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## ON-SITE SIDE IMPACT INFLATABLE OCCUPANT PROTECTION INVESTIGATION

CASE NUMBER - IN-06-004

LOCATION - TEXAS

VEHICLE - 2006 MAZDA MX-5 MIATA

CRASH DATE - January 2006

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

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16. <i>Abstract</i> This report covers an on-site side impact inflatable occupant protection investigation that involved a 2006 Mazda Miata (case vehicle) and a 1989 Toyota Camry LE (other vehicle), which were involved in a front to right side intersection crash. This crash is of special interest because the case vehicle was equipped with multiple Advanced Occupant Protection System (AOPS) features, including seat back-mounted side impact air bags, and the front right side impact air bag deployed and the case vehicle's front right passenger [48-year-old, White (non-Hispanic) female] sustained minor injuries as a result of the crash. The case vehicle was traveling north in the northbound lane of a two-lane city street and was proceeding into a four leg intersection after stopping at a stop sign. The Toyota was traveling west in the westbound lane approaching the intersection. The police crash report indicated the Toyota's driver did not stop at the stop sign and proceeded into the intersection. The case vehicle's driver steered left just prior to impact in an attempt to avoid the crash. The front of the Toyota impacted the right fender of the case vehicle (event 1) causing the case vehicle's front right seat back-mounted side impact air bag to deploy. The case vehicle rotated counterclockwise, the Toyota rotated clockwise and the left side of the Toyota and right quarter panel of the case vehicle impacted (event 2). The Toyota then departed the northwest corner of the intersection and its front left bumper corner impacted a stop sign (event 3). The case vehicle came to rest in the west leg of the intersection heading west. The Toyota came to rest in the front yard of a residence heading northwest. The front right passenger was restrained by her three-point, lap-and shoulder safety belt. She contacted her side impact air bag during the crash and sustained minor injuries and was not transported to a medical facility. The driver was restrained by her three-point, lap-and-shoulder belt. She sustained a minor injury and was not transported to a medical facility.					
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This investigation was brought to NHTSA's attention on or before January 20, 2006 by GES sampling activities. This crash involved a 2006 Mazda MX-5 Miata (case vehicle) and a 1989 Toyota Camry LE (other vehicle). The crash occurred in January 2006 at 5:04 p.m., in Texas and was investigated by the applicable city police department. This crash is of special interest because the case vehicle was equipped with multiple Advanced Occupant Protection System (AOPS) features, including seat back-mounted side impact air bags, and the right side impact air bag deployed, and the case vehicle's front right occupant [48-year-old, White (non-Hispanic) female] sustained minor injuries as a result of the crash. In addition, the manufacturer of the case vehicle has certified that it meets the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. This contractor inspected the scene and vehicles and interviewed the front right passenger on February 14, 2006. This report is based on the police crash report, scene and vehicle inspections, an interview with the front right passenger, occupant kinematic principles, and this contractor's evaluation of the evidence.

## SUMMARY

The case vehicle was traveling north in the northbound lane of a two-lane city street and was proceeding into a four leg intersection after stopping at a stop sign. The Toyota was traveling west in the westbound lane approaching the intersection. The police crash report indicated the Toyota's driver did not stop at the stop sign and proceeded into the intersection. The case vehicle's driver steered left just prior to impact in an attempt to avoid the crash. The front of the Toyota impacted the right fender of the case vehicle (event 1) causing the case vehicle's right seat back-mounted side impact air bag to deploy. The case vehicle rotated counterclockwise, the Toyota rotated clockwise and the left side of the Toyota and right quarter panel of the case vehicle impacted (event 2). The Toyota then departed the northwest corner of the intersection and its front left bumper corner impacted a stop sign (event 3). The case vehicle came to rest in the west leg of the intersection heading west. The Toyota came to rest in the front yard of a residence heading northwest. At the time of the crash the light condition was daylight, the atmospheric condition was clear and the roadway pavement was dry, level bituminous.

The CDC for the case vehicle's right fender impact with the front of the Toyota was determined to be: **02-RFEW-2 (70 degrees)**. The CDC for the case vehicle's right quarter panel impact to the left side of the Toyota was determined to be: **03-RBEW-2 (90 degrees)**. No crush measurements could be taken to the right fender because it had been removed. The case vehicle sustained 6 centimeters (2.4 inches) of maximum residual crush to its right quarter panel. The WinSMASH reconstruction program, missing vehicle algorithm, calculated the case vehicle's Total, Longitudinal, and Lateral Delta Vs for its right fender impact respectively as: 27.0 km.p.h. (16.8 m.p.h.), -9.2 km.p.h. (-5.7 m.p.h.), and -25.4 km.p.h. (-15.8 m.p.h.). The WinSMASH reconstruction program, damage only algorithm, calculated the case vehicle's Total, Longitudinal, and Lateral Delta Vs for the right quarter panel impact respectively as: 4.0 km.p.h. (2.5 m.p.h.), 0.0 km.p.h. (0.0 m.p.h.), and -4.0 km.p.h. (-2.5 m.p.h.). The case vehicle was towed due to damage.

The CDCs for the Toyota were determined to be: **11-FYEW-1 (330 degrees)** for the front impact to the case vehicle's right fender, **09-LPEW-1 (270 degrees)** for the left side impact to the case vehicle's right quarter panel, and **12-FLLE-1 (0 degrees)** for the stop sign impact. The Toyota sustained 20 centimeters (7.9 inches) of residual maximum crush to its front bumper and 1 centimeter (0.4 inch) of residual maximum crush to its left side. The WinSMASH reconstruction program, missing vehicle algorithm, calculated the Toyota's Total, Longitudinal, and Lateral Delta Vs for the front impact to the case vehicle's right fender respectively as: 26 km.p.h. (16.2 m.p.h.), -22.5 km.p.h. (-14.0 m.p.h.), and 13.0 km.p.h. (8.1 m.p.h.). The WinSMASH reconstruction program, damage only algorithm, calculated the Toyota's Total, Longitudinal, and Lateral Delta Vs for the left side impact to the case vehicle's right quarter panel respectively as: 4.0 km.p.h. (2.5 m.p.h.), 0.0 km.p.h. (0.0 m.p.h.), and 4.0 km.p.h. (-2.5 m.p.h.). The Toyota was towed due to damage.

The case vehicle's front right passenger (47-year-old, female) was restrained by her manual, three point, lap-and-shoulder safety belt system. She sustained a bruise on the right side of her right foot from contact with the right side surface forward of the lower right "A"-pillar. In addition, her upper right torso and the right side of her head impacted her deployed seat back-mounted side impact air bag. She rode down the air bag and contacted her right upper arm on the right front window sill causing a large contusion on her right upper arm. She was not transported to a medical facility and sought no medical care subsequent to the crash. The front right passenger's use of her safety belt and the deployment of her side impact air bag mitigated her interaction with the right front door and reduced her injury potential.

The driver (20-year-old, female) was restrained by her manual, three-point, lap-and-shoulder safety belt system. She sustained a contusion on the right side of her right foot from contact with the lower center console. She was not transported to a medical facility and sought no medical care subsequent to the crash. The driver's use of her safety belt restrained her in her seat position and most likely prevented her from impacting the front right passenger during the crash.

## **CRASH CIRCUMSTANCES**

**Crash Environment:** The trafficway on which the case vehicle was traveling was a two-lane, undivided, city street, traversing in a north-south direction. The trafficway on which the Toyota was traveling was a two-lane, undivided, city street, traversing in an east-west direction. The roadways met to form a four leg intersection. Each leg of the intersection was controlled by a stop sign, had two travel lanes and was bordered by mountable curbs. Each travel lane of the north-south roadway was 5.6 meters (18.3 feet) in width and parking was allowed on each side of the roadway. Parking was also allowed on each side of the east-west roadway. The westbound travel lane was 5.2 meters (17.1 feet) in width. The eastbound travel lane was 5.6 meters (18.3 feet) in width. The case vehicle's speed limit was 48 km.p.h. (30 m.p.h.). The Toyota's speed limit was 32 km.p.h. (20 m.p.h.). At the time of the crash the light condition was daylight, the atmospheric condition was clear and the roadway pavement was dry, level bituminous with an estimated coefficient of friction of 0.72. Traffic density was moderate and the site of the crash was residential. See the Crash Diagram at the end of this report.

**Pre-Crash:** The case vehicle was traveling north (**Figure 1**) in the northbound lane and was proceeding into the intersection after stopping at the stop sign. The Toyota was traveling west (**Figure 2**) in the westbound lane. The Toyota's driver was intending to continue westbound through the intersection. The police crash report indicated the Toyota's driver did not stop at the stop sign and proceeded into the intersection. The case vehicle's driver steered left just prior to impact in an attempt to avoid the crash. The crash occurred in the intersection of the two trafficways (**Figure 3**).



**Figure 1:** Approach of case vehicle northbound to intersection, case vehicle stopped at stop sign prior to entering intersection



**Figure 2:** Approach of Toyota westbound to intersection



**Figure 3:** View north to area of impact (arrow)



**Figure 4:** Overview of damage to front of Toyota from right fender impact with case vehicle, arrow shows location of stop sign impact

**Crash:** The front of the Toyota (**Figure 4**) impacted the right fender (event 1) of the case vehicle (**Figure 5** below) causing the case vehicle's right seat back-mounted side impact air bag to deploy. No other air bags deployed. The case vehicle rotated counterclockwise, the Toyota rotated clockwise and the left side of the Toyota (**Figure 6** below) and right quarter panel of the case vehicle (**Figure 7** below) impacted (event 2). The Toyota then continued in a northwest direction, departed the northwest corner of the intersection, and its front left bumper corner impacted a stop sign (event 3).



**Figure 5:** Right front overview of case vehicle, damaged right fender and front bumper had been removed and were not present at inspection facility



**Figure 6:** Damage to left front and left rear doors from impact with right quarter panel of case vehicle



**Figure 7:** Damage to case vehicle's right quarter panel from side slap impact with the left side of the Toyota

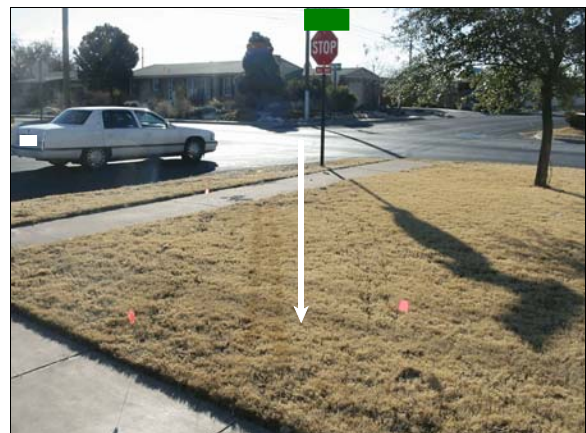


**Figure 8:** Left arrow shows area of final rest of case vehicle, stop sign (right arrow) impacted by Toyota has been replaced

**Post-Crash:** The case vehicle came to rest in the west leg of the intersection heading west (**Figure 8**). The Toyota continued northwest and came to rest in the front yard of a residence (**Figure 9**) heading northwest.

### CASE VEHICLE

The 2006 Mazda MX-5 Miata was a rear wheel drive, two-door convertible (VIN: JM1NC25F160-----) equipped with 2.0 L, I4 engine; six-speed manual transmission; four-wheel, anti-lock brakes and a tire pressure monitor. The seating row was equipped with driver and front right bucket seats with integral head



**Figure 9:** View southeast through the area of Toyota's final rest (arrow), flags show Toyota's left and right tire marks in grass



restraints, driver seat track position sensor; driver and front right passenger manual, three-point, lap-and-shoulder safety belt systems with usage sensors, pretensioners and force limiters, dual-stage driver and front right passenger air bags with passenger air bag suppression switch, and seat back-mounted side impact air bags with torso and head coverage. In addition, the front right seat was equipped with a LATCH system for securing a child safety seat. The manufacturer of the case vehicle has certified that it meets the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The case vehicle's wheelbase was 233 centimeters (91.7 inches). The odometer reading at the time of the inspection could not be determined because the case vehicle was equipped with an electronic odometer.

For front impacts, the various sensors in the case vehicle's advanced occupant restraint system analyze a combination of factors including the predicted crash severity and driver and front right passenger safety belt usage to determine the front air bag inflation level appropriate for the severity of the crash. For the front right seat position, an occupant weight sensor in the seat cushion determines if an occupant is on the seat and enables or suppresses deployment of the air bag based on the amount of weight on the seat. For side impacts, sensors determine if a side impact has occurred of sufficient severity to require deployment of the seat back-mounted, side impact air bags.

#### CASE VEHICLE DAMAGE

**Exterior Damage:** The case vehicle's first impact with the Toyota involved the right fender and right front wheel. The direct damage began 155 centimeters (61 inches) forward of the right rear axle. The direct damage most likely involved the full length of the fender; however, the length of the direct damage and the crush profile could not be determined because the fender had been removed from the vehicle and was not available for inspection. The second impact with the Toyota involved the case vehicle's right quarter panel, which was directly damaged and crushed inward. The direct damage began 9 centimeters (3.5 inches) rear of the right rear axle and extended 49 centimeters (19.3 inches) rearward along the quarter panel. The residual maximum crush was measured as 6 centimeters (2.4 inches) occurring at C<sub>3</sub> and C<sub>4</sub>. The table below shows the case vehicle's right quarter panel crush profile.

Units	Event	Direct Damage		Field L	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>	Direct	Field L
		Width CDC	Max Crush								±D	±D
cm	2	49	6	49	4	5	6	6	4	1	-151	-151
in		19.3	2.4	19.3	1.6	2.0	2.4	2.4	1.6	0.4	-59.4	-59.4

The case vehicle's right side wheelbase was extended 1 centimeter (0.4 inch) and the left side wheelbase was reduced 1 centimeter (0.4 inch). Induced damage involved the right quarter panel and most likely the front bumper.

The recommended tire size was: P205/45R17, and the case vehicle was equipped with tires of this size. The case vehicle’s tire data are shown in the table below.

Tire	Measured Pressure		Recommend Pressure		Tread Depth		Damage	Restricted	Deflated
	kpa	psi	kpa	psi	milli-meters	32 <sup>nd</sup> of an inch			
LF	207	30	200	29	7	9	None	No	No
RF	Flat	Flat	200	29	7	9	Sidewall abraded	No	Yes
LR	207	30	200	29	7	9	None	No	No
RR	221	32	200	29	7	9	None	No	No

**Vehicle Interior:** Inspection of the case vehicle’s interior (**Figure 10** and **Figure 11**) revealed a small scuff on the right seat back-mounted side impact air bag. No other occupant contact evidence was found and no intrusion of the passenger compartment was observed. Finally, there was no compression of the energy absorbing steering column or deformation of the steering wheel (**Figure 12** below).



**Figure 10:** Overview of case vehicle’s steering wheel, windshield and instrument panel through driver’s door



**Figure 11:** Overview of case vehicle’s right instrument panel, front right passenger’s seat and right front door

**Damage Classification:** The damaged right fender had been removed from the case vehicle and was not available for inspection. However, based on the components left on the case vehicle, the damage to the Toyota and the impact configuration, a CDC for the case vehicle’s right fender impact with the front of the Toyota was estimated to be: **02-RFEW-2 (70 degrees)**. Based on the vehicle inspection, the CDC for the case vehicle’s right quarter panel impact to the left side of the Toyota was determined to be: **03-RBEW-2 (90 degrees)**. The WinSMASH reconstruction program, missing vehicle algorithm, was used to reconstruct the case vehicle's Delta Vs for its right fender impact with the front of the Toyota. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 27.0 km.p.h. (16.8 m.p.h.), -9.2 km.p.h. (-5.7 m.p.h.), and -25.4 km.p.h. (-

15.8 m.p.h.). The crash fits the reconstruction model for this impact and is considered borderline, and the results appear reasonable. The WinSMASH reconstruction program, damage only algorithm, was used to reconstruct the case vehicle's Delta Vs for the right quarter panel impact to the left side of the Toyota. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 4.0 km.p.h. (2.5 m.p.h.), 0.0 km.p.h. (0.0 m.p.h.), and -4.0 km.p.h. (-2.5 m.p.h.). The crash fits the reconstruction model for this impact and the results appear reasonable. The case vehicle was towed due to damage.



**Figure 12:** Right side view of case vehicle's steering wheel and steering column showing lack of deformation

### AUTOMATIC RESTRAINT SYSTEM

The case vehicle was equipped with a certified advanced 208-compliant front air bag system and seat back-mounted side impact air bags. The case vehicle's driver and front right passenger air bags did not deploy in this crash. The case vehicle's crash sensing algorithm most likely determined that the case vehicle's longitudinal deceleration was not severe enough to require deployment of the front air bags. In addition, the case vehicle driver's seat back-mounted side impact air bag did not deploy because there was no left side impact to the case vehicle.



**Figure 13:** Case vehicle's front right passenger seat back-mounted side impact air bag located in right side of passenger seat back, each increment on rod is 5 cm (2 in)

The front right passenger's seat back-mounted side impact air bag deployed in this crash as a result of the initial impact to the case vehicle's right fender (event 1). The side impact air bag was located in the outboard side of the front right passenger's seat back (**Figure 13**). The air bag deployed properly through the tear seam in the side of the seat back. There was no evidence of damage to the air bag due to the deployment. The side impact air bag (**Figure 14** below) was an irregular oval-shape and was wider at the top than the bottom. The air bag measured 79 centimeters (31.1 inches) in height and 40 centimeters (15.7 inches) in width at it widest point near the top of the air bag. The air bag was designed without tethers or vent ports. An occupant contact scuff was observed on the central portion of the air bag

approximately 18 centimeters (7.1 inches) from the top of the air bag. It appeared to be a small scuff of eye makeup. No other evidence of occupant was observed on the air bag fabric

#### **CASE VEHICLE FRONT RIGHT PASSENGER KINEMATICS**

Immediately prior to the crash the case vehicle's front right passenger [48-year-old, White (non-Hispanic) female; 175 centimeters and 61 kilograms (69 inches, 135 pounds)] was seated in an upright position with both feet on the floor and her hands on her lap. Her seat track was adjusted to its middle position, the seat back was slightly reclined and she was restrained by her manual, three-point, lap-and-shoulder safety belt system. In addition, the front right passenger was wearing glasses at the time of the crash.

Just prior to the impact, the case vehicle's driver steered left in an attempt to avoid the crash.

It is likely that the driver's steering maneuver caused the front right passenger's upper torso to move slightly to the right. The Toyota's impact with the case vehicle caused the front right passenger's safety belt retractor to lock and she continued forward and moved to the right along a path opposite the case vehicle's 70 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated laterally to the left. The front right passenger loaded her safety belt and her right foot impacted the right side surface forward of the lower right "A"-pillar causing a contusion to the right side of her foot. Her upper right torso and the right side of her head impacted her deployed seat back-mounted side impact air bag. She rode down the air bag and contacted her right upper arm on the right front window sill causing a large contusion on her right upper arm. The head contact with the air bag left a scuff of what appeared to be eye makeup on the air bag; however, she reported no injuries to her face or head. Following the initial impact the case vehicle rotated counterclockwise, and the side-slap impact between the left side of the Toyota and the case vehicle's right quarter panel caused the front right passenger to move to the right opposite the case vehicle's 90 degree direction of principal force into her side impact air bag. The front right passenger then most likely rebounded back to the left as the case vehicle continued to rotate counterclockwise to final rest. She remained restrained in her seat and was able to exit the case vehicle under her own power.



**Figure 14:** Case vehicle's front right passenger seat back-mounted side impact air bag

#### **CASE VEHICLE FRONT RIGHT PASSENGER INJURIES**

The police crash report indicated that the front right passenger was not injured and was not transported from the scene. The front right passenger stated she sought no treatment for her

injuries subsequent to the crash and was not working at the time of the crash. The table below shows the front right passenger’s self-reported injuries and the injury mechanisms.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Contusion {bruise}, 15.2 to 20.3 x 5.1 to 12.7 cm (6-8 x 2-5 in), lateral right upper arm	minor 790402.1,1	Right front window sill	Probable	Interviewee (same person)
2	Sprained right foot, not further specified	minor 850404.1,1	Right side interior surface forward of right “A”-pillar	Probable	Interviewee (same person)

**CASE VEHICLE DRIVER KINEMATICS**

Immediately prior to the crash the case vehicle's driver [20-year-old, White (non-Hispanic) female; 170 centimeters and 61 kilograms (67 inches, 135 pounds)] was seated in an upright position with her back against the seat back, her right foot on the accelerator, left foot on the floor and both hands on the steering wheel. Her seat track was adjusted to its middle position, the seat back was slightly reclined and she was restrained by her manual, three-point, lap-and-shoulder safety belt system. In addition, the driver was wearing sunglasses at the time of the crash.

The case vehicle driver’s left steer just prior to the impact most likely caused the driver’s upper torso to move slightly to the right. The Toyota’s impact with the case vehicle then caused the driver to continue forward and move to the right along a path opposite the case vehicles 70 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated laterally to the left. The driver loaded her safety belt and her right foot impacted the lower center console bruising the right side of her foot. The driver’s right hip and thigh most likely impacted the case vehicle’s center console as well; however, no injuries to her hip or thigh were reported. The secondary side-slap impact between the left side of the Toyota and the case vehicle’s right quarter panel caused the driver to move to the right opposite the case vehicle’s 90 degree direction of principal force. The driver’s right hip and thigh most likely impacted the case vehicle’s center console; however, no injuries to her hip or thigh were reported. The driver then most likely moved back to the left as the case vehicle continued to rotate counterclockwise to final rest. She remained restrained in her seat and was able to exit the case vehicle under her own power.

**CASE VEHICLE DRIVER INJURIES**

The police crash report indicated the driver was not injured and was not transported from the scene. The driver stated she sought no treatment for her injury subsequent to the crash and lost no work days as a result of the crash. The table below shows the driver’s interviewee reported injury and the injury mechanism.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Contusion {bruise} right foot, along lateral surface	minor 890402.1,1	Floor, center console	Probable	Interviewee (other occupant)

#### OTHER VEHICLE

The 1989 Toyota Camry LE was a front wheel drive, four-door sedan (VIN: 4T1SV22E2KU-----). The Toyota was not equipped with air bags and was equipped with passive, motorized, two-point shoulder belts in the front two seat positions with manual lap belts. Anti-lock brakes were an option on the vehicle, but it is not known if it was so equipped. The Toyota's wheelbase was 260 centimeters (102.4 inches). The odometer reading is not known because the Toyota's interior was not inspected.

**Exterior Damage:** The Toyota's first impact with the case vehicle involved the front of the vehicle. The front bumper, front of the left fender, left headlamp/turn signal assembly, grille and the hood were directly contacted and crushed rearward and displaced to the right. Direct damage began at the left front bumper corner and extended 82 centimeters (32.3 inches) along the bumper. Crush measurements were taken at the bumper level and the maximum residual crush was measured as 20 centimeters (7.9 inches) occurring at C<sub>2</sub>. The table below shows the Toyota's crush profile for its front impact with the case vehicle's right fender.

Units	Event	Direct Damage		Field L	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>	Direct	Field L
		Width CDC	Max Crush								±D	±D
cm	1	82	20	149	19	20	19	12	6	0	-37	0
in		32.3	7.9	58.7	7.5	7.9	7.5	4.7	2.4	0.0	-14.6	0.0

The second impact with the case vehicle involved the left front and left rear doors. The back portion of the left front door and front middle portion of the left rear door were directly contacted. There was paint transfer from the case vehicle on both doors, and the case vehicle's right rear tire scuffed and dented the left front door. Otherwise, there was scant damage to the doors from this impact. The direct damage began 68 centimeters (27.8 inches) forward of the left rear axle and extended 63 centimeters forward along the left front and left rear doors. Maximum residual crush was approximately 1 centimeter (0.4 inch) occurring at C<sub>4</sub> and C<sub>5</sub>. The table below shows the Toyota's crush profile for the side-slap impact with the case vehicle.

Units	Event	Direct Damage		Field L	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>	Direct	Field L
		Width CDC	Max Crush								±D	±D
cm	1	63	1	63	0	0	0	1	1	0	-30	-30
in		24.8	0.4	24.8	0.0	0.0	0.0	0.4	0.4	0.0	-11.8	-11.8

The direct damage from the stop sign impact (event 3) began at the left corner of the front bumper and extended approximately 14 centimeters (5.5 inches) along the bumper. There was only minor crush due to this impact. A crush profile could not be taken for the stop sign impact due to the overlapping damage from the Toyota's front impact with the case vehicle's right fender.

The Toyota's left side wheelbase was reduced 2 centimeters (0.8 inch) while the right side wheelbase was unchanged. Induced damaged involved the right portion of the bumper, the hood and the right and left fender. There was also minor induced damage to both left side doors.

**Damage Classification:** Based on the vehicle inspection the CDCs for the Toyota were determined to be: **11-FYEW-1 (330 degrees)** for the front impact to the case vehicle's right fender (event 1), **09-LPEW-1 (270 degrees)** for the left side impact to the case vehicle's right quarter panel (event 2), and **12-FLLE-1 (0 degrees)** for the stop sign impact (event 3). The WinSMASH reconstruction program, missing vehicle algorithm was used to reconstruct the Toyota's Delta Vs for the front impact to the right fender of the case vehicle. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 26 km.p.h. (16.2 m.p.h.), -22.5 km.p.h. (-14.0 m.p.h.), and 13.0 km.p.h. (8.1 m.p.h.). The reconstruction is considered borderline for this impact and the results appear reasonable. The WinSMASH reconstruction program, damage only algorithm, was used to reconstruct the Toyota's Delta Vs for the left side impact to the case vehicle's right quarter panel. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 4.0 km.p.h. (2.5 m.p.h.), 0.0 km.p.h. (0.0 m.p.h.), and 4.0 km.p.h. (-2.5 m.p.h.). The crash fits the reconstruction model for this impact and the results appear reasonable. The case vehicle was towed due to damage.

**Toyota's Occupants:** According to the police crash report, the driver of the Toyota [18-year-old,(unknown race, Hispanic) female] was restrained by her manual, three-point, lap-and-shoulder, safety belt system. The police crash report indicated the driver sustained a "C" (possible) injury, and was not transported from the scene to a medical facility.

