INDIANA UNIVERSITY

TRANSPORTATION RESEARCH CENTER
School of Public and Environmental Affairs
501 South Madison Street Suite 105
Bloomington, Indiana 47403-2452

ON-SITE OFFICE OF DEFECTS INVESTIGATION POTENTIAL UNINTENDED ACCELERATION INVESTIGATION

CASE NUMBER - IN10024
LOCATION - TEXAS
VEHICLE - 2008 TOYOTA TACOMA PRERUNNER
CRASH DATE - January 2010

Submitted:

September 29, 2010

Contract Number: DTNH22-07-C-00044

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
National Center for Statistics and Analysis
Washington, D.C. 20590-0003

DISCLAIMERS

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no responsibility for the contents or use thereof.

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the National Highway Traffic Safety Administration.

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.* IN10024	2. *Government Accession No.*	3. *Recipient's Catalog No.*	
4. *Title and Subtitle* On-Site Office of Defects Investigation Potential Unintended Acceleration Investigation Vehicle - 2008 Toyota Tacoma PreRunner Location - Texas		5. *Report Date:* September 29, 2010 6. *Performing Organization Code*	
7. *Author(s)* Special Crash Investigations Team #2		8. *Performing Organization Report No.*	
9. *Performing Organization Name and Address* Transportation Research Center Indiana University 501 South Madison Street, Suite 105 Bloomington, Indiana 47403-2452		10. *Work Unit No. (TRAIS)* 11. *Contract or Grant No.* DTNH22-07-C-00044	
12. *Sponsoring Agency Name and Address* U.S. Department of Transportation (NVS-411) National Highway Traffic Safety Administration National Center for Statistics and Analysis Washington, D.C. 20590-0003		13. *Type of Report and Period Covered* Technical Report Crash Date: January 2010 14. *Sponsoring Agency Code*	
15. *Supplementary Notes* On-site potential unintended acceleration investigation involving a 2008 Toyota Tacoma PreRunner.			

16. *Abstract*

This on-site investigation focused on a 2008 Toyota Tacoma PreRunner, which was alleged to have experienced an Unintended Acceleration (UA) that led to an alleged loss of control by the driver. The recall service, which required Toyota to modify or replace the accelerator pedal and replace the driver's all-weather floor mat with a newly designed floor mat had not been performed. Based on information provided by the attorney for the deceased driver, the driver did not receive a recall letter. The unrestrained 25-year-old male driver was traveling south in the outside lane of a 4-lane divided city street negotiating a left curve. The vehicle departed the west (right) side of the roadway and sustained multiple impacts with fixed objects and rolled over. Based on medical records, the driver's Blood Alcohol Concentration (BAC) was 0.259 mg/dl and a urine test was positive for cocaine. Inspection of the Denso accelerator mechanism revealed no evidence of sticking. There was no evidence of entrapment of the accelerator pedal by the floor mat. There was no evidence of pre-crash braking found during the SCI crash scene inspection and no physical evidence was present in the police on-scene photographs. Toyota has indicated that this vehicle's EDR module does not contain pre-crash data and zeros are recorded for speed and engine rpm.

17. *Key Words* Unintended acceleration Fatal Injury Motor Vehicle Traffic Crash Injury Severity		18. *Distribution Statement* General Public		
19 *Security Classif. (of this report)* Unclassified	20. *Security Classif. (of this page)* Unclassified	21. *No. of Pages* 14	22. *Price*	

Form DOT 1700.7 (8-72) Reproduction of completed page authorized

TABLE OF CONTENTS IN10024

This on-site investigation focused on a 2008 Toyota Tacoma PreRunner (**Figure 1**), which was alleged to have experienced an Unintended Acceleration (UA) that led to a loss of control by the driver. This crash was brought to our attention by the National Highway Traffic Safety Administration (NHTSA) on March 5, 2010 through the Office of Defects Investigation (ODI). This investigation was assigned on June 28, 2010 following multiple communications with insurance representatives and law firms to establish cooperation and obtain permission to inspect the vehicle. This crash involved the Toyota, which departed the roadway and sustained multiple impacts and a rollover. The crash occurred in January, 2010, at 0235 hours, in Texas and was investigated by the sheriff's department. The Toyota was inspected and the Event Data Recorder (EDR) was imaged on July 8, 2010 using the manufacturer's EDR readout tool with software version 1.1.0. The imaged EDR data was read and printed with version 1.4.1.0 of the readout tool software. The crash scene was inspected on July 7, 2010. This report is based on the police crash report, police on-scene photographs, vehicle inspection, exemplar vehicle inspection, EDR data, crash scene inspection, occupant kinematic principles, driver's medical records, and evaluation of the evidence.

Figure 1: The damaged 2008 Toyota Tacoma PreRunner

The Toyota was subject to NHTSA recall campaign number 09V388000, which concerned the possibility of the accelerator pedal becoming entrapped by an unsecured or incompatible driver's floor mat. Toyota began mailing recall notice letters to owners in December 2009. The recall required Toyota to modify or replace the accelerator pedal and replace the driver's all-weather floor mat with a newly designed floor mat. Based on information provided by the deceased driver's attorney, the driver did not receive a recall letter and no recall work had been performed on the vehicle. The driver's familiarity with the roadway, the vehicle, and details about his trip are not known.

CRASH CIRCUMSTANCES

Crash Environment: The crash occurred within a residential area on a 4-lane, divided city street during night time hours and dry, cloudy weather conditions. The trafficway traversed in a general north-south direction and the Toyota was approaching a 4-leg intersection. The approach to the intersection was uncontrolled and the trafficway was illuminated by overhead lighting. The trafficway was divided by a grass median and the roadways were bordered by 13 cm (5.1 in) high concrete curbs. Utility poles, trees, and street light poles were located adjacent to the roadway. The privates residences located on the west side of the roadway near the intersection were surrounded by brick walls that were located approximately 3 m (9.8 ft) from the roadway. The roadway pavement was level concrete. The speed limit was 56 km/h (35 mph). The Crash Diagram is on page 14 of this report.

Pre-Crash: The unrestrained 25-year-old male driver was traveling south in the outside lane negotiating a left curve when the vehicle departed the west (right) side of the roadway (**Figure 2**). Based on medical records, the driver's Blood Alcohol Concentration (BAC) was 0.259 mg/dl and a urine test was positive for cocaine. Toyota has indicated that this vehicle's EDR module does not contain pre-crash data and zeros are recorded for speed and engine rpm.

Figure 2: Southbound approach of the Toyota in the outside lane; arrow shows location of roadway departure

Crash: The on-scene police measurements and photographs indicated that the vehicle departed the right side of the roadway approximately 33.5 m (110 ft) north of the 4-leg intersection and the right front wheel impacted a 13 cm (5.1 in) high concrete curb (event 1). The vehicle traveled along the curb for approximately 2.7 m (9 ft) where the right side wheels entered the grass. The police reported a rolling tire print in the grass for an additional 20.1 m (66 ft) leading to the location where the front right corner (**Figure 3**) impacted an 18 cm (7.1 in) diameter metal streetlight pole (event 2). The impact broke the pole at the ground (**Figure 4**) and caused the vehicle to rotate clockwise. The vehicle reentered the roadway at the mouth of the intersecting street and rolled over left side leading (event 3). As the vehicle rolled over and rotated clockwise, the front plane (**Figure 5**) impacted and broke out a section of a brick wall (**Figure 6**, event 4). The right side plane (**Figure 7**) then impacted a 33 cm (13 in) diameter wood utility pole (event 5). The vehicle rotated clockwise around the utility pole and impacted a fire hydrant with the right A-pillar and windshield (event 6) as it came to final rest on its right side heading north. The vehicle rolled over 3 quarter turns and traversed a distance of approximately 14 m (45.9 ft) from rollover initiation to the final rest position.

Figure 3: Damage on the front right bumper corner and right fender from the impact with the 18 cm (7.1 in) diameter metal streetlight pole

Figure 4: Arrow shows impact location of metal streetlight pole (Police image, view south)

Post-Crash: The police, emergency medical personnel, and rescue personnel responded to the crash scene. The driver was extricated from the vehicle and was transported by air ambulance to a hospital. He was admitted to the hospital where he expired from his injuries at 1456 hours the following day. The Toyota was towed from the crash scene.

The 2008 Toyota Tacoma PreRunner was a rear wheel drive, 5-passenger, 4-door, double cab, long bed pickup truck (VIN: 3TMKU72N78M-------) that was manufactured in April 2008. The vehicle was equipped with a 4-liter, V-6 engine, a 5-speed automatic transmission, 4-wheel anti-lock brakes with electronic brake force distribution, traction control, and Electronic Stability Control (ESC). The front row was equipped with bucket seats, adjustable head restraints, lap-and-shoulder safety belts, and driver and front right passenger frontal air bags. The second row was equipped with a split bench seat with folding backs, lap-and-shoulder safety belts, adjustable head restraints, and Lower Anchors and Tethers for Children (LATCH) in the outboard seating positions.

Figure 5: Damage on the front plane from the brick wall impact overlapped the damage on the front right corner from the metal streetlight pole impact

Figure 6: Section of brick wall was broken out from impact with vehicle's front plane; divot on ground shows touchdown location of left side plane of vehicle; arrow shows utility pole impacted by right side plane (Police image, view south)

Figure 7: Damage on the right side doors from the impact with the 33 cm (13 in) diameter wood utility pole

CASE VEHICLE DAMAGE

Exterior Damage: The vehicle sustained direct damage on the front plane, top plane, and both side planes as a result of the crash. The right front wheel rim was abraded from the curb impact (event 1). The wheel was also damaged during the front right corner impact with the metal streetlight pole (event 2). Both side planes and the top plane were directly damaged during the rollover (event 3). The maximum vertical crush from the rollover was 11 cm (4.3 in) and occurred on the left windshield header. The maximum lateral crush from the rollover was 16 cm and occurred on the left B-pillar. There was overlapping damage on the front plane from the impacts with the metal streetlight pole and brick wall (events 2 and 4). Crush measurements were taken on the front plane to document the combined damage from both impacts. The maximum residual crush was 36 cm (14.2 in) at C_6. The table below presents the crush measurements. There was also overlapping damage on the right side plane from the impacts with the metal streetlight pole, the brick wall, and the wood utility pole impact on the right side plane (events 2, 4, and 5). Crush measurements were taken on

the right side plane to document the combined damage from these impacts. The maximum residual crush was 56 cm (22 in) at both C_3 and C_5. The second table below presents the crush measurements. The right A-pillar, windshield, and top of the instrument panel were damaged from the impact with the fire hydrant (event 6).

Front Plane Measurements

Units	Event	Direct Damage		Field L	C_1	C_2	C_3	C_4	C_5	C_6	Direct	Field L
		Width CDC	Max Crush								±D	±D
cm	2 & 4	166	36	109	6	4	10	17	22	36	0	0
in		65.4	14.2	42.9	2.4	1.6	3.9	6.7	8.7	14.2	0.0	0.0

Side Plane Measurements

Units	Event	Direct Damage		Field L	C_1	C_2	C_3	C_4	C_5	C_6	Direct	Field L
		Width CDC	Max Crush								±D	±D
cm	2,4,and 5	209	56	209	0	34	56	47	56	35	9	9
in		82.3	22.0	82.3	0.0	13.4	22.0	18.5	22.0	13.8	3.5	3.5

Damage Classification: The Collision Deformation Classifications (CDC) for each of the six events are as follows:

- Event 1, right front wheel impact with a 13 cm (5.1 in) high concrete curb: 12FRWN3
- Event 2, front right corner impact with metal streetlight pole: 12FREE6
- Event 3, rollover: 00LDHO3
- Event 4, front plane impact with brick wall during the rollover: 00FDEW2
- Event 5, right side plane impact with wood utility pole during rollover: 00RPAW4
- Event 6, fire hydrant impact to right A-pillar and windshield during rollover: 00TPDW5

The WinSMASH program could not be used to calculate a Delta V for any of the impacts since a rollover, an impact with a wheel, non-horizontal impacts, and impacts with overlapping damage are out of scope for the program. The severity of the damage for event 1 was minor. The severity of the damage for events 2 and 4 was moderate based on the extent of the crush. The severity of the damage for event 3 was moderate based on the extent of passenger compartment intrusion. The severity of the damage for event 5 was severe based on the extent of crush. The severity of the damage for event 6 was severe based on the extent of the crush on the windshield and right A-pillar.

The manufacturer's recommended tire size was P245/75R16. The Toyota was equipped with the recommended size tires. The vehicle's tire data are shown in the table below.

Tire	*Measured Pressure*		*Vehicle Manufacturer's Recommended Cold Tire Pressure*		*Tread Depth*		*Damage*	*Restricted*	*Deflated*
	kPa	psi	kPa	psi	milli-meters	32nd of an inch			
LF	172	25	200	29	6	7	None	No	No
LR	172	25	200	29	4	5	None	No	No
RR	138	20	200	29	3	4	None	No	No
RF	Flat	Flat	200	29	6	8	Hole in sidewall	Yes	Yes

Vehicle Interior: The steering wheel had been cut out of the vehicle during the extrication of the driver. There was no discernable evidence of occupant contact.

The left front door remained closed and operational, but once it was opened it would not close. The remaining doors were all jammed shut. Prior to the crash, all the window glazings were closed for operable windows and fixed for the others. All the side window glazings and backlight glazings were disintegrated from impact forces. The windshield was cracked and partially displaced from the windshield frame. The windshield was removed during the extrication of the driver. The passenger compartment sustained 17 intrusions. The most severe intrusions into the driver's space involved the left windshield header, the roof, and the left A-pillar. The windshield header and roof intruded vertically 11 cm (4.3 in) and the left A-pillar intruded laterally 12 cm (4.7 in).

ACCELERATOR PEDAL, DRIVER'S FLOOR MAT, AND BRAKE PEDAL

The initial status of the Denso accelerator pedal, brake pedal, and Toyota OEM floor mat at the time of the SCI inspection is shown in **Figure 8**. The floor pan below the brake pedal and accelerator pedal was deformed and intruded 7 cm (2.8 in) and 6 cm (2.4 in), respectively. The floor mat was displaced by the deformation of the floor pan and was in contact with the bottom end of the accelerator pedal. Since the floor mat was displaced by crash induced damage and the accelerator pedal was found in its full rear position, the accelerator pedal was not considered entrapped by the floor mat. There were no abrasions or marks on the floor mat in the area adjacent to the bottom end of the accelerator pedal. The accelerator pedal had a normal usage wear pattern. The floor mat was secured to the floor by the right side floor mat attachment clip.

Figure 8: Initial status of the brake pedal, accelerator pedal, and Toyota floor mat at the SCI inspection

The left side floor mat attachment clip was inserted in the floor mat receptacle, but the attachment clip was not connected to the floor anchor. The carpet was also folded and displaced from the floor pan intrusion. The displaced carpet was in contact with the right side of the accelerator pedal but was not entrapping it. There was no evidence on the carpet that the back of the accelerator pedal had been in contact with the carpet. When the accelerator pedal was pushed fully forward and released, it functioned smoothly and returned to its full rear position without binding.

Figure 9: The Denso accelerator mechanism

The distance between the accelerator pedal and the brake pedal was 6 cm (2.4 in). The accelerator pedal was 4 cm (1.6 in) in width and 9 cm (3.5 in) in height. The brake pedal was 11.5 cm (3.9 in) in width at the top, 8.5 cm (3.3 in) in width at the bottom, and 7 cm (2.8 in) in height. The distance between the centerline of the driver's seat and the right edge of the brake pedal was 10 cm (3.9 in). The distance from the brake pedal to the front of the driver's seat cushion was 51 cm (20.1 in). **Figure 9** shows the Denso accelerator mechanism housing. The brake rotors and brake pads were not inspected. No evidence of pre-crash braking was found during the SCI crash scene inspection and no physical evidence was present in the police on-scene photographs. The police report identified and the on-scene photographs showed a rolling tire print in the grass leading to the impact with the metal streetlight pole.

EVENT DATA RECORDER

Due to the electrical system being compromised during the crash sequence, it was not possible to image the EDR via connection to the diagnostic link connector. The Air Bag Control Module (ACM), which contains the EDR was removed from the vehicle and the data was imaged via direct connection to the ACM using the manufacturer's EDR readout tool with software version 1.1.0. The imaged data was subsequently read and printed using version 1.4.1.0 of the readout tool software. The EDR recorded data for two frontal events. The event indicated as "Latest/Frozen BANK1, Event counter 2" was probably related to the impact with the metal streetlight pole. The event indicated as "Next most recent BANK0, Event counter 1" was probably related to the right front wheel impact with the concrete curb. For the "Latest/Frozen BANK1, Event counter 2" event, the EDR recorded the driver's safety belt switch status as "UnBelted." The driver's seat position was recorded as "RW." The transmission shifter position was recorded as "N/A." The deployment time for the driver's frontal air bags was recorded as 18 ms. The deployment stage was recorded as "Lo." The EDR recorded 153.6 ms of velocity change data , which is presented in the table below. A column was added to convert mph to km/h. As discussed in the pre-crash section on page 2 of this report, Toyota has indicated that this EDR module does not contain pre-crash data.

Latest/Frozen BANK1, Event Counter 2 data

ms	Vel Chg (mph)	Vel Chg (km/h	ms	Vel Chg (mph)	Vel Chg (km/h)	ms	Vel Chg (mph)	Vel Chg (km/h)
10.2	0.4	0.6	61.4	5.3	8.5	112.6	6.5	10.5
20.5	1.1	1.8	71.7	6.0	9.7	122.9	6.1	9.8
30.7	3.2	5.1	81.9	6.1	9.8	133.1	6.0	9.7
41.0	3.7	6.0	92.2	6.3	10.1	143.4	5.8	9.3
51.2	4.4	7.1	102.4	6.5	10.5	153.6	6.0	9.7

For the "Next most recent BANK0, Event counter 1" event, the EDR recorded the driver's safety belt switch status as "UnBelted." The driver's seat position was recorded as "RW." The transmission shifter position was recorded as "N/A." The EDR recorded 153.6 ms of velocity change data, which is presented in the table below.

Next Most Recent BANK0, Event Counter 1 data

ms	Vel Chg (mph)	Vel Chg (km/h	ms	Vel Chg (mph)	Vel Chg (km/h)	ms	Vel Chg (mph)	Vel Chg (km/h)
10.2	0.4	0.6	61.4	-0.2	-0.3	112.6	-0.5	-0.8
20.5	0.4	0.6	71.7	-0.2	-0.3	122.9	-0.9	-1.5
30.7	0.2	0.3	81.9	0.0	0.0	133.1	-0.9	-1.5
41.0	-0.2	-0.3	92.2	-0.2	-0.3	143.4	-0.9	-1.5
51.2	-0.2	-0.3	102.4	-0.4	-0.6	153.6	-0.9	-1.5

AUTOMATIC RESTRAINT SYSTEM

The Toyota was equipped with a Certified Advanced 208-Compliant (CAC) frontal air bag system that consisted of dual stage driver and front right passenger frontal air bags, driver seat position sensor, seat belt usage sensors, retractor mounted pretensioners and a front right passenger weight sensor. Based on the seventh edition of Holmatro's Rescuer's Guide to Vehicle Safety Systems, the frontal air bag sensors were located on the inner fenders. The driver's frontal air bags deployed in this crash, probably during the impact with the metal streetlight pole (event 2). The manufacturer has certified that the vehicle is compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The vehicle was not equipped with seat-mounted side impact air bags or side impact inflatable curtain air bags.

The driver's frontal air bag was located within the steering wheel hub. The steering wheel had be cut out of the vehicle during the extrication of the driver and the air bag had been cut out

of the air bag module. The air bag module cover was a two flap configuration constructed of pliable vinyl. Each cover flap was 13 cm (5.1 in) in width at the tear seam. The top flap was and 8 cm (3.1 in) in height, while the bottom flap was 5 cm (2 in) in height. The cover flaps opened at the designated tear points and were undamaged. The deployed air bag was 65 cm (25.5 in) in diameter. It had two tethers at the 3 and 9 o'clock positions and two 3 cm (1.2 in) diameter vent ports located at the 11 and 1 o'clock positions. The front of the air bag had two small holes in it that were probably not crash related. Several small blood transfers were also present on the front of the air bag. The blood transfers appeared to be blood spatter and not direct occupant contact.

MANUAL RESTRAINT SYSTEM

The Toyota was equipped with lap-and-shoulder safety belts for all the seating positions. The driver's safety belt consisted of continuous loop belt webbing, an Emergency Locking Retractor (ELR), sliding latch plate, retractor-mounted pretensioner, and an adjustable upper anchor that was located in the full down position. The remaining seat positions were unoccupied.

The inspection of the driver's safety belt assembly revealed no evidence of usage in this crash. The pretensioner had actuated and the safety belt webbing was taut in the retracted position. The portion of the safety belt webbing that remained outside of the B-pillar was entrapped between the intruded B-pillar and the driver's seat back indicating it was in the retracted position at the time of the crash. The condition of the safety belt was consistent with the EDR data, which recorded the driver's safety belt switch status as "UnBelted."

CASE VEHICLE DRIVER KINEMATICS

The unrestrained driver of the Toyota [25-year-old male, 168 cm (66 in) and 58 kg (128 lbs)] was seated in an unknown posture. The seat track was adjusted to the approximate middle position and the seat back was slightly reclined.

The Toyota's initial impact with the curb was minor and probably had little affect on the driver's seated position. The vehicle's front right corner impact with the metal streetlight pole displaced the driver forward opposite the 12 o'clock direction of force. This impact probably triggered the deployment of the driver's frontal air bag. While there was no discernable evidence of occupant contact on air bag, the driver probably loaded the air bag during this impact. The driver was redirected to the left as the vehicle rotated clockwise and began to roll over left side leading. He was then redirected forward when the front of the vehicle impacted the brick wall as the vehicle touched down on the left side plane. His upper torso contacted the left instrument panel and his head contacted the left A-pillar. He sustained a compression of the brainstem, subdural hematomos, cerebral contusions, intraventricular hemorrhage, subarachnoid hemorrhage, and a basilar skull fracture from contact with the left A-pillar. He sustained contusions of the lungs with hemothorax and pneumothoraces, fractured right ribs 2-6, lacerations of the right kidney and spleen, and a fractured right clavicle and scapula from contact with the left instrument panel. Contact with the lower left instrument panel caused a comminuted fracture of the right femoral diaphysis. The driver was redirected to the right and then forward as the vehicle's right side plane impacted the wood utility pole and then the fire hydrant as the vehicle came to final rest.

The windshield was partially displaced from the windshield frame by the impact with the fire hydrant, which created an opening for ejection and the driver's upper torso was ejected. Based on the driver's medical records, he was found by emergency responders with his upper torso out of the vehicle through the windshield opening with his legs entrapped by the steering wheel and his upper torso resting on the fire hydrant and his head and arms on the ground. Rescue personnel cut the left A-pillar, steering wheel, and removed the displaced windshield to extricate the driver (**Figure 10**).

Figure 10: Police photo showing the status of the Toyota following the extrication of the driver

CASE VEHICLE DRIVER INJURIES

The driver was transported by air ambulance to a hospital. He was admitted to the hospital and expired from his injuries at 1456 hours the following day. The table below presents the driver's injuries and injury sources.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 2005	Injury Source	Source Confidence	Source of Injury Data
1	Compression brainstem, both transtentorial and left uncal herniations with complications[1]	critical 140202.5,8	Left A-pillar	Probable	Hospitalization records
2	Hematomas, subdural, bilateral[2], extending along interhemispheric fissure–thickest on left at 1.2 cm (0.5 in) and in anterior left middle cranial fossa	critical 140656.5,2	Left A-pillar	Probable	Hospitalization records

[1] Driver was unconscious and unresponsive at scene and throughout hospitalization. Pupils were equal and nonresponsive. Patient sustained hemorrhagic shock, metabolic acidosis, and acute blood loss anemia.

[2] A left side hemicraniectomy and hematoma evacuation was performed on the left frontotemporal parietal region.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 2005	Injury Source	Source Confidence	Source of Injury Data
3 4	Cerebral edema with effacement of several cisterns[3]; diffuse parenchymal edema with 10 mm (0.4 in) of left-to-right	critical 140674.5,1 140674.5,2	Left A-pillar	Probable	Hospitalization records
4 (Cont'd.)	midline shift at septum pellucidum[4]; sulci effaced diffusely				
5	Cerebral contusions, diffuse, bilateral hemispheres, not further specified	serious 140620.3,3	Left A-pillar	Probable	Hospitalization records
6	Hemorrhage, intraventricular, not further specified	severe 140677.4,9	Left A-pillar	Probable	Hospitalization records
7 8	Pneumocephalus present, right greater than left, not further specified	serious 140682.3,1 140682.3,2	Left A-pillar	Probable	Emergency room records
9 10	Hemorrhage, subarachnoid, scattered over both hemispheres with left greater than right	serious 140695.3,1 140695.3,2	Left A-pillar	Probable	Hospitalization records

[3] Cisterns effaced included: supraseller, basilar and the cerebrospinal fluid spaces in the posterior fossa– especially pontine and prepontine, as well as the craniocervical junction and left ventricle. The following terms are defined in Dorland's Illustrated Medical Dictionary as follows:

cistern (sis′tern): a closed space serving as a reservoir for fluid; see also *cisterna*.

basal c.: cisterna interpeduncularis.

interpeduncular c.: cisterna interpeduncularis.

pontine c.: a large space ventral to the pons, continuous caudally with the spinal subarachnoid space and the cerebellomedullary cistern and rostrally with the interpeduncular space; the basilar artery runs through it.

suprasellar c.: the subarachnoid space anterior and posterior to the optic chiasm above the sella turcica.

cisterna (sis-ter′na) **pl.** ***cister′nae***: a cistern -- a closed space serving as a reservoir for lymph or other body fluid, especially one of the enlarged subarachnoid spaces containing cerebrospinal fluid.

c. basa′lis: c. interpeduncularis.

c. interpeduncula′ris: interpeduncular cistern -- a dilatation of the subarachnoid space between the cerebral peduncles; called also *basal cistern*.

[4] From Wikipedia, the free encyclopedia: The septum pellucidum (also called the septum lucidum) is a thin, triangular, vertical membrane separating the lateral ventricles of the brain. It separates the anterior horn of the left and right lateral ventricles. It runs as a sheet from the corpus callosum down to the fornix. When the hemispheres are cut apart, the septum remains on one hemisphere, usually the left. The septum pellucidum actually consists of two layers or laminae of both white and gray matter, called the laminae septi pellucidi. These layers are normally fused; however, in approximately one-tenth of humans, there is a slit-like cavity between them, referred to as cavum septum pellucidum, cavum septi pellucidi. The septum pellucidum is located in the midline of the brain, between the two cerebral hemispheres. It is attached superiorly (above), anteriorly (in front), and inferiorly (below) to the corpus callosum, the large collection of nerve fibers that connect the two hemispheres. Inferiorly and posteriorly (in back), it is attached to the anterior part of the fornix. On either side are the two lateral ventricles, pockets of cerebrospinal fluid within the cerebral hemispheres.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 2005	Injury Source	Source Confidence	Source of Injury Data
11	Fracture basilar skull from squamous and mastoid portions of right temporal bone through middle cranial fossa and clivus[5] to left temporal bone; and	serious 150206.4,8	Left A-pillar	Probable	Hospitalization records
	fractures, type II, bilateral occipital condyles				Emergency room records
12	Contusions lungs: large, right upper and middle lobes and smaller, lingular portion of left superior lobe, not further specified	severe 441412.4,3	Left instrument panel	Probable	
13	Hemothorax, small, right, not further specified	serious 442200.3,1	Left instrument panel	Probable	Hospitalization records
14	Pneumothoraces, small, bilateral, left is anteriorly	moderate 442202.2,3	Left instrument panel	Probable	Emergency room records
15	Hematoma, extrapleural[6], right, adjacent to multiple right rib fractures	unknown 442999.9,1	Left instrument panel	Probable	Hospitalization records
16	Fractures right ribs: 2nd through 6th, not further specified	serious 450203.3,1	Left instrument panel	Probable	Hospitalization records
17 18	Laceration right kidney, grade 2, upper and lower poles with perinephric hematoma	moderate 541622.2,1 541610.2,1	Left instrument panel	Probable	Emergency room records
19 20	Laceration, spleen, grade 2 with perisplenic hematoma	moderate 544222.2,2 544210.2,2	Left instrument panel	Probable	Emergency room records
21	Fracture, comminuted, displaced, right mid-clavicle	moderate 750671.2,1	Left instrument panel	Probable	Hospitalization records

---

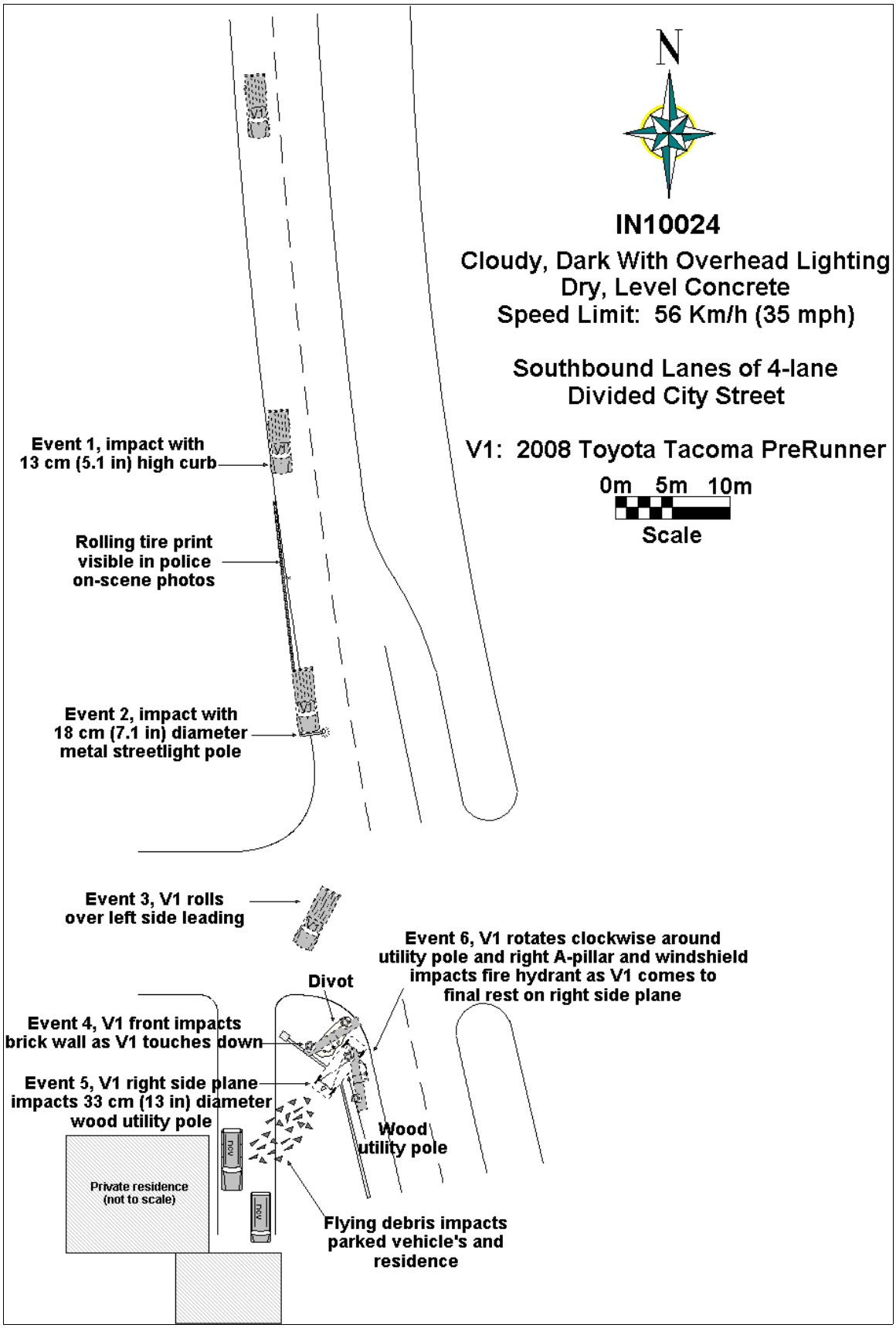
[5] The following term is defined in DORLAND'S ILLUSTRATED MEDICAL DICTIONARY as follows:
clivus (klī′vas) [L. "slope"]: a bony surface in the posterior cranial fossa, sloping superiorly from the foramen magnum to the dorsum sellae, the inferior part being formed by a portion of the basilar part of the occipital bone *c. ossis occipitalis*) and the superior part by a surface of the body of the sphenoid bone *c. ossis sphenoidalis*).

[6] The following terms are defined in DORLAND'S ILLUSTRATED MEDICAL DICTIONARY as follows:
extrapleural (eks"tra-ploor′al): outside the pleural cavity. ***web material*** Significant amounts of blood can be sequestered between parietal pleura and the ***endothoracic fascia*** leading to ventillatory and circulatory disturbances and even death. Extrapleural hematoma (EH) is rare. Only a few cases have been reported under different names: extrapleural, subpleural, or epipleural hematoma. It is potentially lethal because of bleeding risks and ventilatory consequences.
***fascia (fash′e-a)* [L. "band"]**: a sheet or band of fibrous tissue such as lies deep to the skin or forms an investment for muscles and various other organs of the body.
endothoracic fascia, fascia endothora′cica: the extrapleural fascial sheet beneath the serous lining of the thoracic cavity; called also *parietal fascia of thorax* and *fascia parietalis thoracis*.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 2005	Injury Source	Source Confidence	Source of Injury Data
22	Fracture, comminuted, right scapular spine, extending into body but not involving glenoid	moderate 750951.2,1	Left instrument panel	Probable	Emergency room records
23	Fracture, chip, open, involving volar aspect right medial distal ulna	moderate 752364.3,1	Left instrument panel	Probable	Hospitalization records
24	Fracture, comminuted, right proximal femoral diaphysis with medial displacement–distal fragment freely mobile	serious 853271.3,1	Left lower instrument panel (includes knee bolster), right of steering column	Probable	Hospitalization records
25 26	Abrasion, 7.6 cm (3 in) and laceration right parietotemporal scalp	minor 110202.1,1 110602.1,1	Left A-pillar	Probable	Hospitalization records
27	Abrasion, 12.7 cm (5 in), left side of face extending toward temporal scalp	minor 210202.1,2	Noncontact injury: flying glass, left front glazing	Probable	Hospitalization records
28 29	Lacerations, multiple, small, midface and left cheek	minor 210602.1,4 210602.1,2	Noncontact injury: flying glass, left front glazing	Probable	Hospitalization records
30 31	Abrasions neck: right neck, 7.6 x 7.6 cm (3 x 3 in); anterior neck, not further specified; left neck, 10.2 x 15.2 cm (4 x 6 in), extending and overlying left clavicle	minor 310202.1,0 710202.1,2	Noncontact injury: flying glass, left front glazing	Probable	Hospitalization records
32	Lacerations x 3 left neck: one vertically oriented, 3.2 cm (1.25 in), and two obliquely oriented, 2.5 cm and 3.8 cm (1 and 1.5 in)	minor 310602.1,2	Noncontact injury: flying glass, left front glazing	Probable	Hospitalization records
33	Lacerations x 7, superficial, involving left neck base and upper chest, just below and left of left clavicle: 1-6 cm (2.4 in), 2-4 cm (1.6 in), and 4-2 cm (0.8 in)	minor 410602.1,2	Front left windshield's glazing	Possible	Hospitalization records[7]
34	Contusions, multiple, anterior chest, 2.5 cm to 3.8 cm (1 to 1.5 in)	minor 410402.1,0	Other object: fire hydrant	Possible	Hospitalization records

[7] The apparent overlap between this lesion and the one immediately above cannot be discerned because of the differing sources of the injury data.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 2005	Injury Source	Source Confidence	Source of Injury Data
35 36	Abrasion, 25.4 cm (10 in), linear, obliquely oriented left torso in mid-axillary line	minor 410202.1,2 510202.1,2	Left front door panel, rear upper quadrant	Probable	Hospitalization records
37	Abrasions, multiple, right lower quadrant of abdomen, not further specified	minor 510202.1,1	Front left windshield's glazing	Possible	Hospitalization records
38	Abrasions, anterolateral and posterior right upper arm	minor 710202.1,1	Front left windshield's glazing	Possible	Hospitalization records
39	Abrasion proximal, anterior, left forearm, not further specified	minor 710202.1,2	Noncontact injury: flying glass, left front glazing	Possible	Emergency room records
40	Abrasions, proximal, anterior legs, bilaterally, not further specified	minor 810202.1,3	Left lower instrument panel (includes knee bolster)	Probable	Emergency room records


N
IN10024
Cloudy, Dark With Overhead Lighting
Dry, Level Concrete
Speed Limit: 56 Km/h (35 mph)
Southbound Lanes of 4-lane
Divided City Street
V1: 2008 Toyota Tacoma PreRunner
0m 5m 10m
Scale
Event 1, impact with
13 cm (5.1 in) high curb
Rolling tire print
visible in police
on-scene photos
Event 2, impact with
18 cm (7.1 in) diameter
metal streetlight pole
Event 3, V1 rolls
over left side leading
Event 6, V1 rotates clockwise around
utility pole and right A-pillar and windshield
impacts fire hydrant as V1 comes to
final rest on right side plane
Divot
Event 4, V1 front impacts
brick wall as V1 touches down
Event 5, V1 right side plane
impacts 33 cm (13 in) diameter
wood utility pole
Wood
utility pole
Private residence
(not to scale)
Flying debris impacts
parked vehicle's and
residence