from scene: None  
 Type of medical treatment: None, fatally injured

**Driver Injuries**

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
1	Global, charred thermal injuries exposing bone to head, neck, chest, back, pelvis, and arms with heat fractures of the bones of the 8-12th left ribs, bilateral arms, and fingers; Global charred thermal injuries of abdomen exposing muscle; Global, charred thermal injures to buttocks exposing adipose tissue; Nearly global charred thermal injuries exposing bone of bilateral lower extremities; Right and left foot have superficial thermal injuries	912032.6	Isolated IPC Noncontact Injury – Fire in vehicle	Certain
2	Few, up to 1.0 cm punctate and linear areas of hemorrhage in white matter of right parietal lobe	140632.4	Isolated IPC Right Side - Right A (A1/A2)-pillar	Probable
			Alternate: Right Door Unknown upper quadrant	Possible
3	0.2 x 0.1 cm hemorrhage on gray matter of medial	140631.2	Isolated IPC Right Side - Right A (A1/A2)-pillar	Probable

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
3 (cont.)	portion of left temporal lobe adjacent to hippocampus		Alternate: Right Door Unknown upper quadrant	Possible
4	Bite marks to anterior portion of tongue	243401.1	Isolated IPC Other Noncontact Injury – Self-inflicted	Certain

Source: medical examiner's autopsy report. Additional injury detail is available in the Public Crash Viewer.

### ***Driver Kinematics***

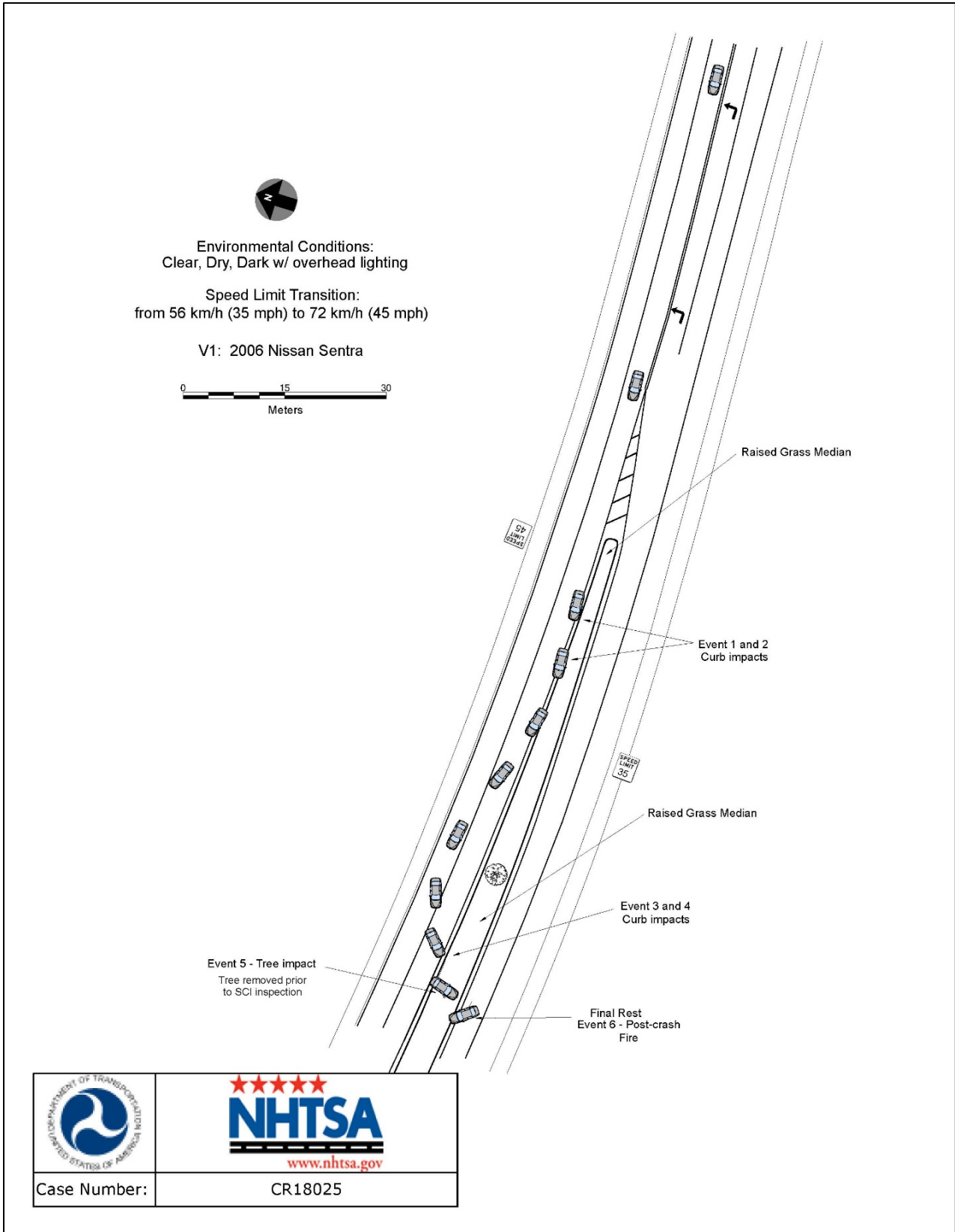
The 17-year-old female driver of the Nissan was seated in the left front position with the seat adjusted to a mid-track position. She was not restrained by the manual seat belt system. The lack of seat belt use was determined by the final rest position of the driver's body and the location of the driver's latch plate, which was found lying on the second row left floor where it fell from its stowed location as the webbing was consumed by the post-crash fire.

The curb impacts did not significantly displace the driver from her position as she attempted to regain control of the Nissan by counter-steering to the right and left. The Event 5 impact with the tree resulted in a force direction of 2 o'clock and a longitudinal velocity change sufficient to deploy the frontal air bag system. This system consisted of single stage air bag inflators without automatic suppression of the passenger's frontal air bag. Based on the observations during the vehicle inspection and a reconstruction of the sequence of events, it is most probable the frontal air bags deployed at impact with the tree. During the deployment sequence, the passenger's frontal air bag inflator ruptured. At an undetermined point in the post-crash timeline, a fire developed in the occupant compartment.

The unbelted driver initiated a right lateral and forward trajectory in response to the impact's 2 o'clock direction of force. Her torso translated over the center console leading with her head. Her head probably struck the right upper A-pillar, or possibly the right front door, as the Nissan rotated counterclockwise about the tree impact. This head contact produced autopsy-identified focal cerebral hemorrhages. Due to the severity of the fire, there was no remaining evidence of occupant contact.

The driver came to rest lying across the interior of the Nissan with her pelvic region on the center console and her torso on the front row right seat cushion. As the fire progressed, it completely consumed the interior of the Nissan and subsequently began to proliferate to the engine compartment and back plane of the vehicle. Once extinguished, the driver's heavily charred body was observed in the vehicle. Firefighters used hydraulic equipment to cut the right front door and the sub-structure of the right instrument panel structure from the Nissan in order to remove the driver's remains for transferal to the Medical Examiner's office for autopsy.

# CRASH DIAGRAM



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U.S. Department  
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**National Highway  
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