Gas/Electric Hybrid Vehicle Investigation/Vehicle to Vehicle
Dynamic Science, Inc./Case Number: DS05017
2005 Toyota Prius
California
July 2005

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.	2. Government Accession No.	3. Recipient Catalog No.
DS05017		

4. Title and Subtitle	5. Report Date
Gas/Electric Hybrid Vehicle Investigation	June 8, 2006
	6. Performing Organization Report No.

7. Author(s)	8. Performing Organization Report No.
Dynamic Science, Inc.	

9. Performing Organization name and Address	10. Work Unit No. (TRAIS)
Dynamic Science, Inc. 530 College Parkway, Ste. K Annapolis, MD 21401	11. Contract or Grant no. DTNH22-01-C-27002

12. Sponsoring Agency Name and Address	13. Type of report and period Covered [Report Month, Year]
U.S. Dept. of Transportation (NRD-32) National Highway Traffic Safety Administration 400 7th Street, SW Washington, DC 20590	14. Sponsoring Agency Code

15. Supplemental Notes

16. Abstract

This on-site investigation focused on the gas/electric hybrid system in a 2005 Toyota Prius, as well as conformance to Federal Motor Vehicle Safety Standard, Section 571.305, Standard No.305 (Electric-powered vehicles: electrolyte spillage and electrical shock protection). This two vehicle crash occurred in July 2005 at 1030 hours in an urban area of California. The case vehicle was a 2005 Toyota Prius being driven by a restrained 37-year-old female. There were two additional occupants in the Prius. The other vehicle was a 2004 Toyota Sequoia being driven by a 23-year-old female, who was restrained per the police report. There was one additional occupant in the Sequoia. The crash occurred within the confines of a four-leg intersection controlled by tri-color traffic signals. The Prius was traveling south. The Sequoia was traveling north and entered the left-turn only lane, intending to turn west. The Prius was crossing through the intersection as the Sequoia began its left turn, resulting in the front of the Sequoia striking the left side of the Prius. At impact, the case vehicle's left seat back mounted side air bag and left side air curtain deployed. The driver of the Prius sustained a fractured pelvis and lumbar vertebrae. The passenger in the second row left seating area sustained lacerations to her left hand and forehead. The second row right seat passenger sustained neck abrasions and was examined by paramedics at the scene, but did not receive any medical treatment. Both vehicles were towed from the scene. The 2005 Toyota Prius was later declared a total loss.

17. Key Words	18. Distribution Statement
Air bag, deployment, injury, side curtain, hybrid, child safety seat	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No of pages	22. Price

Form DOT F 1700.7 (8_72) Reproduction of this form and completed page is authorized

Dynamic Science, Inc.
Crash Investigation
Case Number: DS05017

TABLE OF CONTENTS

BACKGROUND

This on-site investigation focused on the gas/electric hybrid system in a 2005 Toyota Prius, as well as conformance to Federal Motor Vehicle Safety Standard, Section 571.305, Standard No.305 (Electric-powered vehicles: electrolyte spillage and electrical shock protection).

Figure 1. Left side damage - 2005 Toyota Prius

This two vehicle crash occurred in July 2005 at 1030 hours in an urban area of California. The case vehicle was a 2005 Toyota Prius (Figure 1) being driven by a restrained 37-year-old female. There were two additional occupants in the Prius. The other vehicle was a 2004 Toyota Sequoia being driven by a 23-year-old female, who was restrained per the police report. There was one additional occupant in the Sequoia.

Figure 2. Left side damage - 2005 Toyota Prius

The crash occurred within the confines of a four-leg intersection controlled by tri-color traffic signals. The Toyota Prius was traveling south and approached the intersection at a driver reported speed of 64-72 km/h (40-45 mph). The Toyota Sequoia was traveling north and entered the left-turn only lane, intending to turn west. The Prius was crossing through the intersection as the Sequoia began its left turn, resulting in the front of the Sequoia striking the left side of the Prius (Figure 2). At impact, the case vehicle's left seat back mounted side air bag and left side air curtain deployed. The Prius continued forward, traveled over the southwest corner of the intersection and struck a wall with its front right bumper and fender. Per the police report, both vehicles came to final rest near the southwest corner of the intersection.

The driver of the Prius sustained a fractured pelvis and lumbar vertebrae and was transported by ambulance to an area hospital, where she was hospitalized for six days. The passenger in the second row left seating area sustained lacerations to her left hand and forehead and was transported to a different hospital where she was treated and released. The second row right seat passenger sustained neck abrasions and was examined by paramedics at the scene, but did not receive any medical treatment.

The driver of the Sequoia sustained a burn to her left forearm and complained of chest, neck and shoulder pain. She was transported by ambulance to an area hospital. The second row right seat female passenger in the Sequoia sustained a fractured shoulder, a right knee contusion and complained of neck and back pain. She was transported by ambulance to the same hospital.

Both vehicle were towed from the scene. The 2005 Toyota Prius was later declared a total loss.

This case was identified by NHTSA during a review of GES police reports. On September 19, 2006, DSI was faxed a copy of the police report with instructions to locate the case vehicle. DSI located and obtained permission to inspect the Prius on September 23, 2005. Field work was completed on September 26, 2005.

SUMMARY

Crash Site

The two vehicle crash occurred in July 2005 at 1030 hours in an urban area of California. The crash occurred within the confines of a four-leg intersection controlled by tri-color traffic signals.

Figure 3. Approach of case vehicle - south

The Toyota Prius was traveling south on a seven lane, two way, undivided roadway (Figure 3). The north/south roadway was comprised of three northbound lanes, three southbound lanes, and a left-turn only lane on both sides of the intersection. Northbound traffic is separated from southbound traffic by double solid yellow lane lines and the left turn only lanes are delineated by solid white lane lines. The east/west intersecting roadway was also comprised of seven lanes, including three eastbound lanes, three westbound lanes and one left turn only lane on both sides of the intersection. The other vehicle, a 2004 Toyota Sequoia was traveling north in the left-turn only lane, intending to make a left-turn onto the intersecting street (Figure 4).

Figure 4. Approach of other vehicle - north

The posted speed limit for the north/south roadway was 56 km/h (35 mph). At the time of the crash the intersecting asphalt roadways were dry, there were no adverse weather conditions and no visual obstructions were present.

Pre Crash

The case vehicle is a 2005 Toyota Prius being driven by a restrained 37-year-old female. There was an unrestrained 44-year-old female passenger in the second row left seating position and a 3-year-old female passenger restrained in a child safety seat that was secured in the second row right seating position. The other vehicle was a 2004 Toyota Sequoia being driven by a 23-year-old female, who was restrained per the police report. There was a 58-year-old restrained female occupant in the second row right seating position.

The Toyota Prius was traveling south and approached the intersection at a driver reported speed of 64-72 km/h (40-45 mph).

The Toyota Sequoia was traveling north and entered the left-turn only lane in order to turn west. The Prius was in the intersection as the Sequoia began its left turn.

Crash

The Toyota Sequoia turned left as the Prius was crossing through the intersection and the front of the Sequoia struck the left side of the Prius (11LDEW3). The impact severity was moderate and resulted in the deployment of the case vehicle's driver's seat back mounted side air bag and left side curtain. The missing vehicle routine of the Winsmash program, computed a total delta V of 40.0 km/h (24.9 mph). The longitudinal and lateral components were -34.6 km/h (-21.5 mph) and 20.0 km/h (12.4 mph), respectively. The Prius continued south, traveled over the southwest corner of the intersection and struck a wall (01FREE6) that was adjacent to the sidewalk (Figure 6). Per the police report, both vehicles came to final rest near the southwest corner of the intersection.

Figure 5. Case vehicle's initial point of impact - south

Post Crash

The driver of the Prius sustained a broken pelvis and was transported by ambulance to an area hospital where she was hospitalized for six days. The passenger in the second row left seat sustained lacerations to her left hand and forehead and was transported to a different hospital where she was treated and released. The second row right seat passenger sustained neck abrasions and was treated on-scene by paramedics. Her father took custody of her at the scene and she did not receive any additional medical treatment.

Figure 6. Case vehicle's post-impact trajectory

Per the police report, the driver of the Sequoia sustained a burn to her left forearm and complained of chest, neck and shoulder pain. She was transported by ambulance to an area hospital. The Sequoia's second row right seat female passenger sustained a fractured shoulder, a right knee contusion and complained of neck and back pain. She was transported by ambulance to the same hospital as the driver. The level of treatment they received is currently unknown.

Both vehicles were towed from the scene. The 2005 Toyota Prius was later declared a total loss.

Vehicle Data - 2005 Toyota Prius

The 2005 Toyota Prius was identified by the Vehicle Identification Number (VIN): JTDKB20U253xxxxxx. The vehicle's odometer could not be read, as there was no power to the instrument panel. The Toyota Prius was a 5-door hatchback that was equipped with a 1.5 liter, four-cylinder engine, an electric motor, a continuously variable transmission, a sealed nickel-metal hydride traction battery, rack and pinion steering with electric power assist, and power-assisted front disc/rear drum brakes with an anti-lock brake system and integrated regenerative braking, Vehicle Stability Control and a tilt steering wheel.

The Prius was equipped with Goodyear Integrity P185/65R15 tires. The manufacturer's recommended cold pressure for the front tires was 241 kPa (35 psi) and 228 kPa (33 psi) for the rear. The specific tire information is as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	Flat	6mm (7/32 in)	Yes	None
LR	Flat	5 mm (6/32 in)	Yes	None
RR	221 kPa (32 psi)	5 mm (6/32 in)	No	None
RF	Flat	6 mm (7/32 in)	No	None

The seating in the Toyota Prius was configured with fabric covered front bucket seats with adjustable head restraints and a rear 60/40 split bench seat with folding backs and adjustable head restraints for all three second row seating positions. At the inspection, both front seats were adjusted to the middle track position. The driver's seat back angle was 64 degrees, the seat bottom angle was 14 degrees. The front right seat back was at a 75 degree angle and the seat bottom angle was 14 degrees. The second row bench seat back angle was 68 degrees and the seat bottom angle was 12 degrees.

The second row outboard seating positions were equipped with lower anchor points that are part of this vehicle's Lower Anchors and Tethers for Children (LATCH) system. All three second row seating positions were equipped with child safety top tether strap anchor points, located on the back of the second row seat backs.

Vehicle Damage

Exterior Damage - 2005 Toyota Prius

The 2005 Toyota Prius sustained moderate left side damage as a result of the impact with the Sequoia. The Prius sustained 364.0 cm (143.3 in) of direct damage along the left side beginning at the left front bumper corner, extending rearward (Figure 7). There was also direct damage to the right front of the case vehicle, beginning at the right front bumper corner and extending 95.0 cm (37.4 in) rearward down the right side, and 22.0 cm (8.7 in) laterally across the bumper (Figure 8).

Figure 7. Damage to left front of case vehicle

At the vehicle inspection, the left doors were found completely separated from the vehicle. It appears that both left doors were jammed shut post-crash, and were removed by fire/rescue personnel. The right front door was also found completely separated from the vehicle, but it does not appear that the right front damage was severe enough to jam the door post-crash. It is possible that it may have been removed by fire/rescue personnel during the driver's extrication. The right rear door remained closed and operational and although the rear liftgate could not be opened at the inspection, it appeared to be undamaged.

Figure 8. Damage to the right front of case vehicle

Six crush measurements were documented along the damaged left side as follows: C1=16.0 cm (6.3 in), C2=19.0 cm (7.5 in), C3=19.0 cm (7.5 in), C4=17.0 cm (6.7 in), C5=26.0 cm (10.2 in), C6=27.0 cm (10.6 in).

Figure 9. B pillar intrusion and trapped driver's seat belt

CDC:	Impact 1: 11LDEW3 Impact 2: 01FREE6	
Delta V:	Total	40.0 km/h (24.9 mph)
	Longitudinal	-34.6 km/h (-21.5 mph)
	Latitudinal	20.0 km/h (12.4 mph)
	Energy	87,062 joules (64,214 ft lbs)

Interior Damage - 2005 Toyota Prius

The case vehicle sustained moderate interior damage due to intrusion, occupant contacts and normal air bag deployment related damage.

There was blood found on the right rear door panel and in the right rear sill area, which is likely from the second row left seat passenger who sustained several lacerations in the crash. There were indentations in the fabric of the second row center seat back and inside edge of the second row right seat back. There was no occupant in the center rear seat, but the indentations may have been from the child safety seat that had been secured in the right rear seating position.

Figure 10. Intrusion into driver area

There was glazing integrity loss. The windshield was holed at the left A pillar, and the left front and left rear window glazing had disintegrated due to the left side impact.

The left front door panel, B pillar and lower A pillar all intruded laterally into the driver's area (Figure 10). The B pillar intrusion likely damaged the driver's seat belt retractor, causing her seat belt to lock in place post-crash, after it had been removed by the driver. There was slight longitudinal left front instrument panel intrusion.

The specific passenger compartment intrusions were documented as follows:

Position	Intruded Component	Magnitude of Intrusion	Direction
LF	Door panel	Greater than 10.0 cm (3.9 in)	Lateral
LF	A pillar	10.0 cm (3.9 in)	Lateral
LF	B pillar	9.0 cm (3.5 in)	Lateral
LF	Left instrument panel	2.0 cm (0.8 in)	Longitudinal

Manual Restraint Systems - 2005 Toyota Prius

The 2005 Toyota Prius was configured with manual 3-point lap and shoulder belts for each of the five seating positions. Both front seat belts were equipped with seat belt pretensioners, load limiters and adjustable D-rings that were in the full up position. Neither pretensioner actuated during the crash. The driver's belt was found in a semi-deployed position and was locked in place against the seat back by the intruding left B pillar. There was some slack in the belt, but not enough slack to be able to buckle the latchplate. It is likely that the B pillar retractor was damaged during the impact and the driver's seat belt may have locked in place post-crash, after the driver removed her belt. The driver's safety belt was configured with a sliding latch plate and an emergency locking retractor (ELR). The remaining safety belts were configured with sliding latch plates and switchable ELR/automatic locking retractors.

The second row outboard seating positions were equipped with the lower anchor bars that were part of this vehicle's Lower Anchors and Tethers for Children (LATCH) system. All three seating positions were equipped with child safety seat top tether anchor points, located on the second row seat backs.

Supplemental Restraint System - 2005 Toyota Prius

The 2005 Toyota Prius was equipped with advanced occupant protection systems, including: front dual stage driver and passenger air bags, seat back mounted side air bags for the front seats, and side air curtains that protect both the first and second row outboard seating positions. Per the auto manufacturer, the side air bags and side curtains are designed to deploy in "certain types of severe side-impact collisions".

The Prius was also equipped with safety belt pretensioners for the driver and front right passenger positions. There were no front air bag deployments or pretensioner actuations.

Figure 11. Deployed left side curtain and driver's seat back mounted air bag

The left side air bag and side air curtain both deployed as a result of the impact with the Toyota Sequoia (Figures 11 and 12).

The driver's side air bag deployed from the driver's seat back. The air bag was basically circular in shape and measured 36.0 cm (14.2 in) high by 33.0 cm (13.0 in) wide. There was a 14.0 x 11.0 cm (5.5 x 4.3 in) tether at the forward edge. Within the area bordered by the tether there were three small vent ports. There was no indication of occupant contact and the air bag was not damaged.

Figure 12. Driver's deployed side air bag

The left side air curtain deployed from the roof cladding. The side air curtain was 158.0 cm (62.2 in) long and 38.0 cm (15.0 in) high. It essentially ran from the A pillar to the C pillar. There were 17 horizontal folds in the curtain. There were no indications of occupant contact and the curtain was not damaged.

Child Safety Seat - 2005 Toyota Prius

The 3-year-old second row right seat passenger was secured in a Britax Roundabout forward facing child safety seat (CSS). The exact model number and manufacture date are unknown. According to the driver (also the mother of this occupant), the CSS was secured to the vehicle by the manual lap and shoulder belt, which had been threaded through the back of the frame of the CSS. The CSS was equipped with an internal harness designed to be placed across both of the child's shoulders and latched in a buckle between the legs. The seat was equipped with a harness retainer clip which, per the driver, was in use at the time of the crash. The driver was unsure whether or not the CSS was tightly secured post-crash, but reported that the child remained secured within the CSS and the CSS remained in the right rear seating position. The seat was not available for inspection.

Conformance to Sec. 571.305 Standard No.305; Electric-powered vehicles: electrolyte spillage and electrical shock protection

The case vehicle was examined to determine compliance with the 305 Standard.

- There were no indications of electrolyte spillage from the propulsion battery.
- There was no movement of the battery module.
- The electrical isolation test was not conducted. There was no power available.
- There were no indications of any arcing, fire or component meltdown.

Figure 13. Engine compartment

Figure 14.Traction battery located behind the second row seat back

Figure 15. Battery service plug (power cutoff)

Vehicle Data - 2004 Toyota Sequoia

Description:	2004 Toyota Sequoia	
VIN:	Unknown	
Odometer:	Unknown	
Engine:	4.7L, 8 cylinder	
Reported Defects:	None noted	
Cargo:	Unknown	
Damage Description:	“Major” front end damage, per the police report	
CDC:	Unknown	
Delta V:	Total	23.0 km/h (14.3 mph)
	Longitudinal	-22.7 km/h (-14.1 mph)
	Latitudinal	-4.0 km/h (-2.5 mph)
	Energy	73,622 joules (54,301 ft lbs)

Occupant Demographics - 2005 Toyota Prius

	Driver	Occupant 2	Occupant 3
Age/Sex:	37/Female	44/Female	3/Female
Seated Position:	Front left	Second row left	Second row right
Seat Type:	Fabric covered bucket seat	Fabric covered 60/40 split bench seat with folding backs	Fabric covered 60/40 split bench seat with folding backs
Height:	165 cm (65 in)	165 cm (65 in)	76 cm (30 in)
Weight:	75 kg (165 lbs)	70 kg (155 lbs)	14 kg (30 lbs)
Occupation:	Unknown	Nanny of Occupant #3	None
Pre-existing Medical Condition:	Bilateral L5 spondylolysis, anemia	None	None
Alcohol/Drug Involvement:	None	None	None
Driving Experience:	Unknown	Not Applicable	Not Applicable
Body Posture:	Upright	Presumed to be upright	Upright in child safety seat
Hand Position:	On steering wheel, positions unknown. Driver reported that she braced in anticipation of the impact but did not have her arms locked.	Unknown	Unknown
Foot Position:	Unknown	Presumed to be on floorboard	Unknown
Restraint Usage:	Manual lap and shoulder belt, used	Manual lap and shoulder belt, not used	Manual lap and shoulder belt used with child safety seat
Air bag:	Front air bag, nondeployed. Seat back mounted side air bag, deployed. Left side curtain, deployed.	Left side curtain, deployed.	Right side curtain, nondeployed.

Occupant Demographics - 2004 Toyota Sequoia

	Driver	Occupant 2
Age/Sex:	23/Female	58/Female
Seated Position:	Front left	Second row right
Seat Type:	Unknown	Unknown
Height:	Unknown	Unknown
Weight:	Unknown	Unknown
Occupation:	Unknown	Unknown
Pre-existing Medical Condition:	None noted	None noted
Alcohol/Drug Involvement:	None	Unknown
Driving Experience:	Unknown	Not applicable
Body Posture:	Unknown	Unknown
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	Lap and shoulder belt used per the police report.	Lap and shoulder belt used per the police report.

Occupant Injuries - 2005 Toyota Prius

Driver: Injuries obtained from the discharge summary, radiology reports, emergency room report, and driver interview.

Injury	OIC Code	Injury Mechanism	Confidence Level
Pelvic fracture, vertically through left sacrum	852800.3,6	Door	Certain
Fractures (2), left superior ramus, Fracture, left inferior pubic ramus[1]	852600.2,5	Door	Certain
Fracture, transverse processes of lumbar vertebrae 1 and 2	650620.2,8 650620.2,8	Impact forces	Possible
Cartilaginous fracture at left coastal margin[2]	450212.1,2	Door	Certain

Second row left occupant: Injuries obtained from the history and physical, emergency room records, operative record, radiology reports and driver interview. CT scan for head was negative.

Glasgow Coma Scale score = 14 (Eyes = 4/Motor = 6/Verbal = 4)

Injury	OIC Code	Injury Mechanism	Confidence Level
Concussion with loss of consciousness, awake upon arrival, amnesic for crash events	160608.3,0	Left side B-pillar	Possible
Laceration extending from left forehead into the left scalp (12.0 cm).	290600.1,7 190600.1,2	Side glass (pieces found in scalp)	Certain
Laceration, back of left hand, extending into tendon (5.8 cm)	740200.1,2	Left side B-pillar	Possible

[1]One line of injury code per aspect for pelvic injuries

[2]Coded as rib fracture, coding convention 23

Second row right occupant: Injuries obtained from the driver interview.

Injury	OIC Code	Injury Mechanism	Confidence Level
Abrasion to right side of neck	390202.1,1	Child safety seat internal harness strap	Certain
Abrasion to left side of neck	390202.1,2	Child safety seat internal harness strap	Certain

Occupant Kinematics - 2005 Toyota Prius

Driver Kinematics

The 37-year-old female driver of the case vehicle was seated in an upright posture in the fabric covered bucket seat and was restrained by the 3-point manual lap and shoulder belt. The shoulder belt anchorage adjustment was in the full up position. The seat was adjusted to between the middle and rearward most track position. The seat back was reclined at a 64 degree angle and the seat bottom had a 14 degree angle. The driver reported that she saw the Toyota Sequoia coming from her left and believes she "stiffened up" and may have lightly braced her arms against the steering wheel in anticipation of the impact. During the left side impact, the female driver initiated a forward and slightly lateral trajectory towards the 11 o'clock direction of force. The driver's seat back mounted side air bag and the left side curtain deployed. The left front door panel, side panel and B pillar intruded laterally into the driver's area, contacting the driver's left leg, hip, arm and lower torso. After the initial impact, the Prius was redirected towards the southwest corner of the intersection, traveled over the curb and struck a wall with it's right front, causing the driver to initiate a forward and slightly lateral trajectory towards the 1 o'clock direction of force. The driver was wearing contact lenses at the time of the crash and did not sustain any type of eye injury or damage to her lenses. She was not entrapped in the vehicle post-crash, but was unable to exit the vehicle on her own due to the jammed left front door and the pain from her injuries. The driver sustained a broken pelvis, fractured lumbar vertebrae, cuts to her left cheek and area above her left ear, an upper left arm bruise and severe lower leg bruising. She also reported that she has amnesia regarding most of the crash details. She was removed from the vehicle by rescue personnel and was transported by ambulance to a hospital where she was hospitalized for six days. She was then transferred to a different hospital for insurance reasons and remained there for 11 or 12 days. Nearly three months after the crash, the driver was still undergoing physical therapy for her injuries.

Second Row Left Occupant Kinematics

The 44-year-old second row left female passenger is presumed to have been seated forward facing in the fabric covered bench seat and was not restrained with the available 3-point manual

lap and shoulder belt (Figure 16). The seat back was reclined at a 68 degree angle and the seat bottom had a 12 degree angle. During the initial left side impact, the left side curtain deployed and this passenger initiated a forward and slightly lateral trajectory towards the 11 o'clock direction of force. It is likely that she struck the intruding left B pillar (covered by the deployed left curtain) with the left side of her face. After the initial impact, the Prius was redirected towards the southwest corner of the intersection, traveled over the curb and struck a wall with its right front, causing this occupant to initiate a forward and slightly lateral trajectory towards the 1 o'clock direction of force. According to the driver, this occupant was unconscious for a few minutes after the crash, but regained consciousness prior to the arrival of the paramedics. She was removed from the vehicle by rescue personnel and was transported by ambulance to an area hospital for treatment. She sustained a laceration to the top of her left hand that was deep enough to sever the tendon. She also sustained a forehead laceration, which began near her hairline and extended diagonally across the left side of her head to just above her left ear. This passenger also had severe bruising to both of her legs. The driver reported that this occupant was hospitalized for 4-5 days, but the official medical records show that this passenger was treated and released on the day of the crash.

Figure 16. Second row left seating position

Second Row Right Occupant Kinematics

The 3-year-old second row right female passenger was secured in a Britax Roundabout forward facing child safety seat that was secured to the vehicle with the available manual lap and shoulder belt (Figure 17). This child was secured within the CSS with the internal harness and retainer clip. The seat back cushion was reclined at a 68 degree angle and the seat bottom had a 12 degree angle. During the initial left side impact, this passenger initiated a forward and slightly lateral trajectory towards the 11 o'clock direction of force, likely engaging the

Figure 17. Second row right seating area

harness with her chest and both sides of her neck. After the initial impact, the Prius was redirected towards the southwest corner of the intersection, traveled over the curb and struck a wall with its right front, causing this occupant to initiate a forward and slightly lateral trajectory towards the 1 o'clock direction of force. This passenger was removed from the vehicle by bystanders and was checked at the scene by paramedics, but they did not render any medical treatment. Her father took custody of the child at the scene. She sustained neck abrasions from the internal CSS harness.

Attachment 1. Scene Diagram