Certified Advanced 208 Compliant Investigation / Single vehicle crash
Dynamic Science, Inc. / Case Number: 2003-74-186G
2003 Honda Odyssey
Nebraska
October, 2003

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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. Abstract

This single vehicle crash occurred in October, 2003 at 1615 hours in the state of Nebraska. The crash occurred just outside of a "T" intersection. The western leg of the intersection is a two lane, two way roadway. The concrete roadway was flat and dry. The speed limit is 48 km/h (30 mph). The northern leg of the intersection is a three-lane, two way roadway. The roadway consists of a northbound travel lane, a southbound travel lane, and a southbound left turn lane. At the eastern road edge there is a storm drain that is in line with the concrete curb.

The case vehicle was a 2003 Honda Odyssey minivan that was being driven by an unrestrained 16-year-old male. An unrestrained 15-year-old male was seated in the front right seat. The Odyssey was originally traveling east. As the Odyssey approached the intersection, the driver began a left hand turn. The driver took the turn too wide and the right front of this vehicle struck the storm drain with the right front. The right front wheel came off the vehicle and there was suspension damage. The frontal air bags deployed at this point. The right rear wheel of the vehicle then also contacted the curb. Neither occupant was injured in this crash.

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Dynamic Science, Inc.
Crash Investigation
Case Number: 2003-74-186G

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BACKGROUND:

Description:	This Certified Advanced 208 Compliant (CAC) case was identified by the local National Automotive Sampling System (NASS) team. The electronic data recorder (EDR) was harvested by the team. The EDR was sent to their respective Zone Center who forwarded it to the SCI offices for reading by the Honda Motor Company. DSI was notified on December 4, 2003. This was a combination investigation.
Investigation Type:	Certified Advanced 208 Compliant - Combination case
Crash Location:	Nebraska
Crash Date:	October, 2003
Notification Date:	December 4, 2003
Field Work Completed:	NA

SUMMARY

Crash Site

This single vehicle crash occurred in October, 2003 at 1615 hours in the state of Nebraska. The crash occurred just outside of a "T" intersection. The western leg of the intersection is a two lane, two way roadway. The concrete roadway was flat and dry. The speed limit is 48 km/h (30 mph). The northern leg of the intersection is a three-lane, two way roadway. The roadway consists of a northbound travel lane, a southbound travel lane, and a southbound left turn lane. At the eastern road edge there is a storm drain that is in line with the concrete curb.

Figure 1. Approach to area of impact (east)

Pre-Crash

The case vehicle was a 2003 Honda Odyssey minivan that was being driven by an unrestrained[1] 16-year-old male (173 cm/68 in, 64 kg/143 lbs). He was seated in a bucket seat that was adjusted to between the forward most and middle seat track positions. The seat back was upright at the time of the crash and it retained its pre-impact position. An unrestrained 15-year-old male (175 cm/69 in, weight unknown) was seated in the front right seat. This occupant was seated in a bucket seat that was adjusted to the middle seat track position. The seat back was upright at the time of the crash and it retained its pre-impact position.

[1]SCI change based on EDR and police data

Crash

The Odyssey was originally traveling east. As the Odyssey approached the intersection, the driver began a left hand turn. The driver took the turn too wide (Fig. 2) and the right front of this vehicle struck the storm drain (Fig. 3) with the right front (12FRLE4). The frontal air bags deployed at this point. The pretensioners did not actuate and the side air bags did not deploy. The right rear wheel of the vehicle then also contacted the curb (12RBWN1).

Figure 2. Left hand turn, approach to area of impact (east to north)

Post-Crash

Neither occupant was injured in this crash. Police indicate that the vehicle sustained $2000 in damages. The vehicle was towed from the scene to the owner's residence due to damage. The body shop removed and replaced the air bag modules and the EDR. All the removed components were provided to the NASS team.

Figure 3. Area of curb impact

Figure 4. Front right, case vehicle

VEHICLE DATA -2003 Honda Odyssey

The 2003 Honda Odyssey sport van was equipped with a 5-speed automatic transmission, 4-wheel anti-lock disk brakes, traction control, dual sliding rear doors, a tilt steering column, cruise control, power door and tailgate locks, power windows, and three-row, seven-passenger seating.

VIN:	5FNRL18673Bxxxxxx
Odometer:	5,901 km (3,666 miles)
Engine:	3.5 liter. V6
Reported Defects:	None
Cargo:	None

The 2003 Honda Odyssey was equipped with Michelin P225/60R16 tires. The specific tire data is as follows:

Tire	Tread	Measured pressure	Manufacturer recommended pressure
LF	6 mm (0.23 in)	207 kPa (30 psi)	303 kPa (44 psi)
LR	8 mm (0.31 in)	207 kPa (30 psi)	303 kPa (44 psi)
RF	7 mm (0.27 in)	Flat	303 kPa (44 psi)
RR	9 mm (0.35 in)	207 kPa (30 psi)	303 kPa (44 psi)

The front row and second row seating positions in the 2003 Honda Odyssey were equipped with bucket seats with adjustable head restraints. The second row seats can be moved together to form a bench seat and slide fore and aft to adjust leg room. The third row seating positions were configured with a bench seat with a folding back. The third row seat can be folded flat into the floor.

VEHICLE DAMAGE

Exterior Damage - 2003 Honda Odyssey

Damage Description:	The right front wheel and suspension were damaged. The right drive shaft was loose. The wheel had been removed prior to the vehicle inspection. There was direct contact damage to the right front bumper fascia (Figs. 5 & 6). There was abrasion contact damage to the right rear wheel (Fig. 7).	
CDC:	Impact 1: 12FRLE4 Impact 2: 12RBWN1	
Delta V:	Total	Unknown
	Longitudinal	Unknown
	Latitudinal	Unknown
	Energy	Unknown

Figure 5. Front right bumper corner, fascia damage

Figure 6. Close up of damage to front right bumper fascia

Interior Damage - 2003 Honda Odyssey

There was no crash related damage to the interior of the 2003 Honda Odyssey other than the normal damage to the steering wheel and instrument panel from the deploying air bags. There was no intrusion and all the doors remained closed and operational. There was no glazing damage.

Figure 7. Damage to right rear wheel

MANUAL RESTRAINT SYSTEMS - 2003 Honda Odyssey

The Odyssey was configured with manual 3-point lap and shoulder belts for both front positions, both second row positions, and the third row outboard positions. The front seat belts were equipped with retractor type pretensioners. The third row middle seat position was configured with a manual lap belt. The first row and second row seat restraints were configured with adjustable shoulder belt upper anchorages, all of which had been adjusted to the full down position. All the outboard seat belts were equipped with sliding latch plates. The driver's seat belt was equipped with an emergency locking retractor. The front right passenger's seat belt and all the rear outboard seat belts were equipped with switchable retractors (retractors that can be changed from an emergency locking retractor to an automatic locking retractor to assist in securing child seats).

The front seat belts were not used and the pretensioners did not actuate. The Honda EDR data indicated that the seat belt status for both front seats was "unbelted". The field investigator indicated that both front seat occupants were wearing their respective lap and shoulder belts. There was no physical evidence that the seat belts had been used in this crash. Seat belt usage was based on the driver's interviewee data. The police reported seat belt usage as "unknown". It appears more likely that the occupants were actually unbelted.

AIR BAG SYSTEM - 2003 Honda Odyssey

Front air bags

The Odyssey was equipped with advanced dual stage front air bags. The multi-stage air bags were certified by the manufacturer to meet the advanced air bag requirement of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The system consists of the SRS unit, the driver's air bag, the front right passenger's air bag, front seat belt pretensioners, and front impact sensors (located on the left and right inner fenders behind the front bumper).

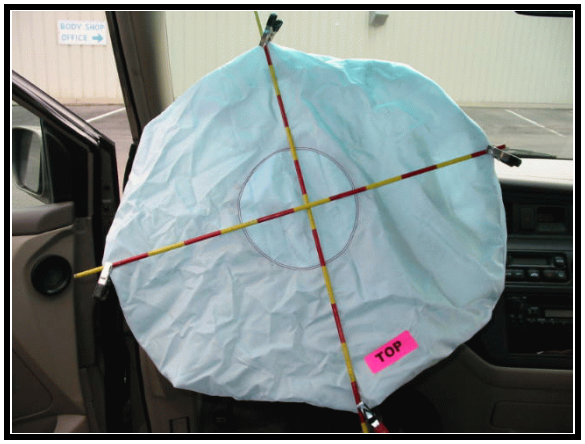

Figure 8. Driver's air bag

The driver's seat was equipped with a seat position sensor located on the inside of the seat bottom. When the driver's seat is moved to its full forward position, the deployment of the air bag is moderated to decrease its deployment force. The front right seat was equipped with a seat weight sensors unit located under the seat and seat weight sensors on the right and left seat risers. The weight sensors detect the weight on the seat, and send the information to the front right passenger's weight sensor unit. If the total weight is approximately 30 kg (65 lbs) or less[2], the front passenger's weight sensor sends a signal to the SRS unit to prevent the passenger's air bag from deploying. The passenger air bag cutoff indicator lamp illuminates to indicate that the front passenger's air bag is suppressed.

Figure 9. Front right passenger's air bag

The driver and front right passenger air bags deployed during the curb impact. The driver's air bag module was an "H" design and located in the center hub of the steering wheel rim. The top flap measured 16.0 cm (6.3 in) x 12.0 cm (4.7 in) high. The bottom flap measured 16.0 cm (6.3 in) wide x 9.0 cm (3.5 in) high. There was no contact evidence on the cover flaps. The diameter of the air bag measured 50.0 cm (19.6 in) in its deflated state (Fig. 8). There were circular vent ports located at the 10 and 2 o'clock positions on the back of the air bag, and two internal tethers. There were color transfers to the bottom left of the air bag face.

[2]Per Honda Odyssey Service Manual

The front right passenger air bag was a top mount design located in the right aspect of the instrument panel. There was a single module cover that was vaguely rectangular in shape. It measured 23.0 cm (9.1 in) wide x 9.0 cm (3.5 in) high (Fig. 9). The deflated air bag measured 60.0 cm (23.6 in) wide x 70.0 cm (27.5 in) high. The air bag was not equipped with vent ports. There was no damage or contacts to either the air bag module cover or the air bag itself.

Figure 10. Front right passenger's air bag cut off indicator

Side air bags

The vehicle was also equipped with seat back mounted side air bags for the front seat positions. There were no side air bag deployments. The side air bag system includes an Occupant Position Detection System (OPDS) for the front right seat. The system consists of sensors and an OPDS unit in the front passenger's seat back. The passenger's seat-back incorporates position sensors running from top to bottom. These determine the height of the occupant. A further sensor is incorporated into the right seat-back bolster, this determines the lateral position of the occupant. Signals from these sensors allow the OPDS to determine the passenger's seated position. In a side-on collision OPDS can then calculate if it is safe to deploy the side airbag or not. If the OPDS determines that it is unsafe to deploy the side air bag, a cutoff indicator on the instrument panel will alert the driver and the bag will be suppressed. The side impact sensors are located in the lower B pillars.

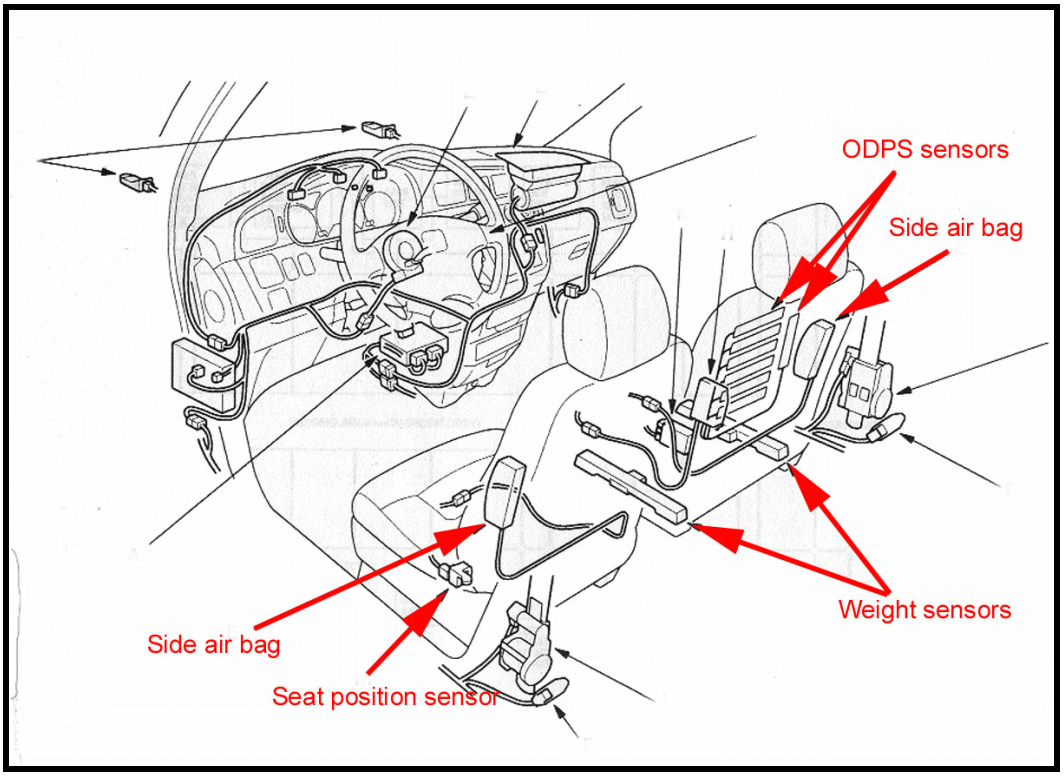

Figure 11. Overview of Odyssey air bag system

EDR data:

The EDR unit was harvested by the NASS team and was later sent to Honda. Honda provided the following information for this crash:

1. This was a multistage air bag system with an SRS system manufactured by TRW.
2. Driver and front right seat occupant positions equipped with seat belt pretensioners.
3. The vehicle was equipped with side (thorax) air bags with side impact sensors located at the side sills.

Event data analysis:

	Left side	**Right side**	
Seat belt status:	Unbelted	Unbelted	
Pretensioner fire:	No	No	
Seat weight sensor (SWS):	x	Child	
Air bag fire mode:	Simultaneous	Simultaneous	Mid speed (bags fired in simultaneous mode: unbelted
SRS ECU "ON" Time	14 ms		
Front crash sensor (FCS) "ON" time:	22 ms	14 ms	Right angle impact (8 ms separation in FCS "ON" time). The 8 ms difference in FCS "ON" time indicated that the right side sensor was reacting first.
Side crash sensor "ON" time	No trigger	No trigger	

Time to fire (TTF) time estimation:

1. The SRS recorded a hexadecimal value of 0E which converts to a decimal value of 14. The number represents the time in ms from trigger turned on to TTF. Trigger turned on is estimated to be 5 ms. The estimated TTF was the calculated to be 5 + 14 =19 ms.
2. The case severity is classified a relatively mild.

Delta V estimation:

1. The SRS recorded a hexadecimal value of 08 which converts to decimal value of 8 mph. An internal correction then calculated the delta v to be 12 mph.

EDR readout discussion:

This contractor has noted two inconsistencies between the Honda provided data and the field investigation. These are discussed below:

1. The Honda data indicated that the seat belt status for both front seats was "unbelted". The NASS field investigator indicated that both front seat occupants were wearing their respective lap and shoulder belts. There was no physical evidence that the seat belts had been used in this crash. Seat belt usage was based on the driver's interviewee data. The police reported seat belt usage as "unknown". It appears more likely that the occupants were actually unbelted.

2. The Honda data indicated that the seat weight sensor indicated that a child was present in the front right seat. There are two issues here. First, why did the sensor report that a child was present (weight less than 65 lbs)? The average weight for a 15-year-old male is 60 kg (132 lbs)[3].

   Second, why did the air bag then deploy? The answer to the first question is probably related to the centripetal acceleration experienced by the occupants. As the vehicle entered into the turn some amount of the front right passenger's weight would have been transferred laterally (against the door) and the weight sensor reading would have been low. The answer to the second question is not known. If the weight sensor did indeed read the lower weight then the air bag should not have deployed.

   According to the Odyssey Service Manual, the seat sensor is considered calibrated if the difference of a known weight of an object between 25-35 kg (55-77 lbs) placed on the seat and the weight read by the sensors is less than ±3.9 kg (8.6 lbs). Based on this information then it would seem possible that there is a gray area between 29.4-38.8 kg (65-85.6 lbs) where the sensors would indicate a child was present but still fire the air bag.

[3]National Center for Health Statistics

OCCUPANT DEMOGRAPHICS - 2003 Honda Odyssey

	Occupant 1	Occupant 2
Age/Sex:	16/Male	15/Male
Seated Position:	Front left	Front right
Seat Type:	Fabric covered bucket seat, adjusted to between the forward most and middle seat track positions. Seat back upright.	Fabric covered bucket seat, adjusted to middle seat track positions. Seat back upright.
Height:	173 cm (68 in)	175 cm (69 in)
Weight:	64 kg (143 lbs)	Unknown
Occupation:	Presumed to not be working	Presumed to not be working
Pre-existing Medical Condition:	None noted	None noted
Alcohol/Drug Involvement:	None	NA
Driving Experience:	Presumed to be one year or less	NA
Body Posture:	Sitting upright	Unknown
Hand Position:	Both hands on steering wheel, 10 and 2 o'clock positions	Unknown
Foot Position:	Left foot on floor, right unknown	Both feet on floorboard
Restraint Usage:	Manual lap and shoulder belt available, not used.	Manual lap and shoulder belt available, not used.
Air bag:	Driver's air bag available, deployed. Side air bag available, did not deploy.	Front right passenger's air bag available, deployed. Side air bag available, did not deploy.

OCCUPANT INJURIES -2003 Honda Odyssey

	Injury	OIC Code	Injury Mechanism	Confidence Level
Driver:	Not injured			
RF Occupant:	Not injured			

OCCUPANT KINEMATICS - 2003 Honda Odyssey

The unrestrained 16-year-old male driver was sitting upright in the fabric covered bucket seat. Both hands were on the steering wheel at the 10 and 2 o'clock positions. The seat had been adjusted to between the forward most and middle seat track positions. The seat back was essentially upright. As the case vehicle approached the intersection the driver began a sharp left hand turn. According to the driver, the vehicle was traveling at 56 km/h (35 mph). The left hand turn pitched this occupant to right somewhat. At impact with the curb the driver's air bag deployed. The driver engaged the deployed air bag. There was a color transfer contact to bottom left of the air bag face (Fig. 12) but there were no resulting injuries.

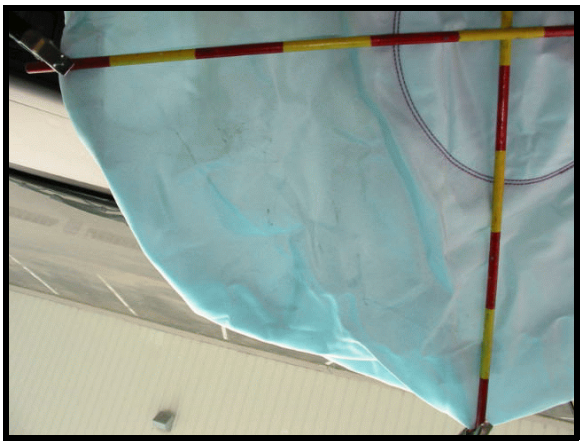

Figure 12. Bottom left of face of driver's air bag (image rotated)

The unrestrained 15-year-old male front right passenger was seated, forward facing, in the fabric covered bucket seat. The seat had been adjusted to the middle seat track position. The seat back was essentially upright. As the case vehicle approached the intersection the driver began a sharp left hand turn. The left hand turn pitched this occupant to right somewhat–causing him to possibly load the right side door. At impact with the curb the front right passenger's air bag deployed. This occupant likely engaged the deployed air bag but there were no resulting contacts or injuries.

Figure 13. Side view showing front right seat occupant position

Attachment 1. Scene Diagram

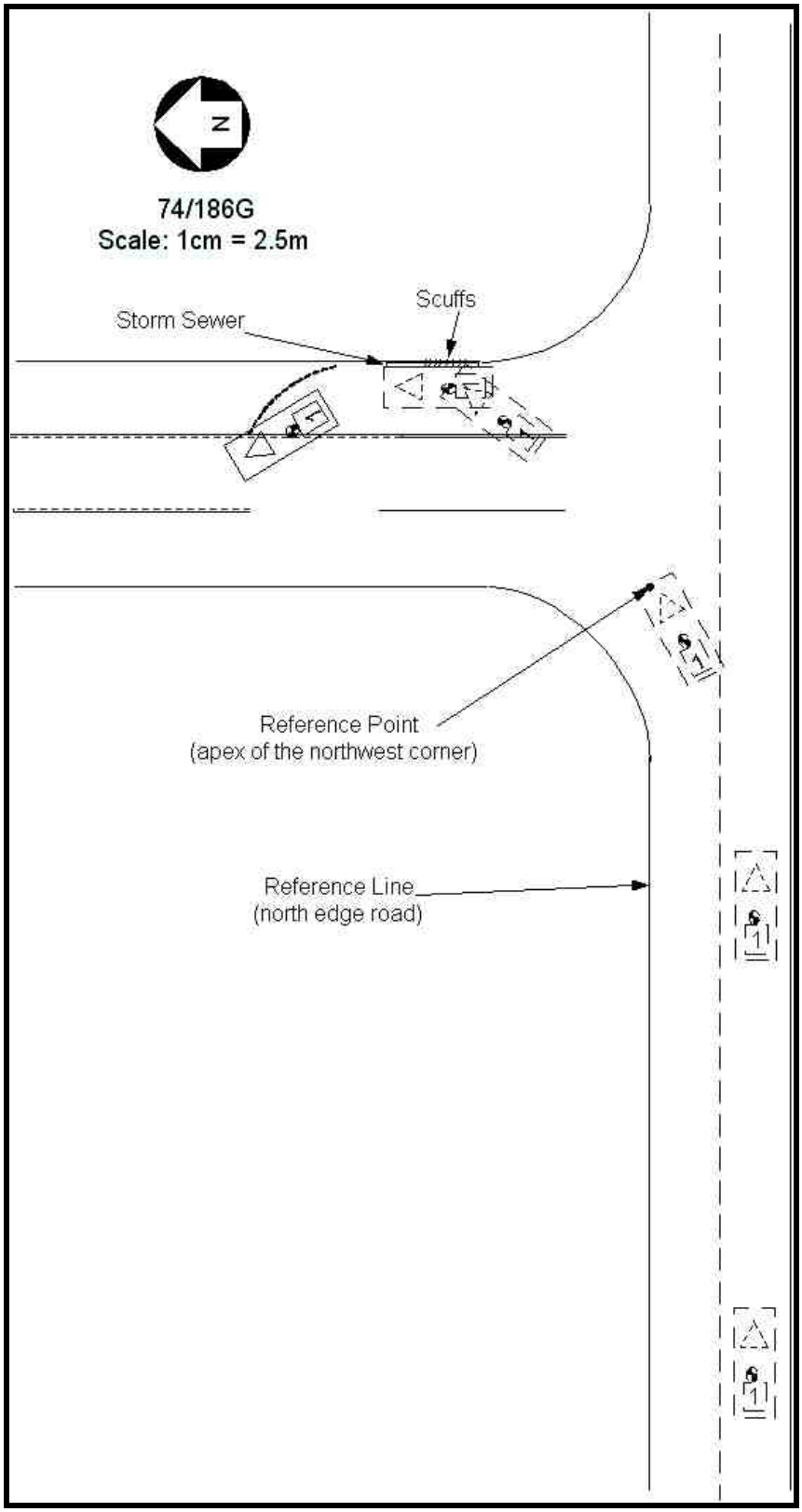

Figure 14. Scene diagram