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ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE INVESTIGATION

CASE NUMBER - IN09029
LOCATION - GEORGIA
VEHICLE - 2005 HONDA ODYSSEY TOURING
CRASH DATE - May 2009

Submitted:

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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.

Technical Report Documentation Page

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On-site Certified Advanced 208-Compliant Vehicle investigation involving a 2005 Honda Odyssey Touring minivan and a 2006 Ford E250 Econoline van.

16. *Abstract*

This report covers an On-Site Certified Advanced 208-Compliant Vehicle investigation involving a 2005 Honda Odyssey Touring minivan and a 2006 Ford E250 Econoline van. This investigation focused on the Honda, which was equipped with an Advanced Compatibility Engineering (ACE) body structure. The vehicle was also certified by the manufacturer to be compliant to the Advanced Air Bag portion of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The restrained 60-year-old male driver of the Honda was traveling northeast in the right lane of a three lane roadway approaching a 3-leg intersection. The Ford was stopped in the center lane heading northeast and the driver was preparing to initiate a left turn at the intersection. The driver of the Honda initiated a left steering maneuver to pass a non-contact vehicle and the front plane of the Honda impacted the back plane of the Ford. The impact was offset to the left on the front plane of the Honda and to the right on the back plane of the Ford. There was also a vertical mismatch between the vehicle's bumpers, causing the Honda to underride the back of the Ford. The force direction on the Honda was within the 12 o'clock sector and the impact force was sufficient to trigger a deployment of the driver's frontal air bag. Neither driver was transported to a hospital and both vehicle's were towed from the crash scene due to damage. The driver of the Honda sustained a contusion on the left shoulder from loading the safety belt. He also sustained a thermal burn on the left wrist from the frontal air bag exhaust gas.

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This on-site investigation focused on a 2005 Honda Odyssey Touring minivan (**Figure 1**), which was equipped with Honda's Advanced Compatibility Engineering (ACE) body structure. The vehicle's frontal air bag system was also certified by the manufacturer to be compliant to the Advanced Air Bag portion of Federal Motor Vehicle Safety Standard (FVMSS) 208. This crash was brought to our attention by the National Highway Traffic Safety Administration on August 27, 2009, following an on-line review of vehicles from an auto auction facility. This investigation was assigned on September 2, 2009. The crash involved the Honda and a 2006 Ford E250 Econoline van. The crash occurred in May, 2006 at 1610 hours, in Georgia and was investigated by the city police department. The Honda and crash scene were inspected on September 3-4, 2009. The Honda's driver was interviewed on September 15, 2009. This report is based on the police crash report, inspections of the Honda and crash scene, photographs of the Ford, interview with the driver of the Honda, occupant kinematic principles, and evaluation of the evidence.

Figure 1: The damaged 2005 Honda Odyssey Touring minivan

CRASH CIRCUMSTANCES

Crash Environment: The trafficway on which both vehicles were traveling was a 3-lane, undivided, city street, traversing in a northeast and southwest direction. The roadway had reversible lanes. At the time of the crash there were two northeast lanes and one southwest lane in operation. Each lane was approximately 3.3 m (10.8 ft) in width. The roadway had a positive 3.3% grade in the northeast direction and was bordered by 5 cm (2 in) curbs. Both vehicles were approaching a 3-leg, uncontrolled intersection. The intersecting city street traversed in a north-south direction. At the time of the crash the light condition was daylight, the atmospheric condition was clear, and the bituminous roadway pavement was dry. Traffic density was heavy and the site of the crash was urban commercial. See the Crash Diagram on page 9 of this report.

Figure 2: Arrow shows the stopped location of the Ford; the driver was waiting to initiate a left turn onto the intersecting street

Pre-Crash: The Ford was occupied by a 57-year-old male driver. He was stopped heading northeast in the center lane (**Figure 2**) waiting for southwest-bound traffic to clear. He intended to initiate a left turn onto the intersecting street. Based on the SCI interview, the Honda's restrained 60-year-old male driver was traveling northeast in the right lane approaching the intersection (**Figure 3**). He initiated a left steering

maneuver to pass a non-contact vehicle and approached the back of the stopped Ford. The Honda's driver took no actions to avoid the crash.

Crash: The front plane of the Honda (**Figure 4**) impacted the back plane of the Ford (**Figure 5**). The impact was offset to the left on the front plane of the Honda and to the right on the back plane of the Ford. There was also a vertical mismatch between the vehicle's bumpers, which caused the Honda to underride the back of the Ford. The force direction on the Honda was within the 12 o'clock sector and the impact force was sufficient to trigger a deployment of the driver's frontal air bag. Both vehicles rotated slightly counterclockwise and came to final rest on the roadway heading north-northeast.

Post-Crash: The police were notified of the crash at 1610 hours and responded to the crash scene. Emergency rescue and medical services did not respond to the crash scene. There were no police reported injuries and both vehicles were towed from the crash scene due to damage.

Figure 3: Approach of the Honda in the right lane

Figure 4: Front plane damage on the Honda from the impact with the back plane of the Ford

Figure 5: Damage on the back plane of the Ford from the impact with the Honda

CASE VEHICLE

Case Vehicle: The 2005 Honda Odyssey Touring was a front wheel drive, 4-door mini-van (VIN: 5FNRL38815B------) that was manufactured in January, 2005. The vehicle was equipped with a 3.5-liter, V6 engine, a 5-speed automatic transmission, 4-wheel anti-lock brakes, traction control, Electronic Stability Control, a tire pressure monitoring system, front and rear parking sensors, and power adjustable pedals. The front row was equipped with box mounted bucket seats, adjustable head restraints, lap-and-shoulder safety belts, dual stage driver and front passenger frontal air bags, seat-mounted side impact air bags, and side impact inflatable curtain (IC) air bags. The second row was equipped with two box mounted bucket seats, lap-and-shoulder safety belts, and Lower Anchors and Tethers for Children (LATCH). The third row was equipped with a split bench seat with a folding back, lap-and-shoulder safety belts, and LATCH at the center and right seating positions.

The Honda was also equipped with ACE body structure features. According to the manufacture's information[1] the ACE body structure (**Figure 6**) enhances frontal crash energy management through a network of load bearing structures in the front of the vehicle. The ACE design also helps reduce the potential for misalignment with the frame of a dissimilar sized vehicle for increased crash compatibility and enhanced occupant protection during a frontal crash. The specified wheelbase of the Honda was 300 cm (118.1 in). The mileage at the time of the crash was 54,026 miles (86,947 kilometers), which was obtained from a salvage yard document since the vehicle was equipped with an electronic odometer and was without power.

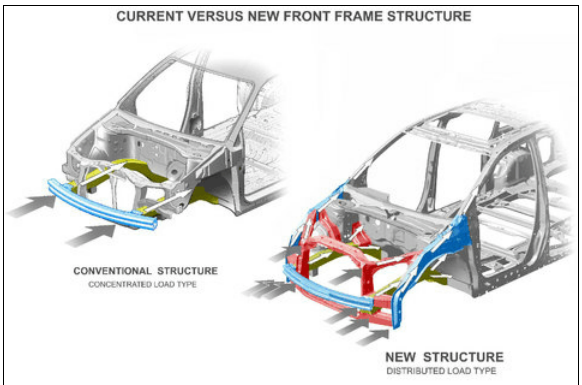


Figure 6: Manufacturer's illustration depicting the Honda's conventional structure and the ACE structure

Figure 7: The crush at the level of the upper radiator support; each increment on rods is 5 cm (2 in); vertical scale in tenths of meter

CASE VEHICLE DAMAGE

Exterior Damage: The impact with the Ford involved the front plane of the Honda. The left portion of the front bumper, hood, and the left fender were directly damaged. The direct damage began at the front left bumper corner and extended 56 cm (22 in) across the front plane. Due to the underride of the back of the Ford, the crush measurements were taken at the bumper level and upper radiator support level on the Honda. The maximum residual crush at the bumper level was 13 cm (5.1 in) occurring at C_1. The maximum residual crush at the upper radiator support level (**Figure 7**) was 44 cm (17.3 in), occurring 19 cm (7.5 in) left of C_1. The table below shows the crush profile, which reflects the average crush of the two levels.

Units	Event	Direct Damage		Field L	C_1	C_2	C_3	C_4	C_5	C_6	Direct	Field L
		Width CDC	Max Crush								±D	±D
cm	1	56	44	174	27	20	9	0	0	0	-54	0
in		22.0	17.3	68.5	10.6	7.9	3.5	0.0	0.0	0.0	-21.3	0.0

The left side wheelbase was reduced 12 cm (6.3 in), while the right side wheelbase was extended 1 cm (0.4 in). The induced damage involved the hood, left fender, and left front wheel.

1 www.hondanews.com/categories/842/releases/3648 9/14/09

Four of the ACE components on the front left sustained damage and were displaced. The components are identified in **Figure 8** as A, B, C, and D. Component A was displaced 9 cm (3.5 in) right and 20 cm (7.9 in) rearward. Components B, C, and D were displaced rearward 12 cm (4.7 in), 20 cm (7.9 in), and 4 cm (1.6 in), respectively. The undamaged components on the front right are shown in **Figure 9**. A left side view of the damaged components is shown in **Figure 10** and the front undercarriage in **Figure 11**. There was no displacement of the lower left A-pillar and no passenger compartment intrusion.

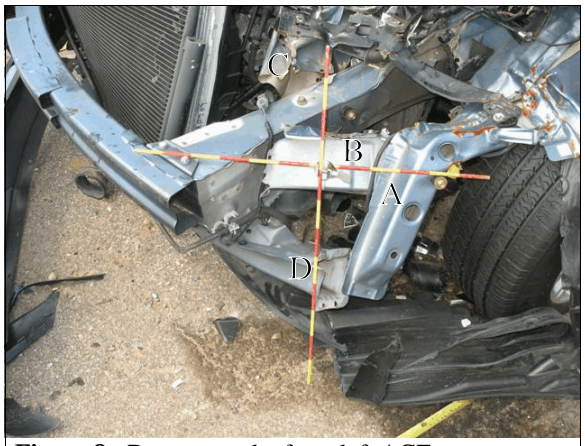


Figure 8: Damage to the front left ACE components identified as A, B, C, and D

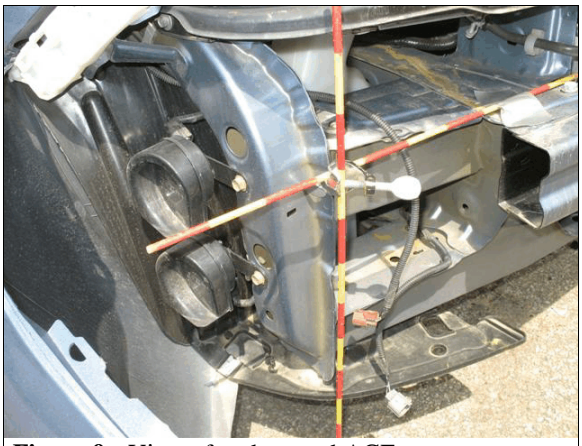


Figure 9: View of undamaged ACE components on front right

Figure 10: Left side view of damaged ACE components

Figure 11: Undercarriage view of the left front wheel, suspensions components, engine, and stub frame

Damage Classification: The Collision Deformation Classification (CDC) for the front impact was **12-FYEW-2** (**0** degrees). The missing vehicle algorithm of the WinSMASH program calculated the Honda's total Delta V as 27.0 km/h (16.8 mph). The longitudinal and lateral velocity changes were -27 km/h (-16.8 mph) and 0 km/h, respectively. Based on the damage to the two vehicles, the results appeared reasonable.

The manufacturer's recommended tire size was 235-710R460 (**Figure 12**) and the vehicle was equipped with tires of this size. The Honda's tire data are shown in the table below.

Tire	*Measured Pressure*		*Vehicle Manufacturer's Recommended Cold Tire Pressure*		*Tread Depth*		*Damage*	*Restricted*	*Deflated*
	kPa	psi	kPa	psi	milli-meters	32nd of an inch			
LF	234	34	228	33	7	9	None	Yes	No
LR	241	35	241	35	6	7	None	No	No
RR	234	34	241	35	4	5	None	No	No
RF	228	33	228	33	7	9	None	No	No

Vehicle Interior: Inspection of the interior of the Honda (**Figure 13**) revealed a possible occupant contact scuff on the driver's frontal air bag. There was no other discernable evidence of occupant contact. The steering wheel rim was not deformed and there was no movement of the energy absorbing steering column.

All of the vehicle's doors remained closed and operational. The pre-crash status of all the window glazing was either closed or fixed. The windshield was in place and cracked due to impact forces, while the remaining glazings were undamaged.

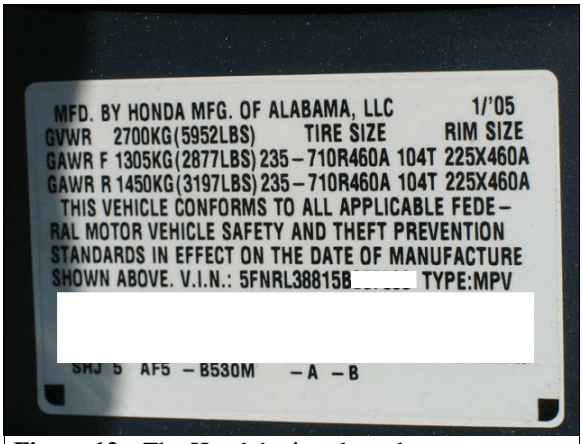


Figure 12: The Honda's tire placard

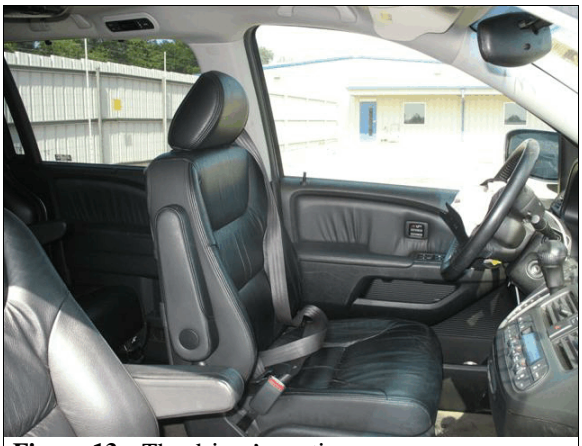


Figure 13: The driver's seating area

AUTOMATIC RESTRAINT SYSTEM

The Honda was equipped with a Certified Advanced 208-Compliant (CAC) frontal air bag system that consisted of dual stage driver and front passenger frontal air bags, a driver seat position sensor, safety belt buckle switch sensors, retractor-mounted pretensioners, and a front passenger weight sensor. The vehicle was also equipped with front seat-mounted side impact air bags and side impact IC air bags. The driver's frontal air bag deployed in this crash. Deployment of the front passenger air bag was suppressed since there was no front occupant present. The remaining air bags did not deploy.

The driver's frontal air bag was located within the steering wheel hub and the module cover was a two flap configuration constructed of pliable vinyl. Each cover flap was 15 cm (5.9 in) in width at the horizontal tear seam. The top flap was 7 cm (2.8 in) in height, while the bottom flap was 10 cm (3.9 in) in height. The flaps opened at the designated tear points and were undamaged. The deployed air bag (**Figure 14**) was 60 cm (23.6 in) in diameter and was designed with two 4.5 cm (1.8 in) diameter vent ports located on the back of the air bag at the 10 and 2 o'clock positions. There were also three internal tethers, each 7 cm (2.8 in) in width. Inspection of the air bag revealed no damage and one possible occupant contact scuff, which was located within the upper right quadrant 7 cm (2.8 in) above and 19 cm (7.5 in) to the right of the center of the air bag.

Figure 14: The driver's frontal air bag, yellow tape shows area of possible occupant contact

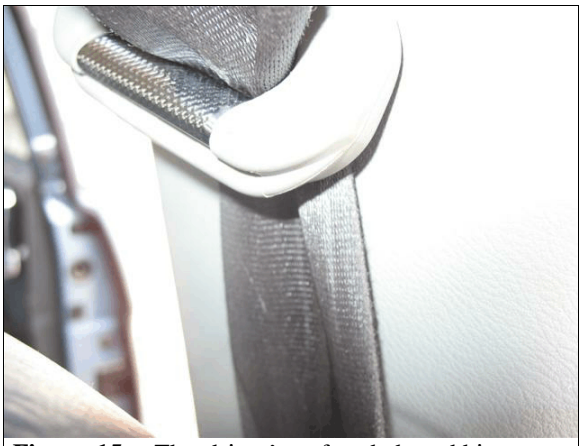


Figure 15: The driver's safety belt webbing was entrapped in the forward corner of the D-ring

Figure 16: Light load abrasions on the driver's latch plate belt guide

MANUAL RESTRAINT SYSTEM

The Honda was equipped with lap-and-shoulder safety belts for all the vehicle's seating positions. The driver's safety belt consisted of a continuous loop belt webbing, an Emergency Locking Retractor (ELR), a sliding latch plate, and an adjustable upper anchor that was in the full-down position. The front right safety belt was similarly equipped but had a switchable ELR/Automatic Locking Retractor (ALR), and the upper anchor was located in the middle position. The second and third row safety belts were similarly equipped as the front passenger safety belt. The second row adjustable anchors were located in the full-down position. The third row safety belts were equipped with fixed upper anchors.

The inspection of the driver's safety belt assembly revealed heavy historical usage scratches on the latch plate. The safety belt webbing was entrapped in the forward corner of the D-ring (**Figure 15**) and the retractor-mounted pretensioner actuated. The length of belt webbing that was extended out of the retractor was 137 cm (53.9 in) in length. There were also light load abrasions on the latch plate belt guide (**Figure 16**). This

evidence indicated that the driver was restrained by the lap-and-shoulder belt at the time of the crash.

CASE VEHICLE DRIVER KINEMATICS

Based on the SCI interview, the Honda's driver [60-year-old, male; 183 cm (72 in) and 118 kg (260 lbs)] was seated in an upright posture with his back against the seat back and both hands on the steering wheel at the 10 and 2 o'clock positions. The driver's seat track was located between the center and rear positions and the seat back was slightly reclined. The adjustable head restraint was located in the full-down position. The distance from the top of the seat back to the top of the head restraint was 20 cm (7.9 in). The tilt steering column was located in the center position.

The front impact with the back of the Ford displaced the driver of the Honda forward opposite the 12 o'clock direction of force and he loaded the safety belt, which caused a contusion on the left shoulder. A possible occupant contact scuff on the driver's frontal air bag indicated his face possibly loaded the deployed air bag, but he reported no such contact or associated injury. The driver reported a 5.1 cm (2 in) thermal burn on the left wrist, which was possibly due to air bag exhaust gas from the left vent port. The driver also reported stiffness to his left knee, but no injury. His left knee probably contacted the lower left instrument panel.

CASE VEHICLE DRIVER INJURIES

The driver stated that he did not seek treatment for his injuries. The table below shows the driver's injuries and injury sources.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source	Source Confidence	Source of Injury Data
1	Contusion (hematoma) left shoulder around left collar bone; size of a cherry tomato	minor 790402.1,2	Torso portion of safety belt system	Probable	Interviewee (same person)
2	Burn, thermal, 5.1 cm (2 in), left wrist near radius	minor 792000.1,2	Noncontact injury: air bag exhaust gases	Possible	Interviewee (same person)

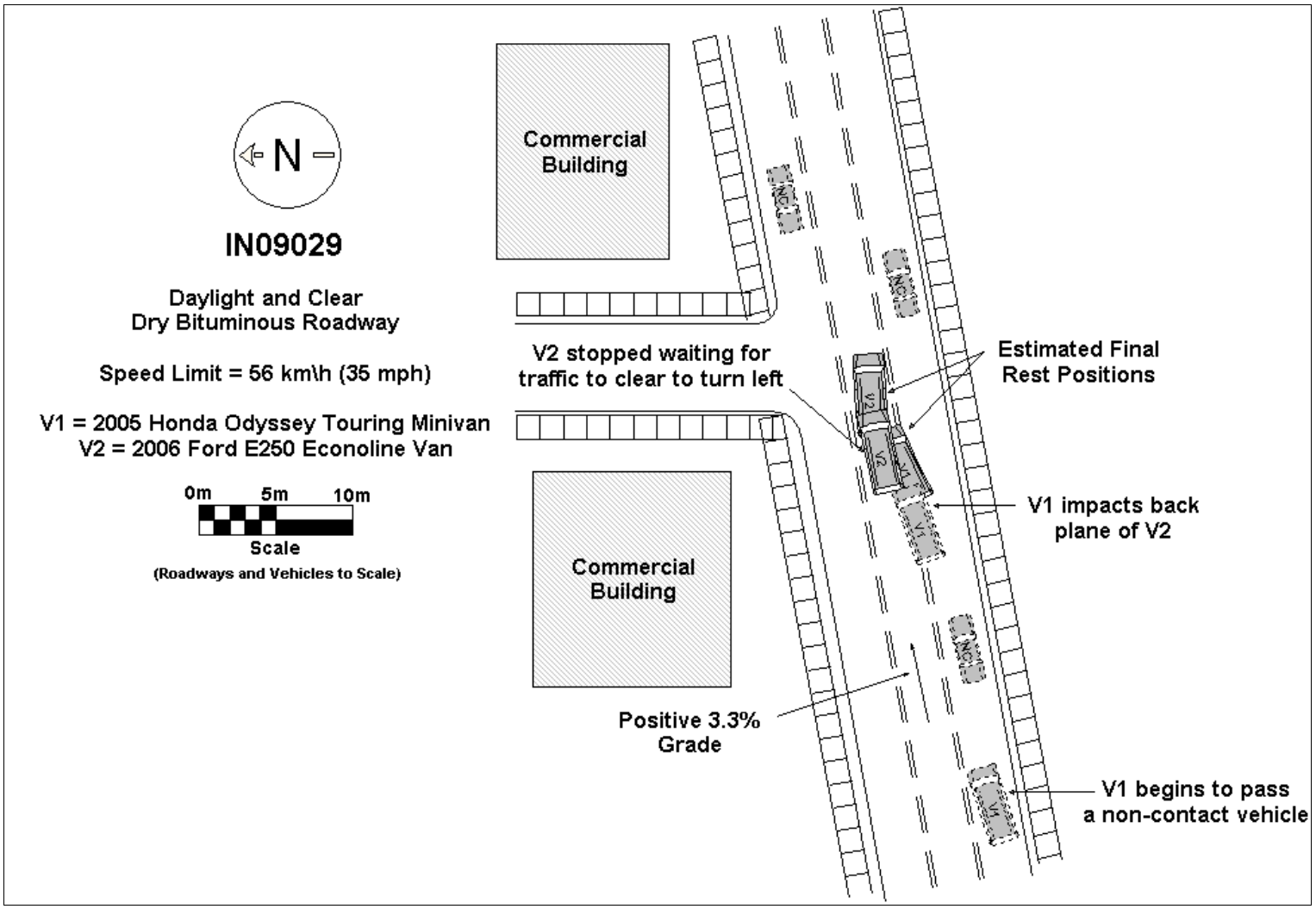
OTHER VEHICLE

The 2006 Ford E250 Econoline was a rear wheel drive, 3-door cargo van (VIN: 1FTNE24L76D------) equipped with a 5.4-liter, V8 engine, an automatic transmission, 4-wheel anti-lock brakes with electronic brake force distribution, and redesigned driver and front passenger frontal air bags.

Vehicle Exterior: The Ford had been repaired and was not inspected. Based on photographs of the damaged vehicle, the CDC was **06-BZEW-2** (**170** degrees).

The Missing Vehicle algorithm of the WinSMASH program calculated the Ford's total Delta-V as 24.0 km/h (14.9 mph). The longitudinal and lateral velocity changes were 23.6 km/h (14.7 mph) and -4.2 km/h (-2.6 mph), respectively. The results were based only on the Honda's crush profile and should be considered a borderline reconstruction of the Ford's Delta V.

Other Vehicle's Occupants: The police crash report indicated that the Ford's driver (56-year-old, male) was restrained by the lap-and-shoulder safety belt. He did not sustain any injuries and was not transported to a medical facility. The restraint status and seat position of the Ford's 55-year-old male passenger was not indicated. He sustained no injuries.


N
IN09029
Daylight and Clear
Dry Bituminous Roadway
Speed Limit = 56 km\h (35 mph)
V1 = 2005 Honda Odyssey Touring Minivan
V2 = 2006 Ford E250 Econoline Van
0m 5m 10m
Scale
(Roadways and Vehicles to Scale)
Commercial Building
Commercial Building
V2 stopped waiting for traffic to clear to turn left
Estimated Final Rest Positions
V1 impacts back plane of V2
Positive 3.3% Grade
V1 begins to pass a non-contact vehicle