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ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE INVESTIGATION

CASE NUMBER - IN-05-036
LOCATION - TEXAS
VEHICLE - 2005 HONDA ACCORD
CRASH DATE - September 2005

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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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16. *Abstract* This report covers an on-site investigation of an air bag deployment crash that involved a 2005 Honda Accord LX (case vehicle) and a 1999 Honda Accord EX (other vehicle), which collided front to side in the intersection of an Interstate entrance/exit ramp and a city street. This crash is of special interest because the case vehicle was equipped with Advanced Occupant Protection System (AOPS) features, and the case vehicle's driver [35-year-old, unknown race (Hispanic) female] and front right passenger [24-year-old, unknown race (Hispanic) female] each sustained police reported “C” (possible) injuries as a result of the crash. The case vehicle was traveling east in the inside through lane of an Interstate exit ramp approaching a four-leg intersection. The other vehicle was traveling north in the inside through lane of a six lane, divided, city street approaching the same intersection. Both vehicles entered the intersection, and the front of the case vehicle impacted the left side of the other vehicle causing the case vehicle's driver and front right passenger air bags to deploy. The case vehicle rotated counterclockwise and most likely came to rest in the northeast quadrant of the intersection. The other vehicle rotated clockwise and also most likely came to rest in the northeast quadrant of the intersection. No physical evidence of the impact or final rest positions was located during the scene inspection. No final rest positions were depicted on the police crash schematic. The case vehicle’s driver was most likely seated in an upright driving position. Her seat was between its middle and rearmost track positions, and her seat back was slightly reclined. She was not restrained by her safety belt system. As a result of the crash, the driver’s face and upper chest impacted her air bag, her left hand impacted and broke off the turn signal lever and her knees impacted and broke the plastic of the knee bolster. The driver was not transported from the scene to a medical facility. The case vehicle’s front right passenger was most likely seated in a upright position. Her seat was in its middle track position, and her seat back was slightly reclined. She was not restrained by her safety belt system. Her face and chest impacted the deployed air bag, and she most likely contacted the right front door during the post-impact rotation. The front right passenger was treated at the scene by emergency medical personnel. She was not transported to a hospital.			
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This investigation was brought to NHTSA's attention on or about October 6, 2005 by NASS CDS/GES sampling activities. This crash involved a 2005 Honda Accord LX (case vehicle) and a 1999 Honda Accord EX (other vehicle), which collided front to side in the intersection of an Interstate entrance/exit ramp and a city street. The crash occurred in September, 2005, at 11:05 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 certified advanced 208-compliant air bags, and the case vehicle's driver [35-year-old, unknown race (Hispanic) female] and front right passenger [24-year-old, unknown race (Hispanic) female] each sustained police reported "C" (possible) injuries as a result of the crash. This contractor inspected the case vehicle on October 27 and the crash scene on October 28, 2005. The case vehicle driver could not be contacted. This report is based on the police crash report, scene and vehicle inspections, occupant kinematic principles, and this contractor's evaluation of the evidence.

SUMMARY

The case vehicle was traveling east in the inside through lane of a three lane Interstate exit ramp approaching a four-leg intersection. The other vehicle was traveling north in the inside through lane of a six lane, divided, city street approaching the same intersection. Both vehicles entered the intersection, and the front of the case vehicle impacted the left side of the other vehicle causing the case vehicle's driver and front right passenger air bags to deploy. The case vehicle rotated counterclockwise and most likely came to rest in the northeast quadrant of the intersection. The other vehicle rotated clockwise and also most likely came to rest in the northeast quadrant of the intersection. No physical evidence of the impact or final rest positions was located during the scene inspection. No final rest positions were depicted on the police crash schematic.

The CDC for the case vehicle was determined to be: **01-FDEW-2** (**30** degrees). The WinSMASH reconstruction program, missing vehicle, algorithm, calculated the case vehicle's Total, Longitudinal, and Lateral Delta Vs respectively as: 36 km.p.h. (22.3 m.p.h.), -31.2 km.p.h. (-19.4.0 m.p.h.), and -18.0 km.p.h. (-11.2 m.p.h.). The case vehicle was towed due to damage.

The other vehicle was not inspected, so no CDC could be assigned. The WinSMASH reconstruction program, missing vehicle, algorithm, calculated the other vehicle's Total, Longitudinal, and Lateral Delta Vs respectively as: 38 km.p.h. (23.6 m.p.h.), -19.0 km.p.h. (-11.8 m.p.h.), and 32.9 km.p.h. (20.4 m.p.h.). The other vehicle was towed due to damage.

Immediately prior to the crash the case vehicle's driver was most likely seated in an upright driving position. Her left foot was most likely on the floor, her right foot on the accelerator or brake, and one or both hands on the steering wheel. Her seat track was located between its middle and rearmost positions, the seat back was slightly reclined, the tilt steering column was located in its full up position, and the telescoping steering column was positioned full forward, toward the instrument panel. The driver was not restrained by her safety belt system.

The case vehicle's impact with the other vehicle caused the case vehicle's driver to continue forward and move rightward along a path opposite the case vehicle's 30 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated latterly to the left. The driver's face and upper chest impacted the deployed air bag, her left hand impacted and broke off the turn signal lever and her knees impacted and broke the plastic of her knee bolster. Following the impact, the driver most likely rebounded off her air bag and moved to the right and back into her seat as the case vehicle rotated counterclockwise. The driver most likely remained in her seat as the case vehicle came to final rest. She was most likely able to exit the case vehicle without assistance following the crash. She was not transported from the scene to a medical facility. The deployment of the case vehicle's driver air bag prevented the driver from impacting the steering wheel and possibly the windshield and mitigated her injuries.

Immediately prior to the crash, the case vehicle's front right passenger was most likely seated in an upright position; however, the position of her feet, arms and hands is unknown. Her seat track was located in its middle position, and the seat back was slightly reclined. She was not restrained by her safety belt system..

The case vehicle's impact with the other vehicle caused the front right passenger to continue forward and move rightward along a path opposite the case vehicle's 30 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated latterly to the left, and her face and chest impacted her deployed air bag. The passenger most likely rebounded off the air bag and moved to the right and back into her seat as the case vehicle rotated counterclockwise. She most likely contacted the right front door during the post-impact rotation. The front right passenger most likely remained in her seat as the case vehicle came to final rest. She was most likely able to exit the case vehicle under her own power following the crash. The deployment of the front right passenger's air bag prevented her from impacting the instrument panel and windshield and mitigated her injuries.

CRASH CIRCUMSTANCES

Crash Environment: The trafficway on which the case vehicle was traveling was a three-lane, undivided Interstate exit ramp traversing in an easterly direction. The case vehicle was eastbound approaching a four-leg intersection. The trafficway on which the other vehicle was traveling was a six-lane, divided, city street traversing in north-south direction. The other vehicle was northbound approaching the same four-leg intersection. The west leg of the intersection had two through lanes, a left turn lane and a channelized right turn lane. The left turn lane and outside through lane were approximately 4.3 meters (14.2 feet) in width while the center through lane was 3.7 meters (12.1 feet) in width. The roadway pavement markings consisted of a solid yellow left outside edge line, solid white right edge line, solid white left turn lane line and a white left turn directional arrow. The east leg of the intersection was an entrance ramp to an Interstate highway and had two through lanes. Each lane was approximately 4.2 meters (13.8 feet) in width. The roadway pavement marking consisted of a solid yellow left edge line and solid white right edge line. The south leg of the intersection had two northbound through lanes, a channelized right turn lane, three southbound through lanes, and was divided by a raised, curbed grass median. The average lane width was 3.7 meters (12.1 feet), the median was 4.2 meters (13.8 feet) in width and

the roadway had a 1.2% positive grade to the north. Roadway pavement marking consisted of solid white outside edge lines, broken white lane lines, solid yellow median lines and right turn directional arrow. The north leg of the intersection had three northbound through lanes, a curbed, raised, concrete median; three southbound through lanes and a left turn lane. The average lane width was 3.6 meters (11.8), and the median was 1.5 meters (4.9 feet) wide. Roadway pavement marking consisted of solid white outside edge lines, solid yellow median edge lines, broken white lane lines, solid white left turn lane line and left turn directional arrow. At the time of the crash the light condition was dark, but illuminated by overhead street lamps, the atmospheric condition was cloudy and the road pavement was dry concrete with an estimated coefficient of friction of 0.70. Traffic density was light and the site of the crash was commercial. See the Crash Diagram at the end of this report.

Pre-Crash: The case vehicle was traveling east in the inside through lane (**Figure 1**). The driver was intending to continue straight through the intersection. The other vehicle was traveling north in the inside through lane (**Figure 2**). Its driver was also intending to continue straight through the intersection. It is unknown if the case vehicle's driver made any avoidance maneuvers prior to the crash. The crash occurred in the four-leg intersection of the two trafficways (**Figure 3**).

Crash: The front of the case vehicle (**Figure 4** below) impacted the left side of the other vehicle causing the case vehicle's driver and front right passenger air bags to deploy.

Post-Crash: As a result of the impact, the case vehicle rotated counterclockwise and most likely came to rest in the northeast quadrant of the intersection (**Figure 3**). The other vehicle rotated clockwise and also most likely came to rest in the northeast quadrant of the intersection. No physical evidence of the impact or final rest

Figure 1: Approach of case vehicle eastbound to intersection in inside through lane

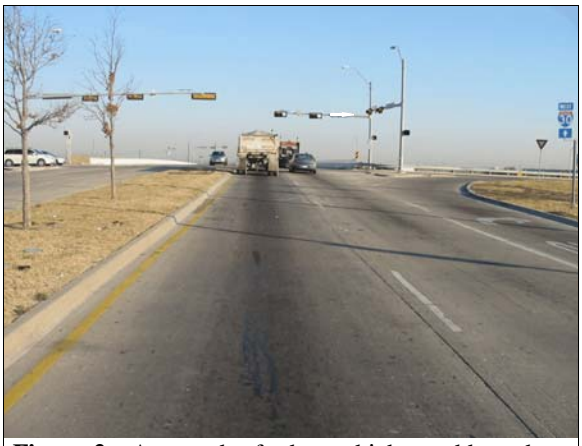


Figure 2: Approach of other vehicle northbound to intersection in inside lane

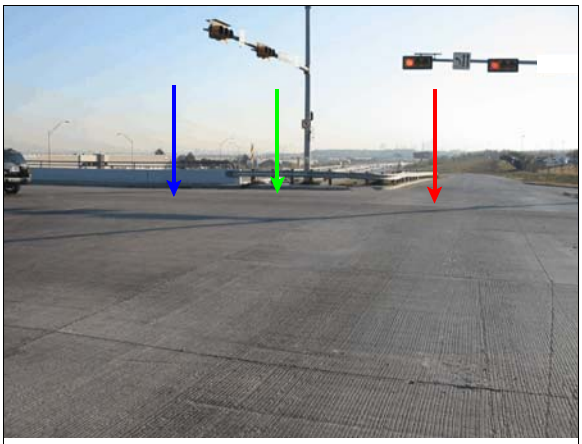


Figure 3: View northwest to area of impact (red arrow) and area of final rest of both vehicles, blue arrow shows estimated area of final rest of case vehicle, green arrow shows estimated area of final rest of other vehicle

positions was located during the scene inspection. No final rest positions were depicted on the police crash schematic.

Figure 4: Front left overview of damage to case vehicle, each number on tape measure is tenths of meter, each stripe on rods is 5 cm (2 in)

CASE VEHICLE

The 2005 Honda Accord was a front wheel drive, four-door sedan (VIN: 1HGCM56415A------) equipped with a 2.4L 4-cylinder engine, five-speed automatic transmission, and power assisted four wheel anti-lock disc brakes. The front seating row was equipped with bucket seats with adjustable head restraints, dual stage driver and front right passenger air bags, a tilt and telescopic steering column, a front right passenger occupant detection system, seat back-mounted side impact air bags with front right passenger "Occupant Position Detection System" (OPDS), side curtain air bags, driver and front right passenger manual safety belts with adjustable upper anchors and retractor mounted safety belt pretensioners and safety belt usage sensors. The back seat was equipped with a bench seat with adjustable head restraints in the outboard seat positions, manual safety belts in all three back seat positions and side curtain air bags. The case vehicle was also equipped with a LATCH system for securing child safety seats. Lastly, 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 various sensors in the case vehicle's advanced occupant restraint system analyze a combination of factors including the predicted crash severity, safety belt usage and presence of a front right passenger to determine the front air bag inflation level appropriate for the severity of the crash. The OPDS utilizes sensors in the front right passenger's seat back to detect the height and seating position of the passenger. If a child or small-statured adult is leaning into the deployment path of the seat back-mounted side impact air bag, sensors suppress deployment of the side impact air bag.

CASE VEHICLE DAMAGE

Exterior Damage: The case vehicle's contact with other vehicle involved nearly the entire frontal plane (**Figure 5**). The case vehicle's front bumper, bumper fascia, grille, radiator, headlamp/turn signal assemblies, and hood were directly damaged and crushed rearward. Direct damage began at the front right bumper corner

Figure 5: Damage to front of case vehicle from impact with the other vehicle

and extended 140 centimeters (55.1 inches) across the bumper. Residual maximum crush was measured as 39 centimeters (15.4 inches) occurring at C_3. The table below shows the case vehicle's crush profile.

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	140	39	112	15	24	39	29	22	13	0	0
in		55.1	15.4	44.1	5.9	9.4	15.4	11.4	8.7	5.1	0.0	0.0

The case vehicle's left side wheelbase was shortened 3 centimeters (1.2 inches) while the right side wheelbase was extended 1 centimeter (0.39 inch). Induced damage involved both fenders as well as the hood, and the windshield glazing. No obvious induced damage or remote buckling was noted to the remainder of the case vehicle's exterior.

The case vehicle's recommended tire size was: P205/65R15 and the 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	32nd of an inch			
LF	186	27	207	30	5	6	No	No	No
RF	193	28	207	30	5	6	No	No	No
LR	193	28	200	29	7	9	No	No	No
RR	207	30	200	29	7	9	No	No	No

Vehicle Interior: Inspection of the case vehicle's interior (**Figure 6** and **Figure 7** below) revealed occupant contact to the knee bolster and turn signal lever. The turn signal lever was broken off the steering column, and the knee bolster was broken. There was also a possible lip print on the center portion of the driver's air bag. No passenger compartment intrusion was observed, and there was no deformation of the steering wheel or obvious compression of the energy absorbing steering column (**Figure 8** below).

Figure 6: Overview of steering wheel, instrument panel and windshield

Damage Classification: Based on the vehicle inspection, the CDC for the case vehicle was determined to be: **01-FDEW-2** (**30** degrees). The WinSMASH reconstruction program, missing vehicle, algorithm, was used to reconstruct the case vehicle's Delta V. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 36 km.p.h. (22.3 m.p.h.), -31.2 km.p.h. (-19.4 m.p.h.), and -18.0 km.p.h. (-11.2 m.p.h.). This was a borderline reconstruction and the results appeared reasonable. The case vehicle was towed due to damage.

Figure 7: Overview of case vehicle's instrument panel and windshield, arrow shows location of front right passenger air bag

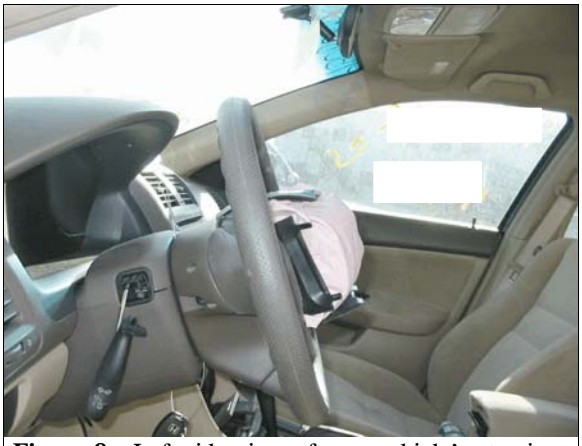


Figure 8: Left side view of case vehicle's steering wheel and steering column

Figure 9: Case vehicle's driver air bag upper module flap

Figure 10: Arrows show driver's air bag vent ports

AUTOMATIC RESTRAINT SYSTEM

The case vehicle's driver air bag was located in the steering wheel hub. An inspection of the air bag module cover flaps and the air bag fabric revealed that the cover flaps opened at the designated tear points. There was no evidence of damage during the deployment to the air bag or the air bag module cover flaps (**Figure 9**). The module cover consisted of two rectangular cover flaps constructed of pliable vinyl approximately 3 millimeters (0.12 inch) thick. Both the upper and lower cover flaps were 12 centimeters (4.7 inch) in width and 6 centimeters (2.4 inches) in height. The driver's air bag was designed with two tethers, each approximately 6 centimeters (2.4 inches) in width, and had two vent ports (**Figure 10**), approximately 5 centimeters (2 inches)

in diameter, located at the 11 and 1 o'clock positions near the center of the back of the air bag. The deployed driver's air bag (**Figure 11** below) was round with a diameter of approximately 55 centimeters (21.7 inches). The distance between the mid-center of the driver's seat back, as positioned at the time of the vehicle inspection (i.e., seat between middle and rearmost track position, seat back slightly reclined), and the front surface of the air bag's fabric at approximate full excursion was 47 centimeters (18.5 inches). An inspection of the driver's air bag fabric revealed a possible lip print on the center of the air bag as well as some kind of fluid stain, also near the center of the air bag.

Figure 11: Case vehicle driver's air bag, arrow shows location of possible lip imprint, yellow tape shows locations of stain, they did not appear to be related to occupant contact

The front right passenger's air bag was located in the top of the instrument panel (**Figure 12**). An inspection of the front right air bag module cover flaps (**Figure 12**) and the air bag fabric revealed that the cover flaps opened at the designated tear points. There was no evidence of damage during the deployment to the air bag or the cover flaps. The module cover consisted of two rectangular cover flaps constructed of pliable vinyl approximately 4 millimeters (0.16 inch) thick. The upper and lower cover flaps were 22.5 centimeters (8.9 inch) in width and 5 centimeters (2 inches) in height. The distance between the front of the instrument panel and the leading edge of the module cover flaps was approximately 15 centimeters (5.9 inches). The front right passenger's air bag was designed without any tethers. The front right air bag had two vent ports, each approximately 6 centimeters (2.4 inches) in diameter, located at the 2:30 and 9:30 o'clock positions. The deployed front right air bag (**Figure 14** below) was rectangular with a height of approximately 55 centimeters (21.7 inches) and a width of approximately 40 centimeters (15.7 inches). The distance between the mid-center of the front right passenger's seat back, as positioned at the time of the vehicle inspection (i.e., seat at middle track position, seat back slightly reclined), and the front surface of the air bag's fabric at approximate full excursion was 32 centimeters (12.6 inches). An inspection of the front right passenger's air bag fabric revealed no evidence of occupant contact; however, there was a large splatter of what appeared to be dried coffee on the air bag.

Figure 12: Case vehicle's front right passenger air bag module cover flap

Immediately prior to the crash the case vehicle's driver [35-year-old, unknown race (Hispanic) female, unknown height and weight] was most likely seated in an upright driving position. Her left foot was most likely on the floor, her right foot on the accelerator or brake, and one or both hands on the steering wheel. Her seat track was located between its middle and rearmost positions, the seat back was slightly reclined, the tilt steering column was located in its full up position, and the telescoping steering column was positioned full forward, toward the instrument panel. It is not known if the driver was wearing glasses or contact lenses at the time of the crash.

Figure 13: Case vehicle's front right passenger air bag, air bag has numerous stains on it, they appeared to be coffee stains

Based on this contractor's vehicle inspection, the case vehicle's driver was not restrained by her manual safety belt system. Inspection of the driver's safety belt webbing, "D"-ring, and latch plate showed no evidence of loading, and the safety belt pretensioner did not activate in the crash.

It is not known if the case vehicle's driver made any pre-crash avoidance maneuvers. However, regardless of any possible avoidance actions, the driver was most likely in an upright driving position at the moment of impact. The case vehicle's impact with the other vehicle caused the case vehicle's driver to continue forward and move slightly rightward along a path opposite the case vehicle's 30 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated laterally to the left. The driver's face and upper chest impacted the deployed air bag, her left hand impacted and broke off the turn signal lever (**Figure 14**) and her knees impacted and broke her knee bolster (**Figure 15** below). Following the impact, the driver most likely rebounded off her air bag and moved to the right and back into her seat as the case vehicle rotated counterclockwise. The driver most likely remained in her seat as the case vehicle came to final rest. She was most likely able to exit the case vehicle without assistance following the crash. The deployment of the case vehicle's driver air bag prevented the driver from impacting the steering wheel and possibly the windshield and mitigated her injuries.

Figure 14: Case vehicle driver's left hand impacted and broke the turn signal lever off the steering column

The case vehicle's driver sustained a police reported "C" (possible) injury, but was not transported from the scene to a medical facility. It is not known if the driver sought any medical treatment subsequent to the crash, or lost any work days as a result of the crash.

Figure 15: Case vehicle driver's knees impacted and broke the drivers knee bolster

CASE VEHICLE FRONT RIGHT PASSENGER KINEMATICS

Immediately prior to the crash, the case vehicle's front right passenger [24-year-old, unknown race (Hispanic) female, unknown height and weight] was most likely seated in an upright position; however, the position of her feet, arms and hands is unknown. Her seat track was located in its middle position, and the seat back was slightly reclined. It is not known if the passenger was wearing glasses or contact lenses at the time of the crash.

The case vehicle's front right passenger was not restrained by her manual safety belt system. Inspection of the front right passenger's safety belt webbing, "D"-ring, and latch plate showed no evidence of loading, and the safety belt pretensioner did not activate in the crash.

It is not known if the case vehicle's driver made any pre-crash avoidance maneuvers. However, regardless of any possible avoidance actions, the front right passenger was most likely remained in an upright seated position at the moment of impact. The case vehicle's impact with the other vehicle caused the front right passenger to continue forward and move rightward along a path opposite the case vehicle's 30 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated laterally to the left, and her face and chest impacted the deployed air bag. The passenger most likely rebounded off the air bag and moved to the right and back into her seat as the case vehicle rotated counterclockwise. She most likely contacted the right front door during the rotation. The front right passenger most likely remained in her seat as the case vehicle came to final rest. She was most likely able to exit the case vehicle under her own power following the crash. The deployment of the front right passenger's air bag prevented her from impacting the instrument panel and windshield and mitigated her injuries.

CASE VEHICLE FRONT RIGHT PASSENGER INJURIES

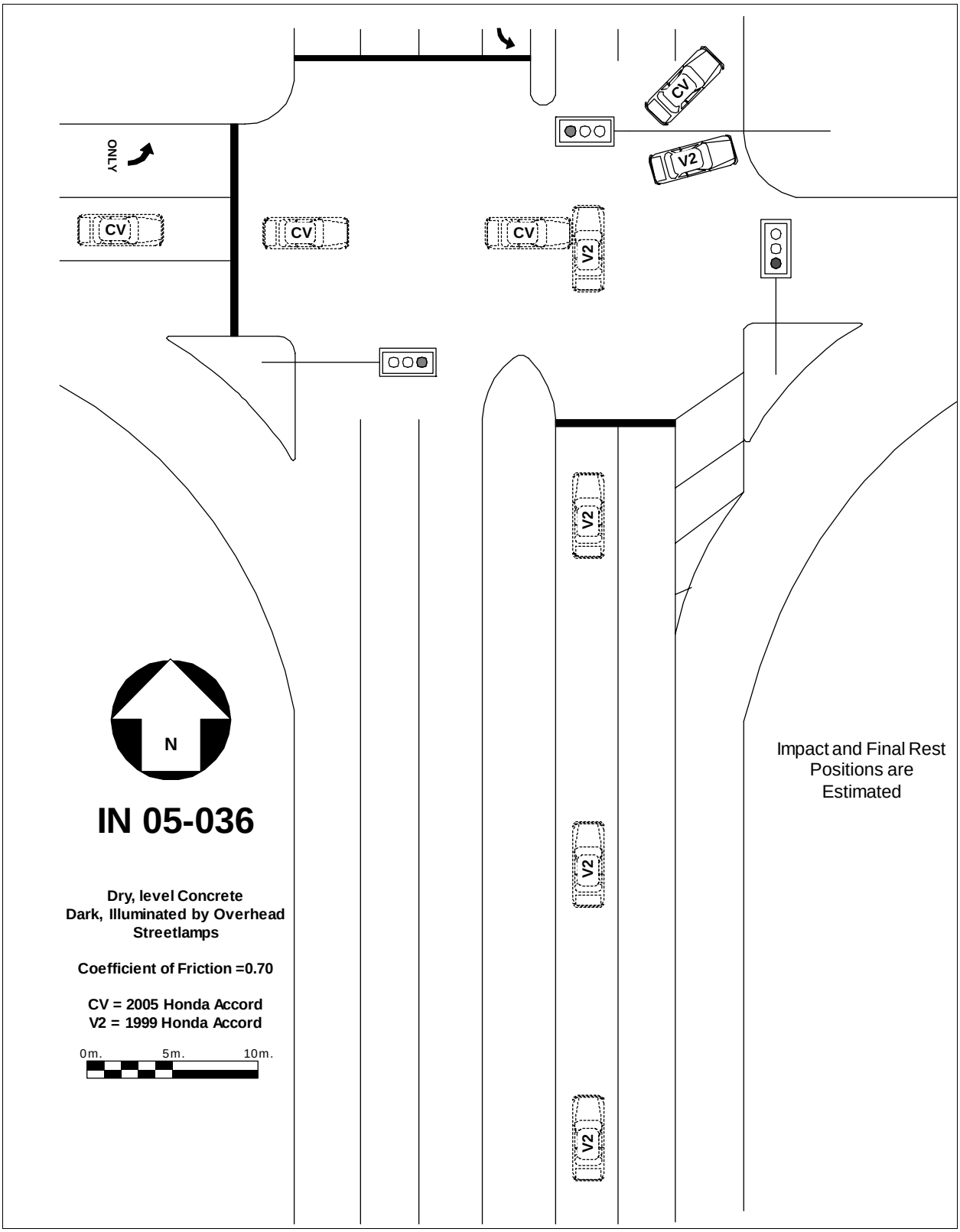
According to the police crash report, the front right passenger sustained a "C" (possible) injury and was treated at the scene. It is not known if the passenger sought any treatment subsequent to the crash, or lost any work days as a result of the crash.

The 1999 Honda Accord EX was a front wheel drive, four-door sedan (VIN: JHMCG5653XC------) equipped with redesigned driver and front right passenger air bags.

Exterior Damage: The Honda was not inspected. It could not be located. With no available vehicle photographs, a CDC for this vehicle could not be estimated. The WinSMASH reconstruction program, missing vehicle, algorithm, was used to reconstruct the Honda's Delta Vs. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 38 km.p.h. (23.6 m.p.h.), -19.0 km.p.h. (-11.8 m.p.h.), and 32.9 km.p.h. (20.4 m.p.h.). This was a borderline reconstruction and the results appeared reasonable. The vehicle was towed due to damage.

Other Vehicle's Occupants: According to the police crash report, the Honda's driver [22-year-old, (unknown race and ethnic origin) female] was restrained by her manual safety belt system. The police crash report indicated that the driver sustained a "C" (possible) injury and was transported by ambulance to the hospital. Her level of medical treatment is not known.

According to the police crash report, the Honda's front right passenger [25-year-old, (unknown race and ethnic origin) female] was restrained by her manual safety belt system. The police crash report indicated that the passenger sustained a "C" (possible) injury and was treated at the scene.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Dark, Illuminated by Overhead Streetlamps
Coefficient of Friction =0.70
CV = 2005 Honda Accord
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Impact and Final Rest Positions are Estimated