

CRASH DATA RESEARCH CENTER

Calspan Corporation
Buffalo, NY 14225

**CALSPAN ON-SITE POTENTIAL UNINTENDED ACCELERATION
CRASH INVESTIGATION
SCI CASE NO.: CA10008**

OFFICE OF DEFECTS INVESTIGATION

VEHICLE: 2007 TOYOTA CAMRY

LOCATION: PENNSYLVANIA

CRASH DATE: JANUARY 2010

Contract No. DTNH22-07-C-00043

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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 are 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.

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<i>16. Abstract</i> <p>This on-site investigation focused on the alleged Unintended Acceleration (UA) crash of a 2007 Toyota Camry. The Toyota was driven by a 68-year-old restrained female. The driver was operating the vehicle in the parking lot of a strip mall and attempted to park in front of a commercial business. As the driver applied a counterclockwise (left) steer to maneuver into a parking stall, she lost control of the vehicle. The Toyota overrode the curb and sidewalk and impacted the front façade of a laundromat. The Toyota penetrated through the wall and door and came to rest inside the building. The Toyota sustained minor body panel abrasions and deformation as a result of the crash. The vehicle was towed and impounded by the investigating police department. The driver was transported to a local hospital, examined and subsequently released. She was not injured.</p>		<i>13. Type of Report and Period Covered</i> Technical Report Crash Date: January 2010	
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BACKGROUND

This on-site investigation focused on the alleged Unintended Acceleration (UA) crash of a 2007 Toyota Camry. The Toyota was driven by a 68-year-old restrained female. The driver was operating the vehicle in the parking lot of a strip mall and attempted to park in front of a commercial business. As the driver applied a counterclockwise (left) steer to maneuver into a parking stall, she lost control of the vehicle. The Toyota overrode the curb and sidewalk and impacted the front façade of a laundromat. The Toyota penetrated through the wall and door and came to rest inside the building. **Figure 1** is an on-scene image of the crash site obtained from Internet media coverage of the event. The Toyota sustained minor body panel abrasions and deformation as a result of the crash. The vehicle was towed and impounded by the investigating police department. The driver was transported to a local hospital, examined and subsequently released. She was not injured.



Figure 1: On-scene image of the Toyota at final rest. Image obtained from Internet media coverage.

The Toyota penetrated through the wall and door and came to rest inside the building. **Figure 1** is an on-scene image of the crash site obtained from Internet media coverage of the event. The Toyota sustained minor body panel abrasions and deformation as a result of the crash. The vehicle was towed and impounded by the investigating police department. The driver was transported to a local hospital, examined and subsequently released. She was not injured.

The investigating police department informed the National Automotive Sampling System (NASS) of the alleged UA crash on January 28, 2010. The notification was subsequently forwarded to the Calspan Special Crash Investigations (SCI) team by the NASS Zone 1 center. Calspan SCI informed the Crash Investigation Division (CID) of the National Highway Traffic Safety Administration (NHTSA) on January 29, 2010. After receiving the necessary hardware, software and training from Toyota to image vehicle's Event Data Recorder (EDR), NHTSA's Office of Defects Investigation (ODI) requested that SCI conduct further research of the crash on February 26, 2010.

The Toyota was subsequently located at an insurance salvage yard and the Toyota's insurer approved a safety inspection of the vehicle on March 8, 2010. The March 10, 2010 on-site

investigation involved the detailed inspection and documentation of the vehicle and crash site. The vehicle's EDR was imaged during the on-site inspection.

SUMMARY

VEHICLE DATA

2007 Toyota Camry

The 2007 Toyota Camry was identified by the Vehicle Identification Number (VIN): 4T1BE46K47U (production sequence deleted). The police investigation determined that the Toyota was acquired by the driver approximately two weeks prior to the crash from a deceased family member. The driver was not the registered owner of the Toyota. **Figure 2** is a front view of the Toyota taken during the SCI inspection. The vehicle was manufactured in October 2006 and the digital odometer reading was 54,011 km (33,562 miles) at the time of the SCI inspection. The 4-door sedan was equipped



Figure 2: Front view of the 2007 Toyota Camry taken during the SCI inspection.

with a 2.4-liter, I4 engine linked to a 5-speed automatic transmission. The Camry was equipped with 4-wheel disc brakes with antilock (ABS). The interior of the vehicle was configured with seating for five passengers. Each seat position was equipped with a 3-point lap and shoulder safety belt. The front safety belts were equipped with retractor pretensioners. The Toyota Camry was equipped with Certified Advanced 208-Compliant (CAC) air bags for the driver and front right passenger, a driver knee bolster air bag, front seat-mounted side impact air bags and Inflatable Curtain (IC) air bags. The vehicle's recommended tire size was P215/60R16 with a cold tire pressure of 207 kPa (30 PSI), front and rear. The vehicle was equipped with Michelin Energy MXV3 P215/60R16 tires mounted on OEM steel wheels. The specific tire data at the time of the SCI inspection was as follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	207 kPa (30 PSI)	7 mm (9/32)	No	None
LR	200 kPa (29 PSI)	6 mm (8/32)	No	None
RF	207 kPa (30 PSI)	6 mm (7/32)	No	None
RR	207 kPa (30 PSI)	6 mm (8/32)	No	None

The front positions of the Toyota were equipped with the OEM carpeted floor mats. These mats were not secured to the vehicle by the two hooks that were located at the rear edge of the carpeted floor. The rear aspect of the driver mat was lying on top of the hooks. **Figure 3** is an on-scene police image of the Toyota's driver interior and depicted the post-crash position of the

mat. The forward-most edge of the mat was lying on top of the accelerator pedal. The position of the mat prompted the police investigator to contact the NASS due to his concerns about the floor mat recall.

CRASH SITE

This single-vehicle crash occurred during the daylight hours of January 2010. At the time of the crash, the environmental conditions were clear and dry. The crash occurred in the parking lot of a strip mall that was located on the east side of a 4-lane north/south road. Several commercial businesses shared the designated spaces within the southern-half of the parking lot. This area of parking lot measured 35.2 m x 39.2 m (115.5 ft x 128.6 ft). The lot was configured with parking spaces around the perimeter and with a double row of opposing spaces at the center. This configuration created a one-way counterclockwise traffic flow through the lot. The asphalt surface of the lot was painted with (worn) directional arrows and a small one-way traffic sign was attached to the building. **Figure 4** is a view looking eastward across the parking lot.

A laundromat located within the row of businesses in the southern-half of the parking lot was the point of impact. **Figure 5** is a police image of the crash site. The front of the laundromat was bordered by a 4.3 m (14.1 ft) wide concrete sidewalk and a 10 cm (4 in) curb. There were four parking spaces oriented perpendicular to the curb in front of the laundromat. Along the direction of the parking spaces, there was a positive eight percent (+8 %) grade from the traffic lane toward the sidewalk. There was no physical evidence of the vehicle's trajectory (tire marks) on the curb or across sidewalk evident in the on-scene police images. At the time of the SCI scene inspection, the front façade of the building had been repaired. Examination of the curb, sidewalk and building was unremarkable for crash related evidence. **Figure 14** at the end of this report is a schematic of the crash site.



Figure 3: Post-crash position of the Toyota's OEM carpeted floor mat. Image supplied by the police investigator.



Figure 4: View looking eastward across the southern half of the parking lot.



Figure 5: View of the crash site looking eastward. Image supplied by the investigating police officer.

CRASH SEQUENCE

Pre-Crash

Reconstruction of the crash indicated that the 68-year-old female driver of the Toyota was operating the vehicle in the parking lot in a clockwise direction (against the designated traffic flow). The driver intended to turn left and park the vehicle in one of the marked spaces in front of the laundromat. As the driver was parking, she lost control of the Toyota and the vehicle accelerated forward.

Crash

The Toyota mounted the curb, crossed the sidewalk and impacted the front façade of the laundromat. The brick wall fractured and the vehicle penetrated into the building. The left aspect of the vehicle's front plane contacted two washing machines located approximately 1.8 m (6 ft) into the building. This contact deflected the vehicle to its right. The front tires of the Toyota travelled off a carpet (located in front of the washing machines) and onto the tiled floor. The front tires began to mark. The Toyota then accelerated forward an estimated 2 m (6.5 ft) and contacted a row of dryers located along the south wall of the building. The center and right aspects of the vehicle's front plane struck and displaced three dryers approximately 30 cm (12 in) rearward. The vehicle came to rest in contact with dryers. The driver air bag did not deploy during the crash sequence. **Figures 6 and 7** are the on-scene police images depicting the vehicle at final rest. The images depict what appear to be acceleration marks across the tiled floor of the laundromat. **Figure 8** is a view of the tire marks after the vehicle was removed.



Figure 6: On-scene police image of the Toyota's final rest position and the left front tire mark.



Figure 7: On-scene police image of the Toyota's final rest and the left front tire mark.

Toyota Camry was equipped with 4-wheel ABS brakes. The tire marks were dark and consistent over the entire length. A braking tire mark from an ABS-equipped vehicle has a broken pattern as the braking tire is locked and unlocked by the system. Further, the reconstructed speed of the vehicle during the crash sequence was approximately 16 km/h (10 mph). A braking vehicle that is skidding from a low speed does not generate enough heat at the tire /surface interface to produce dark marks similar to those depicted in the on-scene images.



Figure 8: View of the front tire marks after the removal of the Toyota. Image supplied by the police investigator.

Based on the above facts, the marks were most likely generated by an accelerated tire. The sudden change in the friction coefficient, as the tires moved off the carpet to the tiled floor, caused the tires to spin. Additionally, the imaged EDR data indicated that the position of the accelerator pedal changed from “Off” to “Full” during the last second of the recording and the brake remained “Off”. Refer to the Event Data Recorder section below for further information regarding the imaged data.

Post-Crash

The police, fire and medical personnel responded to the crash. The driver was assisted from the vehicle and transported to a local hospital. She was examined and released. The police investigator indicated that the driver was not injured in the crash. During his investigation, the police officer noted that the OEM floor mat was unsecured and that the forward aspect of the mat was resting on top of the accelerator pedal. The police investigator was aware of the news reports regarding alleged unintended acceleration in Toyota vehicles and reported the crash to the police department’s internal safety office. The Toyota was impounded and inspected by a safety officer. No vehicle defects could be identified. The vehicle’s accelerator pedal appeared to operate properly.

2007 TOYOTA CAMRY

Exterior Damage

Figure 9 is a left front oblique view of the Toyota. The front, top and side planes of the vehicle sustained minor body panel abrasions and isolated deformation as a result of the crash. The damage extended rearward to the right C-pillar area of the vehicle. There was no residual frontal deformation. An analysis of the crash severity (delta-V) through the use of the WINSMASH program was not possible. The estimated delta-V of the Toyota during the crash sequence was less than 8 km/h (5 mph) based on the physical evidence and SCI field experience.



Figure 9: Left front oblique view of the Toyota.

Interior Damage

There was no interior damage or intrusion as a result of the crash. At the time of the SCI inspection, the driver seat was adjusted to a rear track position. However, the seat position had been changed during the transfer of the vehicle. The on-scene police images depict the seat in a mid-track position, **Figure 10**.

The front interior was equipped with the OEM carpeted floor mats. **Figure 11** is an image depicting the unsecured position of the driver's mat at the time of the SCI inspection. The mat was not secured by the hooks located at the rear aspect of the foot well. The mat was lying on top of the hooks. There was no damage or scuffing noted to the mat. The immediate post-crash position of the mat is depicted in **Figure 3**. The mat was identified by the following number embossed to the rubber on the back side of the mat: *PT206-32060*.



Figure 10: On-scene police image depicting the mid-track position of the driver's seat.



Figure 11: View of the unsecured OEM carpeted floor mat in the driver's foot well. Image taken during the SCI inspection.

The Toyota was equipped with the CTS accelerator pedal and was subject to the “Sticky Pedal Recall”. The Toyota had not been serviced for the recall prior to crash. **Figure 12** is a view of the accelerator pedal taken during the SCI inspection. The pedal was identified by the following:

78110-07010
06277B2A
44472814626
LHD

A small section of the interior carpet was folded over and lying on top of the upper aspect of the accelerator pedal assembly (denoted by the arrow in the figure). This carpet section should have been tucked in, adjacent to the inboard aspect of the pedal, along the center tunnel. The “dog ear” section was located near the hinge opening of the depressed pedal, but did not snag or interfere with the proper operation of the pedal. The accelerator fully returned to the idle position after each application. It was not possible to get the carpet to impede the pedal’s movement. It is not known how or why the carpet became misplaced.



Figure 12: View of the Toyota’s CTS accelerator pedal.

During the SCI inspection, the Toyota’s engine was started in order to check its operation. The engine started without difficulty and initially idled (cold) at approximately 1400 RPM. There were no illuminated Malfunction Indicator Lamps (MIL) in the instrument cluster. The accelerator pedal was depressed and released several times. During each application, the engine responded as expected and immediately returned to idle. The pedal did not stick or bind. After the engine had operated approximately 2 minutes, it idled at approximately 900 RPM. The radio and all the HVAC controls were in the “Off” position at the time of the SCI inspection. The at-crash position of these controls was unknown.

Manual Restraint Systems

The Toyota Camry was equipped with 3-point lap and shoulder safety belts in the five seat positions. The driver’s restraint consisted of continuous loop webbing, a sliding latch plate, an adjustable D-ring and an Emergency Locking Retractor. The driver’s D-ring was adjusted to the full-up position. The retractor was equipped with a pretensioner. The pretensioner did not actuate as a result of the crash. The webbing was stowed on the retractor at initial inspection. The retractor was operational. Examination of the webbing revealed indications of historical use. However, this usage evidence was not directly related to this driver due to her limited experience (two weeks) with the vehicle. There was no crash related evidence. Crash related evidence of use would not be expected given the low delta-V severity of the impact. Based on

the driver's statement to the police officer, she was restrained at the time for the crash. The imaged EDR data recorded that the driver safety belt was buckled at the time of the crash.

Air Bag Systems

The Toyota Camry was equipped with Certified Advanced 208-Compliant (CAC) frontal air bags for the driver and front right passenger. A CAC air bag is certified by the vehicle manufacturer to be in compliance with the advanced air bag portion of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The Toyota was also equipped with a driver knee bolster air bag, front seat-mounted side impact air bags and side impact Inflatable Curtain air bags. None of the air bags deployed during the crash. The air bag systems were controlled by an Air bag Control Module (ACM) located under the center instrument stack. The ACM had Event Data Recording (EDR) capabilities.

Event Data Recorder

The vehicle's EDR data was imaged at the time of the crash through the use of a proprietary "ROT" hardware interface and software version 1.1 supplied by Toyota. The data was imaged through the vehicle's Diagnostic Link Connector (DLC) located under the left aspect of the instrument panel using the onboard 12-volt electrical power. The imaged data has been reanalyzed with software version 1.4.1.1 and is summarized below.

The EDR in the 2007 Toyota Camry had the capability and capacity to record and store two longitudinal and two lateral crash events. The events were designated "Latest Page 0" and "Next Most-Recent Page1", respectively. Two 5-second pre-crash data buffers related to these events stored data elements regarding the vehicle's operation. When a crash event was triggered by a longitudinal and/or lateral crash pulse, the pre-crash data was saved and linked to that respective event. The order of the trigger numbers determined the order of the crash events, i.e. the highest trigger number identified the "Latest" event.

The imaged EDR had two stored events. The "Latest Page 0" event was related to the subject crash and its data was consistent with the circumstances of the crash. The "Next Most-Recent Page 1" event was ruled out as a related event due to the recorded (higher) speeds of the vehicle and the detection of a right front occupant at the time of the recording. The historical (time) relationship between the recorded events was not known.

The recorded pre-crash data of the "Latest Page 0" event is displayed in the following table. An application of the accelerator was recorded immediately prior to the crash. At the time of the recording, the driver's safety belt was buckled and the front right passenger seat was unoccupied. A field within the imaged data indicated a complete writing of the data.

Time (Seconds)	-4.2	-3.2	-2.2	-1.2	-0.2	0
Speed	0 km/h (0 mph)	1.9 km/h (1.2 mph)	1.9 km/h (1.2 mph)	0 km/h (0 mph)	12.1 km/h (7.5 mph)	15.9 km/h (9.9 mph)
Engine RPM	400	400	400	1200	2000	2400
Accelerator (Voltage)	Off 0.78	Off 0.78	Off 0.86	Off 1.13	Full 3.52	Full 3.71
Brake	Off	Off	Off	Off	Off	Off

It should be noted that the imaged EDR data has also been coded into NHTSA’s Electronic Data System (EDS). Due to the fixed constraints of the EDS, the recorded data has been “rounded and fit”, as necessary, into the variables and attributes of the database. Due to this data fitting, the application of the accelerator immediately prior to the crash (at Time 0) that was recorded by the EDR is not depicted in the EDS database.

The “Latest Page 0” pre-crash data was triggered by a longitudinal (frontal) event. The maximum recorded frontal delta-V was 12.4 km/h (7.7 mph) at 200 milliseconds. The safety belt pretensioners were not actuated and the frontal air bags did not deploy. A field within the data also indicated a complete writing of this data.

Brake System

The left front wheel was removed and the brakes were inspected for excessive wear. The surface of the rotor was lightly rusted from extended exposure to the environment. There was no sign of prolonged heating to the rotor or pads. The brake pads had adequate thickness.



Figure 13: View of the Toyota's left front brake rotor.

DRIVER DEMOGRAPHICS

	Driver
Age/Sex:	68-year-old/Female
Height:	Unknown
Weight:	Unknown
Eyewear:	Prescription glasses (observation from media reports)
Seat Track Position:	Mid-track
Restraint Use:	3-pt. lap and shoulder
Restraint Usage Source:	EDR, SCI interior inspection
Mode of Transport From Scene:	Transported via ground ambulance to a local hospital
Type of Medical Treatment	Examined and released

DRIVER KINEMATICS

The 68-year-old female was restrained and seated in a mid-track position. The mid-track seat position was estimated from the on-scene police images. Her posture was unknown. Numerous attempts to contact the driver via telephone were unsuccessful. The driver was operating the Toyota in the parking lot and applied a left steering input to maneuver the vehicle into a marked parking space. For reasons that could not be determined, the vehicle accelerated forward. The imaged EDR data recorded an application of the vehicle's accelerator. No brake pedal application was recorded.

The Toyota overrode the curb and sidewalk. The front plane of the vehicle impacted the front façade of the Laundromat and penetrated the glass windows and doors of the building. The vehicle came to rest in contact with a row of dryers located along the south wall of the business.

The driver responded to the low delta-V impacts by initiating a forward trajectory. The driver loaded the locked safety belt system. She rode down the force of the crash and reportedly was not injured.

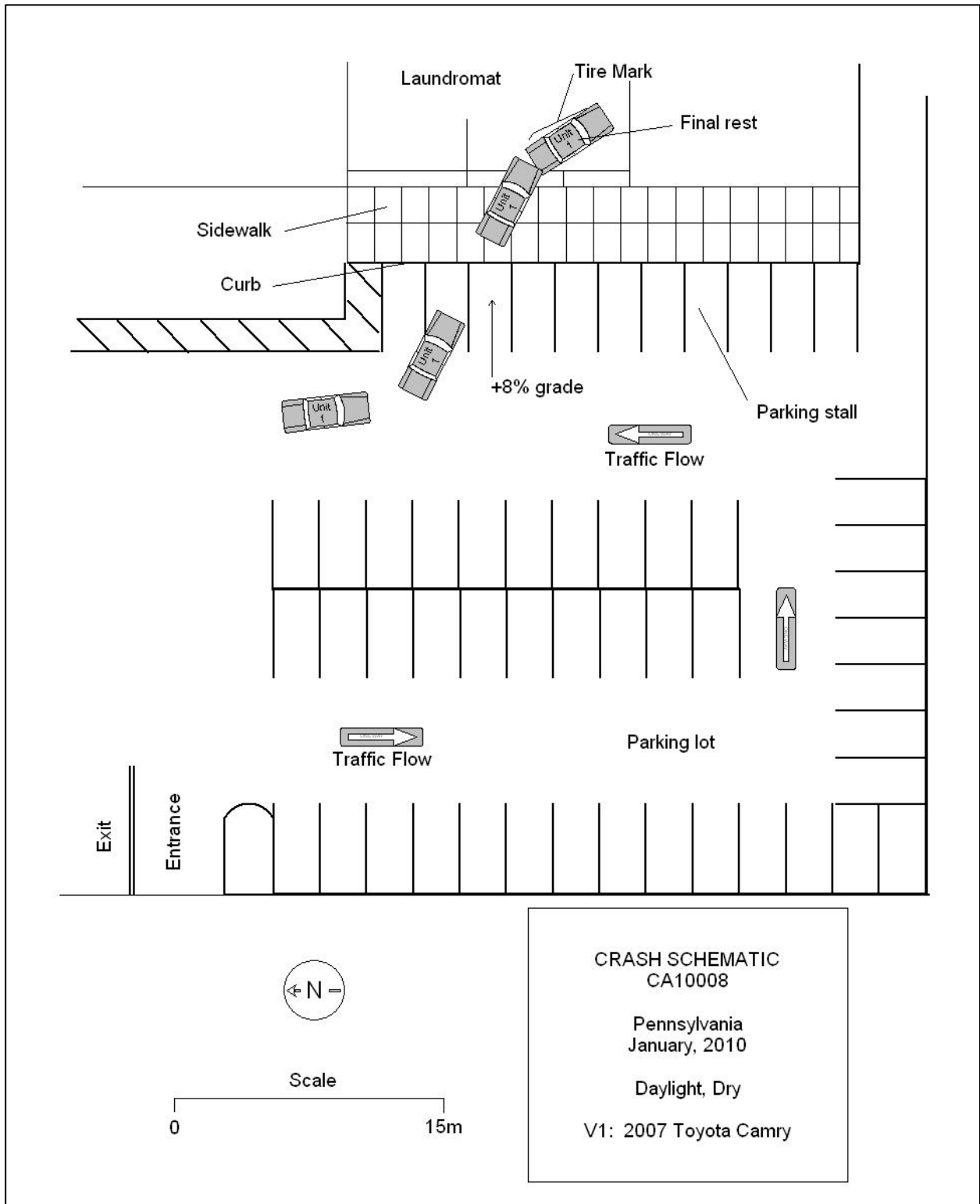


Figure 14: Crash schematic.